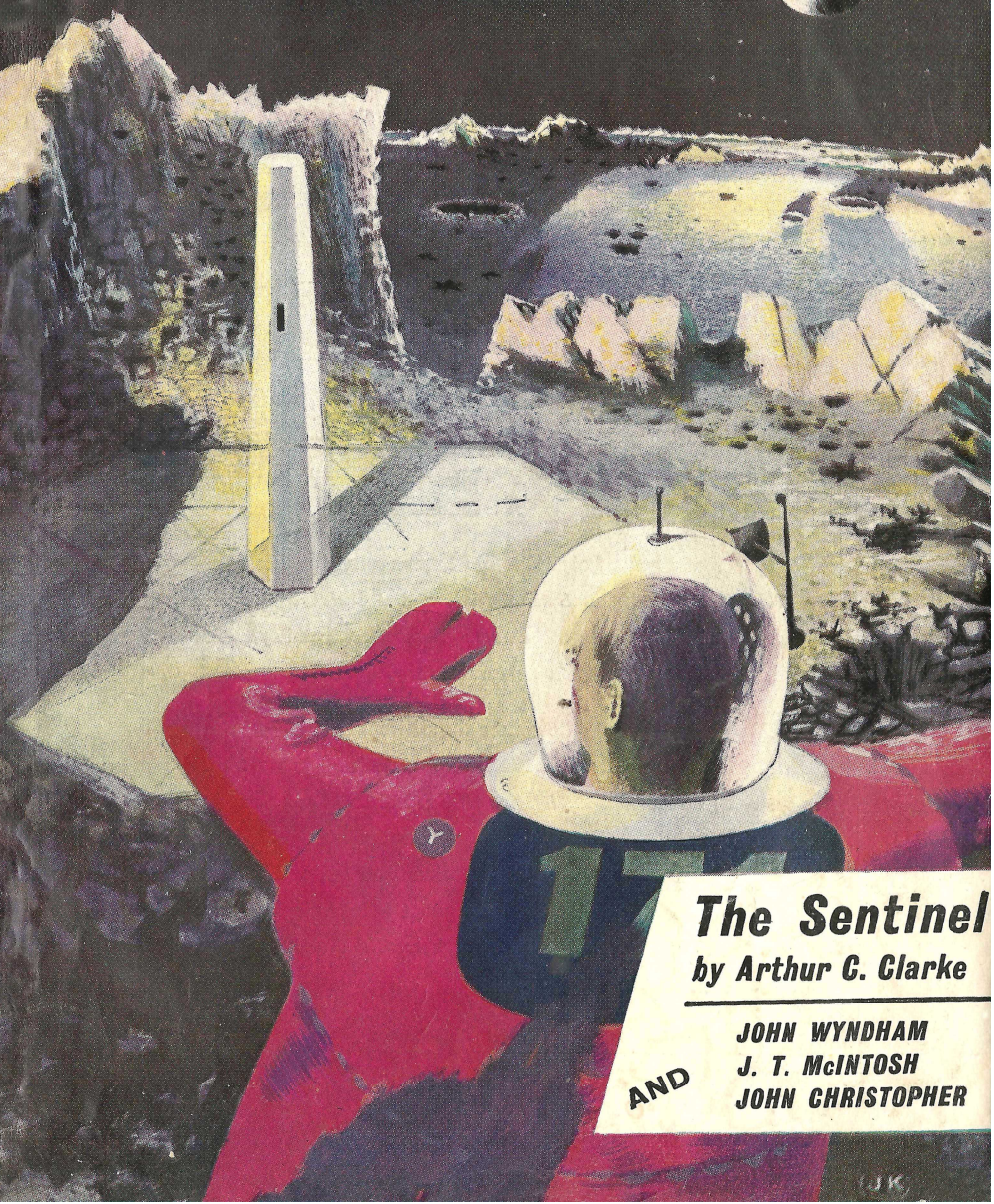


NEW WORLDS Science Fiction

No. 22

1/6



The Sentinel by Arthur C. Clarke

AND
JOHN WYNDHAM
J. T. McINTOSH
JOHN CHRISTOPHER

NEW WORLDS

— PROFILES —

Arthur C. Clarke

B.Sc.

F.R.A.S.



As science fiction has grown into an adult literature so the status of the 37-year old former Chairman of the British Interplanetary Society has gained prestige and honour. Avidly interested in astronomy from an early age, his scientific studies and appetite for s-f have kept pace with each other until today he is one of the few scientists who is also a professional fiction writer.

Still not at the height of his literary career, his novels *Prelude To Space*, *The Sands Of Mars*, and *Childhood's End* are model combinations of science and fiction, readily understandable to all classes of readership.

Better known to the general public for his scientific articles in the Press, radio and TV talks, and his powerful scientific book *The Exploration Of Space*, Mr. Clarke has just left for America where he will reside indefinitely. While in New York this year he will lecture at the Hayden Planetarium, and will also receive the great distinction of being Guest of Honour at the *New York Herald-Tribune Literary Luncheon*.

NEW WORLDS

Science Fiction

VOLUME 8

No. 22

MONTHLY

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Growing Up . . .

There is constant reference these days, especially in book reviews and literary announcements, that science fiction has grown up. Indeed, if one mentally reviews the veritable spate of fantasy now encroaching upon all forms of entertainment, one has the impression that a new kind of Eldorado has been discovered, with representatives from the Press, radio, T.V., films, and commercial industries hurrying to stake claims before the vein peters out. Apart from some very fine radio plays (including the phenomenal success of Charles Chiltern's serial "Journey into Space," which, planned for six weeks was extended to eighteen), science fiction now appears to have the blessing of Fleet Street—serial strips in the dailies and even a fiction serial in one of the evening nationals. What is the story behind this undoubted phenomena? Let me summarise events which have taken place in the past few years.

Before 1939, magazine science fiction, still in its infancy, was published in only *three* regular periodicals in the United States, supported occasionally by stories in various adventure magazines. Just before the war broke out there was a minor boom (accredited to the need for mental "escapism" from the troubled times), when as many as twenty or more magazines managed to secure some measure of popularity, most of which had stopped publication by 1943. As soon as hostilities ceased, however, and riding the tide of "scientific progress" brought about by the sheer necessity of being one better than the enemy (including the development of the atom bomb on one side and V.1 and V.2 on the other), magazine science fiction took an unprecedented upward curve in popularity, including amongst its sponsors such moulders of public opinion as *Collier's Magazine* and *The Saturday Evening Post*.

At the same time an apparently insignificant factor crept into the commercial market with the birth of a number of small specialised book publishing houses who aimed solely at putting the by-now-famous science fiction serials between permanent covers. It was but a short step to some of the larger American publishers investigating the field, trying out the "new" literature, and eventually having stories specially written for them.

The next logical development was that American radio, television and films joined the gold rush and really began to develop the medium as a commercial project. Quite logically the drift then came Eastward and British publishers cautiously investigated the possibilities. As there had been thousands of science fiction readers in this country for

over twenty years their caution was unnecessary but well advised in view of the huge number of pulp pocketbooks invading the British market—no-one could foretell two years ago which way the trend would be; upward to a high literary standard, or down to the rubbish level trying to oust the western and the gangster story.

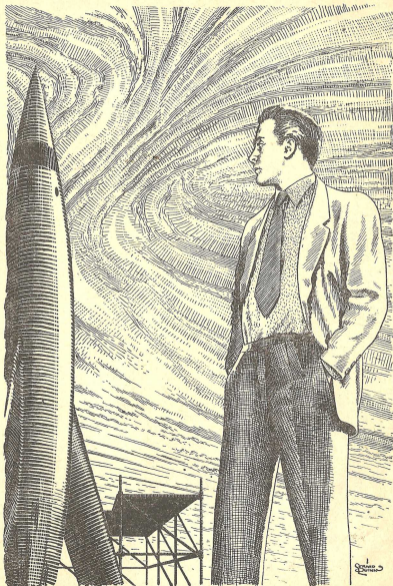
Strangely enough the trend has gone both ways and there appears to be a steady market for high- and low-grade fiction. Fortunately, discriminating publishers of books have called upon the literary services of such notable authors as Clarke, Wyndham, Christopher McIntosh, and other British writers who learned their craft in the short story medium. The combination of first-class author and publisher must effectively make itself felt very shortly, and as soon as the first flush of experimentation dies science fiction will find its own level in the nation's literature.

In its own small way *New Worlds* will have helped science fiction to attain finally that position—for a long time this magazine was the *only* British expression of the art, sharing the field equally with the British reprint edition of *Astounding Science Fiction* (a magazine which obviously portrayed an American slant due to its origin). As long ago as 1947, although restricted through lack of good British material, *New Worlds* was building a reputation for adult science fiction of a high literary standard and over the years has helped develop not only an individual brand of its own but also a whole host of new writers. Nearly thirty stories by our writers have been chosen for anthologising in "best" collections of short stories, many others have been published in American magazines after their initial success between our pages.

It is therefore with considerable pleasure that we now find it possible to publish monthly instead of our previous bi-monthly schedule. Our thanks are due not to the expanding market but specifically to the thousands of staunch readers who have been with us all along—their reading pleasure is now going to be doubled.

To the many thousands of new readers who will find us for the first time with this issue, I can only say "Welcome—you've missed a lot of very fine stories, but there are plenty more to come." But to old and new readers alike I must add a few words of advice—*New Worlds* has been sold out many times in the past, it will be again. Make sure of your future copies by placing a regular order with your news-agent NOW. He will be pleased; we shall be—and you won't be disappointed.

JOHN CARNELL.



In many countries of the world there are Interplanetary or Rocket Societies whose members, fired with Man's age-old dream of space flight, can do little more than plan on paper the vital statistics necessary for the first flight to the Moon. This story, second in last year's International Fantasy Award, tells of one such Society suddenly endowed with unlimited capital.

TAKE OFF

By Cyril M. Kornbluth

Illustrated by QUINN

Part One of Three Parts

I.

Morning of a bureaucrat.

On the wall behind his desk Daniel Holland, general manager of the U.S. Atomic Energy Commission, had hung the following:

His diploma from Harvard Law, '39;

A photograph of himself shaking hands with his hero, the late David Lilienthal, first A.E.C. chairman;

His certificate of honorable active service in the Army of the United States as a first lieutenant, in the Judge Advocate General's Department, dated February 12, 1945;

A letter of commendation from the general counsel of the T.V.A., which included best wishes for his former assistant's success in the new and challenging field of public administration he was entering;

A diploma declaring in Latin that he was an honorary Doctor of Laws of the University of North Carolina as of June 15, 1956;

A blowup of *The New Republic's* vitriolic paragraph on his "Bureaucracy versus the People" (New York, 1956);

A blowup of *Time* magazine's vitriolic paragraph on his "Red Tape Empires" (New York, 1957);

Signed photographs of heroes (Lilienthal, the late Senator McMahon); industrialists (Henry Kaiser, the late Charles E. Wilson of General Motors, Wilson Stuart of Western Aircraft, the late John B. Watson of International Business Machines); scientists (James B. Conant, J. Robert Oppenheimer); and politicians (Chief Justice Palmer, Senator John Marshall Butler of Maryland, ex-President Truman, ex-President Warren, President Douglas);

An extract from the January 27, 1947, hearings of the Senate half of the joint Senate-House Committee on Atomic Energy—held in connection with confirmation of the President's appointees to the A.E.C., particularly that of Lilienthal—which ran as follows:

Senator McKellar (to Mr. Lilienthal): *Did it not seem to you to be remarkable that in connection with experiments that have been carried on since the days of Alexander the Great, when he had his Macedonian scientists trying to split the atom, the President of the United States would discharge General Groves, the discoverer of the greatest secret that the world has ever known, the greatest discovery, scientific discovery, that has ever been made, to turn the whole matter over to you: who never really knew, except from what you saw in the newspapers, that the Government was even thinking about atomic energy?*

The Chairman: *Let us have it quiet please.*

Senator McKellar: *You are willing to admit, are you, that this secret, or the first history of it, dated from the time when Alexander the Great had his Macedonian scientists trying to make this discovery, and then Lucretius wrote a poem about it, about two thousand years ago? And everybody has been trying to discover it, or most scientists have been trying to discuss it, ever since. And do you not really think that General Groves, for having discovered it, is entitled to some little credit for it?*

"Read that," said Holland to his first caller of the morning. "Go on, read it."

James MacIlheny, Los Angeles insurance man and president of the American Society for Space Flight, gave him an inquiring look and slowly read the extract.

"I suppose," MacIlheny said at last, "your point is that you wouldn't be able to justify granting my request if Congress called you to account."

"Exactly. I'm a lawyer myself; I know how they think. Right-wrong, black-white, convicted-acquitted. Exactly why should A.E.C. 'co-operate and exchange information with' you people? If you're

any good, we ought to hire you. If you aren't any good, we oughtn't to waste time on you."

"Are those your personal views, Mr. Holland?" asked MacIlheny, flushing.

Holland sighed. "My personal views are on the record in a couple of out-of-print books, a few magazine articles, and far too many congressional-hearing minutes. You didn't come here to discuss my personal views; you came for an answer to a question. The answer has got to be 'no'."

"I came on your invitation——" MacIlheny began angrily, and then he pulled himself together. "I'm not going to waste time losing my temper. I just want you to consider some facts. American Government rocket research is scattered all over hell—Army, Navy, Air Force, Bureau of Standards, Coast and Geodetic Survey, and God-alone-knows-where-else. You gentlemen don't let much news out, but obviously we're getting nowhere. We would have had a manned rocket on the moon ten years ago if we were! I'm speaking for some people who know the problem, a lot of them trained, technical men. We've got the drawings. We've had some of them for fifteen years! All that's needed is money and fuel, atomic fuel——"

Holland looked at his watch, and MacIlheny stopped in mid-flight. "I see it's not getting through," he said bitterly. "When the Russian or Argentine lunar guided missiles begin to fall on America you'll have a lot to be proud of, Mr. Holland." He started for the door. Before he was out, Holland's secretary was in, summoned by a buzzer.

"Let's hit the mail, Charlie," Holland said, lighting a cigarette and emptying his overflowing "in" basket on his desk.

Ryan's bid on the Missoula construction job. "Tell him very firmly that I want him to get the contract because of his experience, but that his bid's ridiculously high. Scare him a little."

Damages claim from an ex-A.E.C. employee's lawyer, alleging loss of virility from radiation exposure. "Tell Morton to write this shyster absolutely nothing doing; it's utterly ridiculous. Hint that we'll have him up before his state bar association if he pesters us any more. And follow through if he does!"

Dr. Mornay at Oak Ridge still wanted to publish his article arguing for employment of foreign-born scientific personnel in the A.E.C. "Write him a very nice letter. Say I've seriously considered his arguments but I still think publication would be a grave error on his part. See my previous letter for reasons and ask him just to consider what Senator Hoyt would make of his attitude."

The governor of Nevada wanted him to speak at a dam dedication. "Tell him no, I never speak, sorry."

Personnel report from Missoula Directed Ops. "Greenleaf's lost three more good men, damn it. Acknowledge his letter of transmittal—warm personal regards. And tell Weiss to look over the table of

organization for a spot we can switch him to where he'll stay in grade but won't be a boss-man."

Half-year fiscal estimate from Holloway at Chalk River Liaison Group in Canada. "Acknowledge it but don't say yes or no. Make copies for Budget and Comptroller. Tell Weiss to ride them for an opinion but not to give them any idea whether I think it's high, low, or perfect. I want to know what *they* think by tomorrow afternoon.

Messenger query from the A.P. on Hoyt's speech in the Senate. "Tell them I haven't seen the text yet and haven't had a chance to check A.E.C. medical records against the Senator's allegations. Add that in my personal experience I've never met an alcoholic scientist and until I do I'll continue to doubt that there is any such animal. Put some jokes in it."

The retiring Regional Security and Intelligence Office agent in charge at Los Angeles wanted to know Holland's views on who should succeed him. Records of three senior agents attached. "Tell him Anheier looks like the best bet."

The Iranian ambassador, with an air of injured innocence, wanted to know why his country's exchange students had been barred even from nonrestricted A.E.C. facilities. "Tell him it was a State Department decision. Put in some kind of a dig so he'll know I know they started it with our kids. Clear it with State before I see it."

A rambling petition from the Reverend Oliver Townsend Warner, Omaha spellbinder. "I can't make head or tail of this. Tell Weiss to answer it some way or other. I don't want to see any more stuff from Warner; he may have a following but the man's a crank."

Recruiting programme report from Personnel Office. "Acknowledge this and tell them I'm not happy about it. Tell them I want on my desk next Monday morning some constructive ideas about roping better junior personnel in, and keeping them with us. Tell them it's perfectly plain that we're getting the third-rate graduates of the third-rate schools and it's got to stop."

Letter from Regional Security and Intelligence officer at Chicago; the F.B.I. had turned over a derogatory information against Dr. Oslonski, mathematical physicist. "Hell. Write Oslonski a personal letter and tell him I'm sorry but he's going to be suspended from duty and barred from the grounds again. Tell him we'll get his clearance over within the minimum possible time and I know it's a lot of foolishness but policy is policy and we've got to think of the papers and Congress. Ask him please to consider the letter a very private communication. And process the S. and I. advisory."

A North Dakota senator wanted a job for his daughter, who had just graduated from Bennington. "Tell Morton to write him that Organization and Personnel hires, not the general manager."

Dr. Redford at Los Alamos wanted to resign; he said he felt he was getting nowhere. "Ask him please, as a personal favor to me, to

delay action on his resignation until I've been able to have a talk with him. Put in something about our acute shortage of first-line men. And teletype the director there to rush-reply a report on the trouble."

A red-bordered, courier-transmitted letter from the Secretary of the Department of the Interior, stamped *Secret*. He wanted to know when he would be able to figure on results from A.E.C.'s A.D.M.P.—Atomic Demolition Material Programme—in connection with planning for Sierra Reclamation Project. "Tell Interior we haven't got a thing for him and haven't got a date. The feeling among the A.D.M.P. boys is that they've been off on a blind alley for the past year and ought to resurvey their approach to the problem. I'm giving them another month because Scientific Advisory claims the theory is sound. That's secret, by courier."

Hanford's quarterly omnibus report. "Acknowledge it and give it to Weiss to brief for me."

Messenger query from the Bennet newspapers; what about a rumour from Los Angeles that the A.E.C. had launched a great and costly programme for a space-rocket atomic fuel. "Tell them A.E.C. did not, does not, and probably will not contemplate a space-rocket fuel programme. Say I think I know where the rumour started and that it's absolutely without foundation, impossible to launch such a programme without diverting needed weaponeering personnel, etcetera."

Field Investigations wanted to know whether they should tell the Attorney General about a trucking line they caught swindling the A.E.C. "Tell them I don't want prosecution except as a last resort. I do want restitution of the grafted dough, I want the Blue Streak board of directors to fire the president and his damn cousin in the dispatcher's office, and most of all I want Field Investigations to keep these things from happening instead of catching them *after* they happen."

And so on.

MacIlheny went disconsolately to his room at the Willard and packed. They wouldn't start charging him for another day until 3.00 p.m.: he opened his portable and began tapping out his overdue "President's Message" for *Starward*, monthly bulletin of the American Society for Space Flight. It flowed more easily than usual. MacIlheny was sore.

Fellow Members:

I am writing this shortly after being given a verbal spanking by a high muckamuck of the A.E.C. I was told in effect to pick up my marbles and not to bother the older boys: the Government isn't interested in us bumbling amateurs. I can't say I enjoyed this after my hopes had been raised by the exchange of several letters and an invitation to see Mr. Holland about it "the next time I was in Washington." I suppose I mistook routine for genuine interest. But I've learned something out of this disheartening experience.

It's this: we've been wasting a lot of time in the A.S.F.S.F. by

romancing about how the Government would some day automatically take cognizance of our sincere and persistent work. My experience today duplicates what happened in 1946, when our campaign for the Government to release unnecessarily classified rocketry art was the flop of the year.

You all know where we stand. Twenty years of theoretical work and math have taken us as far as we can go alone. We now need somebody else's money and somebody else's fuel. A lot of people have money, but under existing circumstances only the A.E.C. can have or ever be likely to have atomic fuel.

The way I feel about it, our next step is fund-raising—lots of it—hat-in-hand begging at the doors of industrial firms and scientific foundations. With that money we can go on from the drawing board to practical experimental work on bits and pieces of space ship, lab-testing our drawing-board gadgets until we know they work and can prove it to anybody—even an A.E.C. general manager.

When we have worked the bugs out of our jato firing circuits, our deadlight gaskets, our manhole seals, our acceleration couches, and the hundred-and-one accessories of space flight, we'll be in a new position. We will be able to go to the A.E.C. and tell them: "Here's a space ship. Give us fuel for it. If you don't, we'll hold you up to the scorn and anger of the country you are blindly refusing to defend."

*James MacIlheny
President, A.S.F.S.F.*

MacIlheny sat back, breathing hard and feeling more composed. There was no point to hating Holland, but it had been tragic to find him, a keyman, afraid of anything new and even afraid to admit it, hiding behind Congress.

He still had some time to kill. He took from his brief case a report by the A.S.F.S.F. Orbit Computation Committee (two brilliant youngsters from Cal Tech, a Laguna Beach matron to punch the calculating machine and a flow-analysis engineer from Hughes Aircraft) entitled "Refined Calculations of Grazing Ellipse Braking Trajectories for a Mars Landing After a Flight Near Apposition." Dutifully he tried to read, but at the bottom of its first mimeographed page the report ran into the calculus of variations. MacIlheny knew no mathematics; he was no scientist and he did not pretend to be one. He was a rocket crank, he knew it, and it was twisting his life.

He threw himself into a chair and thought bitterly of the United States moon base that should have been established ten years ago, that should be growing now with the arrival of every monthly rocket. He knew it by heart; the observatory where telescopes—of moderate size, but unhampered by Earth's dense and shimmering atmosphere—would solve new stellar mysteries every day; the electronics lab where

space-suited engineers would combine and recombine vacuum-tube elements with all outdoors for their vacuum tube; the hydroponics tanks growing green stuff for air and food, fed exhaled carbon dioxide and animal waste, producing oxygen and animal food under the raw sunlight on the Moon.

And he could see a most important area dotted with launchers for small, unmanned rockets with fission-bomb war heads, ready to smash any nation that hit the United States first.

He could see it; why not they? The scattered, unco-ordinated, conservative rocketry since World War II had produced what?

Army guided missiles, roaring across arcs of the Pacific every now and then on practice runs.

Air Force altitude jobs squirting up on liquid fuel from the deserts of the Southwest. There was a great, strange, powder-blue city of half a million souls at White Sands, New Mexico, where colonels spoke only to generals and generals spoke only to God. They were "working on" the space-flight problem; they were "getting out the bugs."

The Coast and Geodetic Survey firing its mapping rockets up and over, up and over, eternally, coast to coast, taking strips and strips of pictures.

The Bureau of Standards shooting up its cosmic-ray research rockets; for ten years they "had been developing" a space-suit for walking on the Moon. (There were space-suit drawings in the A.S.F.S.F. files—had been for fifteen years.)

The Navy had its rockets too. You could fire them from submarines, destroyers, cruisers, and special rocket-launching battlewagons that cost maybe sixty-odd what a space ship would stand you.

MacIlheny glumly told himself: might as well get to the airport. No point hanging around here.

He checked out, carrying his light overnight bag and portable. An inconspicuous man followed him to the airport; he had been following MacIlheny for weeks. They both enjoyed the walk; it was a coldly sun-bright January day.

II.

There was an immense documentation on Michael Novak, but it was no more extensive than the paper work on any other A.E.C. employee. For everyone—from scrubwoman to Nobel-prize physicist—the A.E.C. had one; so-and-so was eighty-seven years old and dribbled when he ate. Their backgrounds were checked to the times of their birth (it had once been suggested, in effect, that their backgrounds be checked to nine months before their birth—this by a congressman who thought illegitimacy should be sufficient reason for denying an applicant employment by the A.E.C.).

The Security and Intelligence Office files could tell you that Michael Novak had been born in New York City, but not that he had played tag under and around the pillars of the Canarsie Line elevated shortly before it was torn down. They could tell you that his mother and father had died when he was sixteen, but not that he had loved them. They could tell you that he had begun a brilliant record of scholarship-grabbing in high school, but not that he grabbed out of loneliness and fear.

Rensselaer Polytechnic Institute: aeronautical engineering (but he had been afraid to fly; heights were terrifying) and a junior-year switch to ceramic engineering, inexplicable to the A.E.C. years later.

A ten-month affair with a leggy, tough, young sophomore from the Troy Day College for Women. They interviewed her after ten years as a plump and proper Scarsdale matron; she told the Security men yes, their information was correct; and no, Michael had shown no signs of sexual abnormality.

Summer jobs at Corning Glass and Elpico Pottery, Steubenville, Ohio (but not endless tension: will they do what I tell them, or laugh in my face? Are they laughing at me now? Is that laughter I hear?). Ten years later they told the Security men sure I remember him, he was a good kid; no, he never talked radical or stuff like that; he worked like hell and he never said much (and maybe I better not tell this guy about the time the kid beat the ears off Wyrostek when he put the white lead in the kid's coverall pocket).

Scholarship graduate study at the University of Illinois, the Hopkins Prize Essay in Ceramic Engineering (with at first much envy of the scatterbrained kids who coasted four years to a B.A., later thin disgust, and last a half-hearted acceptance of things as they were).

The teaching fellowship. The doctoral dissertation on "Fabrication of Tubular Forms from Boron-Based High-Tensile Refractory Pastes by Extrusion." Publication of excerpts from this in the *Journal* of the Society of Ceramic Engineers brought him his bid from the A.E.C. They needed his speciality in N.E.P.A.—Nuclear Energy for the Propulsion of Aircraft.

He had taken it, his records showed, but they did not show the dream world he had thought N.E.P.A. would be, or the dismaying reality it was.

N.E.P.A. turned out to be one hour in the lab and three hours at the desk; bending the knee to seniors and being looked at oddly if you didn't demand that juniors bend the knee to you. It was wangling the high-temperature furnace for your tests and then finding that you'd been bumped out of your allotted time by a section chief or a group director riding a hobby. It was ordering twenty pounds of chemically pure boron and getting fifty-three pounds of commercial grade. It was, too often, getting ahead on an intricate problem and then learning by accident that it had been solved last year by somebody else in some

other division. It was trying to search the records before starting your next job and being told that you weren't eligible to see classified material higher than *Confidential*. It was stamping your own results *Restricted* or at most *Confidential* and being told that it was safer, all things considered, to stamp them *Secret* and stay out of trouble.

It was being treated like a spy.

It was, in spite of all this, a chance to work a little at new and exciting problems.

And then, his records showed, in August of his second year, he had been transferred to Argonne National Laboratory, Chicago, as N.E.P.A. Refractories Group Liaison with Neutron Path Prediction Division of the Mathematical Physics Section. The records did not say why a ceramic engineer specializing in high-tensile refractories and with a smattering of aircraft background had been assigned to work in an immensely abstruse field of pure nuclear theory for which he had not the slightest preparation or aptitude.

From August to mid-December, the records said, he bombarded the office of Dr. Hurlbut, director of Argonne Lab, with queries, petitions, and requests for a rectification of his absurd assignment, but the records showed no answers. Finally, the records showed that he resigned from A.E.C. without prior notice— forfeiting all salaries and allowances due or to become due—on a certain day toward the end of the year.

This is what happened on that day.

Novak stopped in the cafeteria downstairs for a second cup of coffee before beginning another baffling day at Neutron Path Prediction—a day he hoped would be his last if Hurlbut had looked into the situation.

"Hi, there," he said to a youngster from Reactor Design. The boy mumbled something and walked past Novak's table to one in the corner.

Oh, fine. Now he was a leper just because he was the victim of some administrative foolishness. It occurred to him that perhaps he had become a bore about his troubles and people didn't want to hear any more about them. Well, he was sick of the mess himself.

A girl computer walked past with coffee and a piece of fudge cake. "Hi, there," he said, with less confidence. She had always been good for a big smile, but this time she really gave out.

"Oh, Dr. Novak," she gulped, "I think it's just *rotten*."

What was this—a gag? "Well, I hope to get it fixed up soon, Grace."

She sat down. "You're filing a grievance? You certainly ought to. A man in your position—"

"Grievance? Why, no! I actually saw Hurlbut yesterday, and I just grabbed him in the corridor and told him my troubles. I said that evidently my memos weren't getting through to him. He was very pleasant about it and he said he'd take immediate action."

She looked at him with pity in her eyes and said: "Excuse me." She picked up her tray and fled.

The kid was kidding—or nuts. Hurlbut would straighten things out. He was a notorious scientist-on-the-make, always flying all over the map for speaking dates at small, important gatherings of big people. You saw him often on the front pages and seldom in the laboratory, but he got his paper work cleaned up each month.

Novak finished his coffee and climbed the stairs to the Mathematical Physics Section. He automatically checked the bulletin board in passing and was brought up short by his own name.

FROM THE OFFICE OF THE DIRECTOR

*To: Dr. Michael Novak (NPPD) Re: Requested Transfer
Your request is denied. The Director wishes to call your attention to your poor record of production even on the routine tasks it was thought best you be assigned to.*

The Director suggests that a more co-operative attitude, harder work, and less griping will get you further than your recent attempts at office intrigue and buttonholing of busy senior officers.

"The man's crazy," somebody said at his shoulder. "You have a perfect grievance case to take to the——"

Novak ignored him. He ripped the memo from the board and walked unsteadily from the bare white corridors of the Mathematical Physics Section, through endless halls, and into the Administrative Division—carpets, beige walls, mahogany, business suits, pretty secretaries in pretty dresses walking briskly through these wonders.

He pushed open a mahogany door, and a receptionist stopped doing her nails to say: "Who shall I say is—hey! You can't go in there!"

In the carpeted office beyond, a secretary said: "What's this? What do you want?" He pushed on through the door that said: *Dr. Hurlbut's Secretary.*

Dr. Hurlbut's secretary wore a business suit that fitted like a bathing suit, and she said: "Oops! You weren't announced; you startled me. Wait a minute; Dr. Hurlbut is engaged——"

Novak walked right past her into the director's mahogany-furnished oak-paneled office while she fluttered behind him. Hurlbut, looking like the official pictures of himself, was sitting behind half an acre of desk. A man with him gaped like a fish as Novak burst in.

Novak slapped the memo on his desk and asked: "*Did you write this?*"

The director, impeccably clothed, barbered, and manicured, rose looking faintly amused. He read the notice and said: "You're Novak, aren't you? Yes, I wrote it. And I had it posted instead of slipping it into your box because I thought it would have a favourable effect on

morale in general. Some of the section chiefs have been getting sadly lax. No doubt you were wondering."

He had been warned by the "personality card" that accompanied Novak on his transfer to expect such piffing outbursts. However, the man worked like the devil if you just slapped him down and kept hectoring him. One of those essentially guilt-ridden types, the director thought complacently. So pitifully few of us are smooth-running, well-oiled, efficient machines . . .

"Here's my resignation," said Novak. He gave his resignation to Hurlbut on the point of the jaw. The Director turned up the whites of his eyes before he hit the grey broadloom carpeting of his office, and the man with him gaped more fishily than ever. The secretary shrieked, and Novak walked out, rubbing the split skin on his knuckles. It was the first moment of pure satisfaction he had enjoyed since they took him off refractories at N.E.P.A.

Nobody pulled the alarm. It wasn't the kind of thing Hurlbut would want on the front pages. Novak walked, whistling and unmolested across the lawn in front of Administration to the main gate. He unpinned his badge and gave it to a guard, saying cheerfully: "I won't be back."

"Somebody leave you a fortune?" the guard kidded.

"Uh, no," said Novak, and the mood of pure satisfaction suddenly evaporated. Nobody had left him a fortune, and he had just put a large, indelible blot on his career.

The first thing he did when he got back to his hotel was phone a situation-wanted ad to *Ceramic Industries*. Luckily he caught the magazine as it was closing its forms on classifieds; subscribers would have his ad in ten days.

III.

They were ten bad days.

The local employment agencies had some openings for him, but only one was any good and he was turned down at the interview. It was a scientific supply house that needed a man to take over the crucibles and refractories department; it involved research. The president regretfully explained that they were looking for somebody a little more mature, a little more experienced in handling men, somebody who could take orders—

Novak was sure the crack meant that he knew about his informal resignation from A.E.C. and disapproved heartily.

All the other offers were lousy little jobs; mixing and testing batches in run-down Ohio potteries, with pay to match and research opportunities zero.

Novak went to cheap cinemas and ate in cheap cafeterias until the answers to his ad started coming in. A spark-plug company in Newark

made the best offer in the first batch; the rest were terrible. One desperate owner of a near-bankrupt East Liverpool pottery offered to take him on as full partner in lieu of salary. "I feel certain that with a technical man as well qualified as yourself virtually in charge of production and with me handling design and sales we would weather our present crisis and that the ultimate rewards will be rich. Trusting you will give this proposal your serious——"

Novak held off wiring the Newark outfit to see what the next day would bring. It brought more low-grade offers and a curious letter from Los Angeles.

The letterhead was just an office number and an address. The writer, J. Friml, very formally offered Dr. Novak interesting full-time work in refractories research and development connected with very high-altitude jet aircraft. Adequate laboratory facilities would be made available, as well as trained assistance if required. The salary specified in his advertisement was satisfactory. If the proposition aroused Dr. Novak's interest, would he please wire collect and a telegraphed money order sufficient to cover round-trip expenses to Los Angeles would be forthcoming.

One of the big, coast aircraft outfits? It couldn't be anything else, but why secrecy? The letter was an intriguing trap, with the promised money order for bait. Maybe they wouldn't want him after all, but there was nothing wrong with a free trip to Los Angeles to see what they were up to. That is, if they really sent the money.

He wired J. Friml, collect, at the address on the letterhead:
Interested your offer but appreciate further details if possible.

The next morning a more-than-ample money order was slipped under his door, with the accompanying message:

Full details forthcoming at interview; please call on us at your convenience wiring in advance. Our office open daily except Sunday nine five. J. Friml, Secretary Treasurer.

Of what?

Novak laughed at the way he was being openly hooked by curiosity and a small cash bribe, and phoned for an airline reservation.

He left his bag at the Los Angeles airport and showered in a pay booth. He had wired that he would appear that morning. Novak gave the address to a cabby and asked: "What part of town's that?"

"Well," said the cabby, "I'll tell you. It's kind of an old-fashioned part of town. Nothing's *wrong* with it."

"Old-fashioned" turned out to be a euphemism for "run-down." They stopped at a very dirty eight-storey corner office building with one elevator. The lobby was paved with cracked octagonal tile. The lobby directory of tenants was enormous. It listed upwards of two

hundred tenant firms in the building, quadrupled and quintupled up in its fifty-odd offices. Under *f* Novak found J. Friml, Room 714.

"Seven," he bleakly told the unshaved elevator man. Whatever was upstairs, it wasn't a big, coast plane factory.

Room 712 stopped him dead in the corridor with the audacity of the lettering on its glass door. It claimed to house the Arlington National Cemetery Association, the Lakeside Realty Corporation, the Western Equitable Insurance Agency, the California Veterans League, Farm and Home Publications, and the Kut-Rite Metal Novelties Company in one small office.

But at Room 714 his heart sank like a stone. The lettering said modestly: *American Society for Space Flight*.

I might have known, he thought glumly. Southern California! He braced himself to enter. They would be crackpots, the lab would be somebody's garage, they would try to meet their pay roll by selling building lots on Jupiter . . . but they were paying for his time this morning. He went in.

"Dr. Novak?" said a young man. Nod. "I'm Friml. This is Mr. MacIlheny, president of our organization." MacIlheny was a rawboned middle-aged man with a determined look. Friml was sharp-faced, eye-glassed, very neat and cold.

"I'm afraid you might think you were brought here under false pretences, Doctor," said MacIlheny, as if daring him to admit it.

Friml said: "Sit down." And Novak did, and looked around. The place was clean and small with three good desks, a wall banked with good files—including big, shallow blue-print files—and no decorations.

"I asked for research and development work," Novak said cautiously. "You were within your rights replying to my ad if you've got some for me."

MacIlheny cracked his knuckles and said abruptly: "The anonymous offer was my idea. I was afraid you'd dismiss us as a joke. We don't get a very good press."

"Suppose you tell me what you're all about." It was their money he was here on.

"The A.S.F.S.F. is about twenty years old, if you count a predecessor society that was a little on the juvenile side. They 'experimented' with powder rockets and never got anywhere, of course. They just wanted to hear things go bang.

"An older element got in later—engineers from the aircraft plants, science students from Cal Tech and all the other schools—and reorganized the Society. We had a tremendous boom, of course, after the war—the V-2's and the atom bomb. Membership shot up to five thousand around the country. It dropped in a couple of years to fifteen hundred or so, and that's where we stand now."

Friml consulted a card: "One thousand, four hundred, and seventy-eight."

"Thanks. I've been president for ten years, even though I'm not a technical man, just an insurance agent. But they keep re-electing me so I guess everybody's happy.

"What we've been doing is research on paper. Haven't had the money for anything else until recently. Last January I went to Washington to see the A.E.C. about backing, but it was no dice. With the approval of the membership I went the rounds of the industrial firms looking for contributions. Some foresighted outfits came through very handsomely and we were able to go to work.

"There was a big debate about whether we should proceed on a 'bits-and-pieces' basis or whether we should shoot the works on a full-scale steel mock-up of a moon ship. The mock-up won, and we've made very satisfactory progress since. We've rented a few acres in the desert south of Barstow and put up shops and——" He couldn't keep the pride out of his voice. He opened his desk drawer and passed Novak an eight-by-ten glossy print. "Here."

He studied it carefully: a glamour photograph of a gleaming, massive, bomb-shaped thing standing on its tail in the desert with prefab huts in the background. It was six times taller than a man who stood beside it, leaning with a studied air against a delta-shaped fin. That was a lot of metal—a *lot* of metal, Novak thought with rising excitement. If the picture wasn't a fake, they had money and the thing made a little more sense.

"Very impressive," he said, returning the picture. "What would my job be?"

"Our engineer in charge, Mr. Clifton, is a remarkable man—you'll like him—but he doesn't know refractories. It seems to be all he doesn't know! And our plans include a ceramic exhaust throat liner and an internal steering vane. We have the shapes, theoretically calculated, but the material has to be developed and the pieces fabricated."

"Internal steering vane. Like the graphite vanes in the various German bombardment rockets?"

"Yes, with some refinements," MacIlheny said. "It's got to be that way, though I don't envy you the job of developing a material that will take the heat and mechanical shock. Side-steering rockets would be much simpler, wouldn't they? But the practical complications you run into—each separate steering jet means a separate electrical system, a separate fuel pump, perforating structural members and losing strength, adding weight without a corresponding thrust gain."

"You said you weren't a technical man?" asked Novak.

MacIlheny said impatiently: "Far from it. But I've been in this thing heart and soul for a long time and I've picked up some stuff." He hesitated. "Dr. Novak, do you have a thick hide?"

"I suppose so."

"You'll need it if you go to work for us—crackpots."

Novak didn't say anything and MacIlheny handed him some press clippings :

LOCAL MEN SEE STARS;
BUILDING SPACE SHIP

and

BUCK ROGERS HEARTS BEAT
BENEATH BUSINESS SUITS

There were others.

"We never claimed," said MacIlheny a little bitterly, "that the *Prototype's* going to take off for the Moon next week or ever. We down-pedal sensationalism; there are perfectly valid military and scientific reasons for space-ship research. We've tried to make it perfectly clear that she's a full-scale model for study purposes, but the damned papers don't care. I know it's scared some good men away from the society and I'd hate to tell you how much it's cut into my business, but my lawyer tells me I'd be a fool to sue." He looked at his watch. "I owed you that much information, Doctor. Now tell me frankly whether you're available."

Novak hesitated.

"Look," said MacIlheny. "Why don't you take a look at the field and the *Prototype*? I have to run, but Friml will be glad to drive you out. You've got to meet Clifton."

When MacIlheny had left, Friml said: "Let's eat first." They went to a businessman's restaurant. Friml had hardly a word to say for himself through the meal, and he kept silence through the drive west to Barstow as the irrigated, roadside land turned arid and then to desert.

"You aren't an enthusiast?" Novak finally asked.

"I'm secretary-treasurer," said Friml.

"Um. Was Mr. MacIlheny deliberately not mentioning the names of the firms that contribute to the A.S.F.S.F.? I thought I caught that."

"You were correct. Contributions are private, by request of the donors. You saw those newspaper clippings."

His tone was vinegar. Friml was a man who didn't think the game was worth the kidding you took for playing it. Then why the devil was he the outfit's secretary-treasurer?

They were driving down a secondary black-top road when the *Prototype* came into view. It had the only vertical lines in the landscape for as far as the eye could see, and looked sky-piercing. A quadrangle of well-built prefabs surrounded it, and the area was wire-fenced. Signs at intervals forbade trespassing.

There was a youngster reading at a sort of sentry box in the fencing. He glanced at Friml and waved him through. Friml crawled his car to a parking area, where late models were outnumbered by jalopies, and

brought it alongside of a monstrous, antique, maroon Rolls Royce. "Mr. Clifton's," he said, vinegar again. "He should be in here." He led Novak to the largest of the prefabs, a twelve-foot Quonset some thirty feet long and mounted on a concrete base.

It was a machine shop. Serious-eyed kids were squinting as they filed at bits of bronze. A girl was running a surface grinder that gushed a plume of small, dull red, hot-looking sparks. High-carbon steel, Novak thought automatically. Piece that size costs plenty.

Clifton, Friml's pointed finger said.

The man was in dungaree pants and a dirty undershirt—no, the top of an old-fashioned union suit with buttons. He was bending over a slow-turning engine lathe, boring out a cast-iron fitting. The boring bar chattered suddenly and he snarled at it: "A-a-ah, ya dirty dog ya!" and slapped off the power switch.

"Mr. Clifton," Friml hailed him, "this is Dr. Michael Novak, the ceramics man I told you about yesterday."

"Harya, Jay. Harya, Mike," he said, giving Novak an oily grip. He needed a shave and he needed some dentistry. He didn't look like any engineer in charge that Novak had ever seen before. He was a completely unimpressive Skid Row type, with a hoarse voice to match.

Clifton was staring at him appraisingly. "So ya wanna join the space hounds, hah? Where's ya Buck Rogers pistol?"

There was a pause.

"Conversation-stopper," said Friml with a meagre smile. "He's got a million of them, Mr. Clifton, would you show Dr. Novak around if it doesn't interrupt anything important?"

Clifton said: "Nah. Bar dug into the finish bore on the flange. I gotta scrap it now; I was crazy to try cast iron. That'll learn me to try to save you guys money; next time I cut the fitting outta nice, expensive, mild steel bar stock. Come on, Mike. Mars or bust, hah?"

He led Novak out of the machine shop and wiped his oily hands on the union suit's top. "You any good?" he asked. "I told the kids I don't want no lid on my hands."

"What's a lid?" Novak demanded.

"Morse-man talk. Fighting word."

"You were a telegrapher?" asked Novak. It seemed to be the only thing to say.

"I been everything! Farmer, seaman, gigolo in B.A., glass blower, tool maker, aero-engineer—bet ya don't believe a goddam word I'm saying."

Disgustedly Novak said: "You win." The whole thing was out of the question—crack-pot enthusiasts backing this loudmouthed phony.

"Ask me anything, Mike! Go ahead, ask me anything!" Clifton grinned at him like a terrier.

Novak shrugged and said: "Integral of u to the n , $\log u$, $d-u$."

Clifton fired back: " U to the n -plus-one, bracket, log u over n -plus-one, minus one over n -plus-one-square, un-bracket—plus C . Ask me a hard one, Mike!"

It was the right answer. Novak happened to remember it as an examination problem that had stuck in his head. Normally you'd look it up in a table of integrals. "Where'd you go to school?" he asked, baffled.

"School? School? What the hell would I go to school for?" Clifton grinned. "I'm a self-made man, Mike. Look at that rocket, space hound. Look at her."

They had wandered to the *Prototype's* base. Close up, the rocket was a structure of beautifully welded steel plates, with a sewer-pipe opening at the rear and no visible means of propulsion.

"The kids love her," Clifton said softly. "I love her. She's my best girl, the round-heeled old bat."

"What would you use for fuel?" Novak demanded.

He laughed. "How the hell should I know, pal? All I know is we need escape velocity, so I build her to take the mechanical shock of escape velocity. You worry about the fuel. The kids tell me it's gotta be atomic so you gotta give 'em a throat-liner material that can really take it from here to Mars and back. Oh, you got a job on your hands when you join the space hounds, Mike!"

"This is the craziest thing I ever heard of," said Novak.

Clifton was suddenly serious. "Maybe it ain't so crazy. We work out everything except fuel and then we go to the A.E.C. and say *give*. Do they hold out on us or do they start work on an atomic fuel? The kids got it all figured out. We do our part, A.E.C. does theirs. Why not?"

Novak laughed shortly, remembering the spy mania he had lived in for two years. "They'll do their part," he said. "They'll start by sending a hundred Security and Intelligence boys to kick you off the premises so they can run it themselves."

Clifton slapped him on the back. "*That's* the spirit!" he yelled. "You'll win your Galactic Cross of Merit yet, pal! You're hired!"

"Don't rush me," said Novak, half angrily. "Are they honestly going to deliver on a real lab for me if I sign up? Maybe they don't realize I'll need heavy stuff—rock crushers, ball mills, arc furnaces—maybe a solar furnace would be good out here on the desert. That kind of equipment costs real money."

"They'll deliver," Clifton said solemnly. "Don't low-rate the kids. I'm working from their blue-prints and they're good. Sure, there's bugs—the kids are human. I just had to chuck out their whole system for jettisoning *Proto's* aerodynamic nose. Too gadgety. Now I'm testing a barometer to fire a powder charge that'll blow away the nose when she's out of the atmosphere—whole rig's external, no holes in the hull, no gasket problem. And they design on the conservative side—

inclined to underestimate strength of materials. But, by and large, a ver-ry, ver-ry realistic bunch."

Novak was still finding it impossible to decide whether Clifton was a fake, an ignoramus, or a genius. "Where've you worked?" he asked.

"My last job was project engineer with Western Air. They fired me all right, no fear of that. I wear their letter next to my heart." He hauled a bulging greasy wallet from the left hip pocket of the dungarees, rummaged through it, and came up with a wad of paper. Unfolded, it said restrainedly that the personnel manager of Western Aircraft regretted that the Company had no option but to terminate Mr. Clifton's employment since Mr. Clifton had categorically declined to apologize to Dr. Holden.

An eighteen-year-old boy with a crew cut came up and demanded: "Cliff, on the nylon ropes the blue print says they have to test to one-fifty pounds apiece. Does that just mean parting strength of the ropes or the whole rig—ropes whipped to the D-rings and the D-rings anchored in the frame?"

"Be with ya in a minute, Sammy. Go and wait for me." The boy left and Clifton asked: "Think it's a forgery, Mike?"

"Of course not—" began Novak, and then he saw the engineer grinning. He handed back the letter and asked: "Have you been a forger too? Mr. Clifton—"

"Cliff!"

"—Cliff, how did you get hooked up with this? I'm damned if I know what to make of the setup."

"Neither do I. But I don't care. I got hooked up with them when Western canned me. I can't get another aircraft job because of the industrial black list, and I can't get a Government job because I'm a subversive agent or a spy or some goddamned thing like that." Suddenly he sounded bitter.

"How's that?"

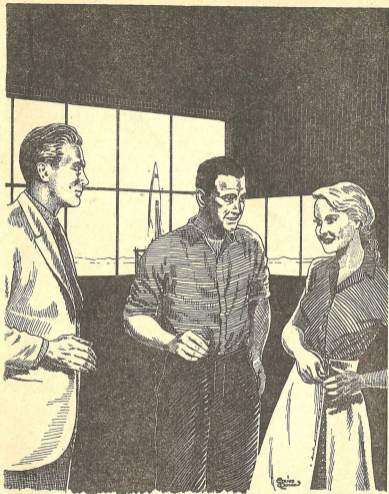
"They don't tell you—you know that; your ad said you was with the A.E.C.—but I guess it's because I been around the world a couple of times. *Maybe*, they figure, just *maybe*, old Cliff sold out when we wasn't watching him. Also my wife's a foreigner, so better be safe than sorry, says Uncle Sam."

"I know that game," Novak said. "Doesn't matter. You wouldn't have lasted five minutes with A.E.C. even if they did hire you."

"Well, well! So I didn't miss a thing! Look, Mike. I gotta go show my kids how to wipe their noses, so I'll let ya rassle with your conscience and I hope to see you around." He gave Novak the oily grip again and walked cockily from the base of the rocket to the Quonsets.

Friml was at Novak's side instantly, looking impatient.

Driving back to Los Angeles, Novak asked bluntly: "Are you people building a moon ship or aren't you?"



"If the A.S.F.S.F. is building a moon ship," said Friml, "I don't want to hear about it. I should tell you that, whatever is being built, they've got a well-kept set of books and a *strictly* controlled audit on the purchasing." He gave Novak a little sidelong look. "One man they tried before Clifton made a very common mistake. He thought that because he knew technical matters and I didn't, he could pad his purchases by arrangement with the vendors' salesmen and I'd be none the wiser. It took exactly eight days for me to see through his plan."

"I get the hint," said Novak wearily. "But I still don't know whether I want the job. Was Clifton really a project engineer with Western Air?"

"I really don't know. I have absolutely no responsibility for procurement of personnel. I can tell you that he has no local or F.B.I. criminal record. I consider it a part of my job to check that far on employees whose duties include recommending expenditures."

Friml left him at the Los Angeles Airport at his request. Novak said he'd get in touch with him in the morning and let him know one way or the other; then he picked up his bag and took a taxi to a downtown hotel. It was 4.30 when he checked in, and he placed a call at once to the personnel department of Western Aircraft.

"I'd like to enquire," he said, "About the employment record of a Mr. Clifton. He says in his, uh; application to us that he was employed as a project engineer at Western Air last year."

"Yes, sir. Mr. Clifton's first name, sir?"

"Ah, I can't make it out from his signature." If he had been told Clifton's first name, he couldn't remember it.

"One moment, sir . . . we have a Mr. August Clifton, project engineer, employed two years and five months, separated January seventeenth last year——"

"What's the reason for separation?"

"It says 'incompatibility with supervisory personnel.'"

"That's the one. Thanks very much, miss."

"But don't you want efficiency, health, and the rest of it, sir?"

"Thanks, no." He didn't need them. Anybody who hung on for two years and five months at Western as a projects man and only got fired after a fight *was* efficient and healthy and the rest of it; otherwise he wouldn't have lasted two hours and five minutes. It wasn't like the A.E.C.; at Western, you produced.

No, he thought, stretching out in his clothes on the bed; it wasn't like the A.E.C., and neither was the A.S.F.S.F. He felt a moment of panic at the thought, and knew why he felt it.

Spend enough time in Government and it unmanned you. Each pay check drawn on the Treasury took that much more of yourself away from yourself. Each one of the stiff, blue-green paper oblongs punched with I.B.M. code slots made you that much more willing to forget you might be running a pointless repeat of a research that had been done and done, and done, with nobody the wiser, in scattered and classified labs across the country.

Each swig from the public teat had more and more poppy juice in it. Gradually you forgot you had been another kind of person, holding ideas, fighting for them, working until dawn on coffee, falling for women, getting drunk sometimes. You turned grey after enough of the poppy juice—nice grey.

You said: "Well, now, I wouldn't put it that way," and "There's

something to be said on both sides, of course," and "It doesn't pay to go overboard; the big thing is to keep your objectivity."

The nice grey people married early and had a child or two right away to demonstrate that they were normal family men. They had hobbies and talked about them to demonstrate that they weren't one-sided cranks. They drank a little, to demonstrate that they weren't puritans, but not much, to demonstrate that they weren't drunks.

Novak wondered if they tasted bile, as he was tasting it now, thinking of what he had almost become.

IV.

In the morning he phoned the A.S.F.S.F. office that he wanted the job. Friml's cold voice said: "That's fine, Dr. Novak. Mr. MacIlheny will be here for the next half-hour, and I have a contract ready. If you can make it right over——"

The contract hog-tied Novak for one year with options to conduct refractory research and development under the direction of the Society. The salary was the one he had specified in his ad. Novak raised his eyebrows at one clause: it released the employer from liability claims arising out of radiation damage to the employee.

"You really think the Government's going to let you play with hot stuff?" he asked.

He shouldn't have said "play". MacIlheny was hurt and annoyed. "We expect," he said testily, "that the A.E.C. will co-operate with us as a serious research group when we enter the propulsion stage of the programme. They'll be fools if they don't, and we intend to let the country know about it."

Novak shrugged and signed. So did the two Society officers, with the elevator man and the building porter as witnesses. MacIlheny shook Novak's hand ceremoniously after the witnesses were shooed out. "The first thing we want," he said, "is a list of what you'll need and a lab layout. Provisional, of course. There should be some changes after you study the problem in detail?"

"I think not," Novak told him. "A lab's a lab. It's what you do with it that counts. How high can I go?"

Friml looked alarmed. MacIlheny said: "I won't tell you that the sky's the limit. But get what you need, and if you see a chance to save us money without handicapping yourself, take it. Give us the maximum estimated cost and the people you think are the best suppliers for each item."

"Reputable firms," said Friml. "The kind of people who'd be prepared to send me a notarized invoice on each purchase."

Novak found the public library and gave himself a big morning in the technical reading room, playing with catalogues and trade-magazine

ads. After lunch he came back with quadrille paper and a three-cornered scale. The afternoon went like lightning; he spent it drawing up equipment and supplies lists and making dream layouts for a refractories lab. What he wound up with was an oblong floor plan with a straight-through flow; storage to grinding-and-grading to compounding to firing to cooling to testing. Drunk with power, he threw in a small private office for himself.

Construction costs he knew nothing about, but by combing the used-machinery classifieds he kept equipment and supplies down to thirty-two thousand dollars. He had dinner and returned to the library to read about solar furnaces until they put him out at the ten-o'clock closing.

The next day Friml was up to his neck in page proofs of the A.S.F.S.F. organ *Starward*. Looking mad enough to spit, the secretary-treasurer said: "There's a publications committee, but believe it or not all five of them say they're too rushed right now and will I please do their work for them. Some of the rank and file resent my drawing a salary. I hope you'll bear that in mind when you hear them ripping me up the back—as you surely will."

He shoved the proofs aside and began to tick his way down Novak's lists. "There's a Marchand calculator in Mr. Clifton's laboratory," he said. "Wouldn't that do for both of you, or must you have one of your own?"

"I can use his."

Friml crossed the Marchand off the list. "I see you want a—a continuous distilled-water outfit. Wouldn't it be cheaper and just as good to install a tank, and truck distilled water in from the city? After all, it's for sale."

"I'm afraid not. I have to have it pure—not the stuff you buy for storage batteries and steam irons. The minute you put distilled water into a glass jar it begins to dissolve impurities out of the glass. Mine has to be made fresh and stored in a tin-lined tank."

"I didn't know that," said Friml. He put a light check mark next to the still, and Novak knew this human ferret would investigate it. Maybe he suspected him of planning to bilk the A.S.F.S.F. by making corn liquor on the side.

"Um. This vacuum pump. Mr. Clifton's had a Cenco Hyvac idle since he completed port-gasket tests a month ago. You might check with him as to its present availability . . . otherwise I see no duplications. This will probably be approved by Mr. MacIlheny in a day or two and then we can let the contract for the construction of your lab. I suggest that you spend the day at the field with Mr. Clifton to clear a location for it and exchange views generally. You can take the bus to Barstow and any taxi from there. If you want to be reimbursed you should save the bus ticket stub and get a receipt from the taxi driver for my files. And tonight there's the membership meeting.

Mr. MacIlheny asked me to tell you that he'd appreciate a brief talk from you—about five minutes and not too technical."

Friml dove back into the page proofs of *Starward*, and Novak left, feeling a little deflated.

The Greyhound got him to Barstow in ninety minutes. A leather-faced man in a Ford with "Taxi" painted on it said sure he knew where the field was: a two-dollar drive. On the road he asked Novak cautiously: "You one of the scientists?"

"No," said Novak. He humbly thought of himself as an engineer.

"Rocket field's been real good for the town," the driver admitted. "But scientists——" He shook his head. "Wouldn't mind some advice from an older man, would you?"

"Why, no."

"Just—watch out. You can't trust them."

"Scientists?"

"Scientists. I don't say they're all like that, but there's drinkers among them and you know how a drinker is when he gets to talking. Fighting Bob proved it. Not just talk."

This was in reference to the Hoyt speech that claimed on a basis of some very wobbly statistics that the A.E.C. was full of alcoholics. "That so?" asked Novak spinelessly.

"Proved it with figures. And you never know what a scientist's up to."

Enough of this nonsense. "Well, out at the field they're up to building a dummy of a moon ship to find out if it can be done."

"You ain't heard?" The driver's surprise was genuine.

"Heard about what? I'm new here."

"Well, that explains it. It's no dummy moon ship. It's camouflage for an oil-drilling rig. They struck oil there. The scientists are experimenting with it to make cheap gasoline. I heard it from the lineman that tends their power line."

"Well, he's wrong," Novak said. "I've been on the grounds and they aren't doing anything but working on the ship."

The driver shook his head. "Nossir," he said positively. "The thing's a dummy all right, but not for a space ship. Space ships don't work. Nothing for the rocket to push against. It stands to reason you can't fly where there's no air for it to push against. You could fire a cannon to the Moon if you made one big enough, but no man could stand the shock. I read about it."

"In the Bennet newspapers?" asked Novak nastily, exasperated at last.

"Sure," said the driver, not realizing that he was being insulted.

"Real American papers. Back up Fighting Bob to the hilt." The driver went on to lavish praise of the Bennet-Hoyt line on foreign policy (go it alone, talk ferociously enough and you won't have to fight); economics (everybody should and must have everything he wants without taking it from anybody else); and military affairs (armed forces

second to none and an end to the crushing tax burden for support of the armed forces).

Novak stopped listening quite early in the game and merely interjected an occasional automatic "uh-huh" at the pauses. After a while the *Prototype* appeared ahead and he stopped even that.

The rocket, standing alone in the desert like a monument was still awe-inspiring. At the sentry box he introduced himself, and the boy on guard shook his hand warmly. "Glad to have you inboard, sir," he said. The word was unmistakably "inboard"—and when Novak had it figured out he had to bite his lip to keep from laughing. The kid was using rocket-ship slang before there were any rocket ships!

The boy never noticed his effort; he was too busy apologizing for stopping him. "You see, Doctor, people don't take our work seriously. Folks used to drive out here the first month and interrupt and even expect us to lend them our drinking water that we trucked out. As if we were here for their entertainment! Finally a gang of little devils broke into one of the Quonsets after dark and smashed everything they could reach. Four thousand dollars' worth of damage in twenty minutes! We were sick. What *makes* people like that? So we had to put up a real fence and mount guard, even if it doesn't look good. But of course we have nothing to hide."

"Of course——" began Novak. But the boy's face had suddenly changed. He was staring, open-mouthed. "What's the matter?" snapped Novak, beginning to inspect himself. "Have I got a scorpion on me?"

"No," said the boy, and looked away embarrassed. "I'm sorry," he said. "Only it suddenly hit me—maybe you'll be one of the people inboard when she—when she goes. But I shouldn't ask."

"The last I heard," Novak said, "*she* is a full-sized mock-up and isn't going anywhere."

The boy winked one eye slowly.

"All right," Novak shrugged, amused. "Have it your way and I'll see you on Mars. Where's Mr. Clifton?"

"Back of the machine shop—a new testing rig."

Crossing the quadrangle, Novak passed the *Prototype* and stopped for another look. To the Moon? This colossal pile of steel? It was as easy to visualize the Eiffel Tower picking up its four legs and waddling across Paris. No wonder the taxi driver didn't believe in space flight—and no wonder the kid at the gate did. *Credo quia impossibilis*, or however it went. There were people like that.

He heard Clifton before he saw him. The engineer in charge was yelling: "Harder! *Harder!* Is that all the hard ya can bounce? *Harder!*" And a girl was laughing.

Back of the machine shop, in its shadow, Clifton was standing with a stop watch over a vaguely coffin-shaped block of moulded rubber swung from a framework by rope. Most of the ropes were milky

nylon. Six of them were manila and had big tension balances, like laundry scales, hooked into them. Towering over Clifton and the framework was a twelve-foot gas-pipe scaffold, and a pretty girl in shorts was climbing a ladder to the top of it.

As Novak watched, she hurled herself from the scaffold into the coffin. Clifton, blaspheming, snapped his stop watch and tried to read the jumping needles on the dials of all six balances at the same time.

"Hello," Novak said.

"Harya, Mike. Mike, this is Amy helping out. Like my rig?"

"I thought they worked all this out at the Wright-Patterson A.F.B. Space Medicine School. It is an acceleration couch, isn't it?"

"Kindly do not speak to me about Air Force Space Medicine," said Clifton distinctly. "It happens to be mostly bushwah. Ya know what happened? They had this ejector-seat problem, blowing a jet pilot out of a plane because he'd get cut in half if he tried to climb out at 600 m.p.h. So they had an acceleration problem and they licked it fine and dandy. So a publicity-crazy general says acceleration is acceleration, what's good enough for an ejector seat is good enough for a space ship and anyway nobody knows what the hell space flight is like so why worry?"

Clifton folded his arms, puffed out his chest, and assumed the Napoleonic stance, with one foot forward and the knee bent. His hoarse voice became an oily parody of the general's. "My gallant public relations officers! Let us enlighten the taxpaying public on what miracles us air force geniuses pass off daily before breakfast. Let us enlighten them via the metropolitan dailies and wire services with pictures. Let us tell them that we have solved all the medical problems of space flight and have established a school of space medicine to prove it. You may now kiss my hand and proceed to your typewriters at the gallop. To hell with the Navy!"

The girl laughed and said: "Cliff, it *can't* be that bad. And if you keep talking treason they'll lock you up and you'll pine away without your sweetheart there." She meant *Proto*.

"A-a-ah, what do you know about it, ya dumb Vassar broad? What time's Iron Jaw pick you up? Time for any more bounces?"

"Barnard, not Vassar," she said, "and no time for more bounces, because he said he'd be here at noon and Grady is the world's best chauffeur." She took a wrap-around skirt from a lower horizontal of the gas-pipe scaffolding and tied it on. "Are you a new member, Mike?" she asked.

"I'm going to work on the reaction chamber and throat liner."

"Metal or ceramic?"

"Ceramic refractories is my field."

"Yes, but what about strength? I was thinking about tungsten metal as a throat-liner material. It's a little fantastic because it oxidizes in air at red heat, but I have an idea. You install a tungsten

liner and then install a concentric ceramic liner to shield it. The ceramic liner takes the heat of the exhaust until the ship is out of atmosphere and then you jettison it, exposing the tungsten. In vacuum, tungsten holds up to better than three thousand centigrade——"

Clifton bulled into it. "Ya crazy as a bunny rabbit, Amy! What about atmosphere on Mars or Venus? What about the return trip to Earth? What about working the tungsten? That stuff crystallizes if ya look at it nasty. What about paying for it? Ya might as well use platinum for cost. And what about limited supply? Ya think America's going to do without tool bits and new light bulbs for a year so ya can have five tons of tungsten to play with? Didn't they teach economics at Miss Twitchell's or wherever it was?"...

It was exactly noon by Novak's watch and a black Lincoln rolled through the gate and parked.

"See you at the meeting, Cliff? Glad to have met you, Mike." The girl smiled, and hurried to the car. Novak saw a white-haired man in the back open the door for her, and the car drove off.

"Who was *that*?" Novak asked.

"She's Miss Amelia Earhart Stuart to the society pages," Clifton grinned. "In case ya don't read the society pages, she's the daughter of Wilson Stuart—my old boss at Western. She got bit by the space bug and it drives him crazy. The old man's a roughneck like me, but he's in a wheel chair now. Wrecked his heart years ago test-flying. He's been looking backwards ever since; he thinks we're dangerous crackpots. I hear ya got the job okay. Where do you want the lab?"

They left the test rig and walked around the machine-shop Quonset. Clifton stopped for a moment to measure the *Prototype* with his eye. It was habitual.

"How much of a crew does she—would she—hold?" Novak asked.

"Room for three," Clifton said, still looking at her.

"Navigator, engineer—and what?"

"Stowaway, of course!" Clifton roared. "Where ya been all ya life? A girl stowaway in a tin braseer with maybe a cellophane space suit on. Buckle down, Mike! On the ball or I don't put ya in for the Galactic Cross of Merit!"

Novak wouldn't let himself be kidded. "The youngster at the gate might stow away," he said. "He thinks the *Prototype* is going to take off some day and we just aren't telling the public about it."

Clifton shook his head—regretfully. "Not without the A.E.C. develops a rocket fuel and gives it to us. The bottom two thirds of her is a hollow shell except for structural members. I wish the kid was right. It'd be quite a trip and they'd have quite a time keeping me off the passenger list. But I built the old bat, and I know."

Novak picked an area for his lab and Clifton okayed it. They had lunch from a refrigerator in the machine shop, with a dozen kids hanging on their words.

"Give ya an idea of what we're up against, Mike," Clifton said around a pressed-ham sandwich. "The manhole for *Proto*. It's got to open and close, it's got to take direct sunlight in space, it's got to take space-cold when it's in shadow. What gasket material do you use? What sealing pressure do you use? Nobody can begin to guess. Some conditions you can't duplicate in a lab. So what some smart cookie in the A.S.F.S.F. figured out ten years ago was a wring fit, like jo-blocks. Ya know what I mean?"

Novak did—super-smooth surfaces, the kind on hundred-dollar gauges. Put two of those surfaces together and they clung as if they were magnetized. The theory was that the molecules of the surfaces interpenetrate and the two pieces become—almost—the same piece. "Ingenious," he said.

"Ingenious," muttered Clifton. "I guess that's the word. Because nobody ever in the history of machine shops put a jo-block finish on pieces that size. I got a friend in South Bend, so I sent him the rough-machined manhole cover and seating. The Studebaker people happen to have a big super-finish boring mill left over from the war, sitting in a corner covered with cosmoline. Maybe my friend can con them into taking off the grease and machining a superfinish onto our parts. If not, I'll try to handscrape them. If I can't do it on circular pieces—and I probably can't—I'll scrap them and order square forgings. You think you got troubles with your throat liner?"

"Generally, what kind of shape is *Proto* in?"

"Generally, damn fine shape. I finish testing the acceleration couch today. If it passes I order two more pads from Akron and install them. Then we're all ready to go except for the manhole problem and a little matter of a fuel and propulsion system that oughtta be cleared up in eight-ten years. A detail."

Clifton picked his teeth and led Novak to a blue-print file. He yanked open one of the big, flat drawers and pulled out a 36-by-48 blue print. "Here we are," he said. "The chamber, liner, and vane. You're gonna have to make it; you might as well look it over. I'm gonna appoint a volunteer and supervise some more crash dives."

Novak took the print to an empty corner of the shop and spread it out on a work-bench. He looked first at the ruled box in the lower right-hand corner for specifications. He noted that the drawing had been made some three months ago by "J. MacI." and checked by him. Material: ceramic refractory; melting point higher than 3,000°C.; coefficient of expansion, less than .000,004; bulk modulus . . .

Novak laughed incredulously.

It was *all* there—stretch, twist, and bulk moduli, coefficient of elasticity, everything except how to make it. MacIlheny had laid down complete specifications for the not-yet-developed liner material. A childish performance! He suspected that the president of the A.S.F.S.F. was simply showing off his technical smattering and was

mighty proud of himself. Novak wondered how to tell MacIlheny tactfully that under the circumstances it would be smarter to lay down specifications in the most general terms.

He studied them again and laughed again. Sure he could probably turn out something like that—one of the boron carbides. But it would be a hell of a note if A.E.C. came up with a 3,750-degree fuel and they had a 3,500-degree liner, or if the A.E.C. came up with a hydroxide fuel that would dissolve a liner which was only acidproof. What MacIlheny should have said was something simpler and humbler, like: "Give us the best compromise you can between strength and thermal-shock resistance. And, please, as much immunity to all forms of chemical attack as you can manage."

Well, he'd tell him nicely—somehow.

Novak looked from the specifications to the drawings themselves and thought at first that there had been some mistake—the right drawings on the wrong sheet, the wrong drawings on the right sheet—but after a puzzled moment he recognized them vaguely as a reaction chamber and throat liner.

They were all wrong; all, all wrong.

He knew quite well from N.E.P.A. what reaction chambers and throat liners for jet aircraft looked like. He knew standard design doctrine for flow, turbulence, Venturi effect, and the rest of it. There were tricks that had been declassified when newer, better tricks came along. This—this *thing*—blithely by-passed the published tricks and went in for odd notions of its own. The ratio of combustion volume to throat volume was unheard of. The taper was unheard of. The cross section was an ellipse of carefully defined eccentricity instead of the circle it should be. There was only one hole for fuel injection—only one hole! Ridiculous.

While the shop was filled with the noise of a youngster inexpertly hack-sawing sheet metal in a corner, Novak slowly realized that it was not ridiculous at all. It wasn't MacIlheny showing off; no, not at all. Anybody who could read a popular-science magazine knew enough not to design a chamber and throat like that.

But MacIlheny knew better.

He walked slowly out to the back of the shop where Clifton was clocking dives into the acceleration couch. "Cliff," he said, "can I see you for a minute?"

"Sure, Mike. As long as ya don't expect any help from me."

Together they looked down at the spread blue print, and Novak said: "The kid at the gate was right. They are going to take off some day and they just aren't telling the public about it."

"What ya talking?" demanded Clifton. "All I see there is lines on paper. Don't try to kid a kidder, Mike."

Novak said: "The specs are for me to develop a material to handle a certain particular fuel with known heat, thrust, and chemical properties. The drawings are the wrong shape. Very wrong. I know conventional

jet theory and I have never seen anything like the shapes they want for the chamber and throat of that—thing—out there.”

“Maybe it’s a mistake,” Clifton said uncertainly.

Then he cursed himself. “Mistake ! Mistake ! Why don’t I act my age ? Mistakes like this them boys don’t make. The acceleration couch. They designed it eight years ago on paper. It works better than them things the Air Force been designing and building and field-testing for fifteen years now.”

Novak said: “People who can do that aren’t going to get the throat and chamber so wrong they don’t look like any throat and chamber ever used before. *They’ve got a fuel and they know its performance.*”

Clifton was looking at the data. “MacIlheny designed it—it says here. An insurance man three months ago sat down to design a chamber and throat, did it, checked it, and turned it over to you to develop the material and fabricate the pieces. I wonder where he got it, Mike. Russia ? Argentina ? China ?”

“Twenty countries have atomic energy programmes,” Novak said. “And one year ago the A.S.F.S.F. suddenly got a lot of money—a hell of a lot of money. I ordered thirty-two thousand dollars’ worth of gear and Friml didn’t turn a hair.”

Clifton muttered: “A couple of million bucks so far, I figure it. Grey-market steel. Rush construction—overtime never bothered them as long as the work got done. Stringing the power line, drilling the well. A couple million bucks and nobody tells ya where it came from.” He turned to Novak and gripped his arm earnestly. “Nah, Mike,” he said softly. “It’s *crazy*. Why should a country do research on foreign soil through stooges. It just ain’t possible.”

“Oh, God !” said Novak. His stomach turned over.

“What’s the matter, kid ?”

“I just thought of a swell reason,” he said slowly. “What if a small country like the Netherlands, or a densely populated country like India, stumbled on a rocket fuel ? And what if the fuel was terribly dangerous ? Maybe it could go off by accident and take a couple of hundred miles of terrain with it. Maybe it’s radiologically bad and poisons everybody for a hundred miles around if it escapes. Wouldn’t they want the proving ground to be outside their own country in that case ?”

There was a long pause.

Clifton said: “Yeah. I think they might. If it blows up on their own ground they lose all their space-ship talent and don’t get a space ship. If it blows up on our ground they also don’t get a space ship, but they do deprive Uncle Sam of a lot of space-ship talent. But how—if the fuel don’t blow up California—do they take over the space ship ?”

“I don’t know, Cliff. Maybe MacIlheny flies it to Leningrad and the Red Army takes it from there. Maybe Friml flies it to Buenos Aires and the Guardia Peronista.”

"Maybe," said Cliff. "Say, Mike, I understand in these cloak-and-dagger things they kill you if you find out too much."

"Yeah, I've heard of that, Cliff. Maybe we'll get the Galactic Cross of Merit posthumously. Cliff, *why* would anybody want to get to the Moon bad enough to do it in a crazy way like this?"

The engineer took a gnawed hunk of tobacco from his hip pocket and bit off a cud. "I can tell ya what MacIlheny told me. Our president, I used to think, was just a space hound and used the military-necessity argument to cover it up. Now, I don't know. Maybe the military argument was foremost in his mind all the time.

"MacIlheny says the first country to the Moon has got it *made*. First rocket ship establishes a feeble little pressure dome with one man left in it. If he's lucky he lives until the second trip, which brings him a buddy, more food and oxygen, and a stronger outer shell for his pressure dome. After about ten trips you got a corporal's squad on the Moon nicely dug in and you can start bringing them radar gear and launchers for bombardment rockets homing on earth points.

"Nobody can reach you there, get it? *Nobody*. The first trip has always gotta bring enough stuff to keep one man alive—if he's lucky—until the next trip. It takes a lotta stuff when ya figure air and water. The first country to get there has the bulge because when country two lands their moon pioneer the corporal's squad men hike on over in their space suits and stick a pin in his pressure dome and—he dies. Second country can complain to the U.N., and what can they prove? The U.N. don't have observers on the Moon. And if the second country jumps the first country with an A-bomb attack, they're gonna *die*. Because they can't jump the retaliation base on the Moon."

He squirted tobacco juice between his teeth. "That's simplified for the kiddies," he said, "but that's about the way MacIlheny tells it."

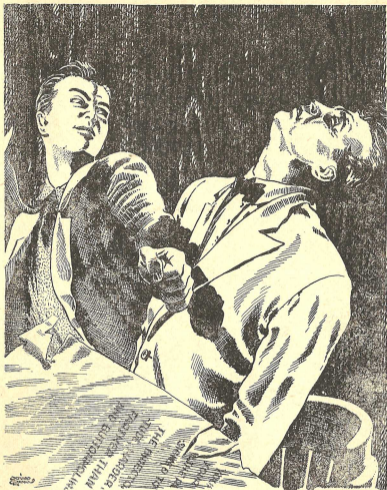
"Sounds reasonable," Novak said. "Personally I am going right now to the nearest regional A.E.C. Security and Intelligence Office. You want to come along?" He hoped he had put the question casually. It had occurred to him that, for all his apparent surprise, Clifton was a logical candidate for Spy Number One.

"Sure," said Clifton. "I'll drive you. There's bound to be one in L.A."

V.

There was, in the Federal Building.

Anheier, the agent in charge, was a tall, calm man. "Just one minute, gentlemen," he said, and spoke into his inter-com. "The file on the American Society for Space Flight, Los Angeles," he said, and smiled at their surprise. "We're not a Gestapo," he said, "but we have a job to do. It's the investigation of possible threats to national security as they may involve atomic energy. Naturally, the space-flight



group would be of interest to us. If the people of this country only knew the patience and thoroughness—here we are.”

The file was bulky. Anheier studied it in silence for minutes. “It seems to be a very clean organization,” he said at last. “During the past fifteen years derogatory informations have been filed from time to time, first with the F.B.I. and later with us. The investigations that followed did not produce evidence of any law violations. Since that’s the case, I can tell you that the most recent investigation followed a

complaint from a certain rank-and-file member that Mr. Joel Friml, your secretary-treasure, was a foreign agent. We found Mr. Friml's background spotless and broke down the complainant. It was a simple case of jealousy. There seems to be a certain amount of, say, spite work and politics in an organization as—as visionary as yours."

"Are you suggesting that we're cranks?" Novak demanded stiffly. "I'm a Doctor of Philosophy of the University of Illinois and I've held a responsible position with the A.E.C. And Mr. Clifton has been a project engineer with Western Aircraft."

"By no means, by no means!" Anheier said hastily. "I know your backgrounds, gentlemen." There was something on his face that was the next thing to a smile. Novak was suddenly, sickeningly sure that Anheier, with patience and thoroughness, had learned how he had socked his A.E.C. director in the jaw and how Clifton had been fired after a fight with his boss. A couple of congenital hotheads, Anheier would calmly decide; unemployables who can't get along with people; crank denouncers and accusers.

Anheier was saying, poker-faced: "Of course we want complete depositions from you on your—your information."

He buzzed and a stenographer came in with a small, black, court machine. "And if investigation seems in order, of course we'll get going with no lost time. First give your name and personal data to the stenographer and then your facts, if you please." He leaned back calmly, and the stenographer zipped out the paper box of his machine and poised his fingers. He looked bored.

"My name is Michael Novak," Novak said, fighting to keep his voice calm and clear. The stenographer's fingers bumped the keys and the paper tape moved up an inch. "I live at the Revere Hotel in Los Angeles. I am a ceramic engineer with the B.Sc. from Rensselaer Polytechnic Institute and M.Sc. and Ph.D. from the University of Illinois. I was employed after getting my doctorate by the U.S. Atomic Energy Commission in various grades, the last and highest being A.E.C. 18. I—I left the A.E.C. last month and took employment with an organization called the American Society for Space Flight at its Los Angeles headquarters.

"I had no previous knowledge of this organization. I was told by officers that it is now making a full-scale metal mock-up of a moon ship to study structural and engineering problems. Purportedly it has no space-ship fuel in mind and intends to ask the co-operation of the A.E.C. in solving this problem after it has solved all the other problems connected with the design of a space ship.

"I believe, however, that this is a cover story. I believe that about one year ago the organization was supplied with funds to build an actual space ship by a foreign power which has developed a space-ship fuel.

"My reasons for believing this are that the organization has liberal funds behind it which are supposed to be private contributions from

industry, but there are no signs of outside interests in the project; further, I was ordered to execute an extremely unorthodox design for a reaction chamber and throat liner, which strongly suggests that the organization has an atomic space-ship fuel and knows its characteristics.

"I want to emphasise that the unorthodox design which aroused my suspicions was purportedly drawn and checked by James MacIlheny, president of the organization, an insurance man who disclaims any special technical training. In other, nonvital details of the space ship, designing was done mostly by technical men employed in the aircraft industry and by local college students and teachers following space flight as a hobby of a technical nature. It is my belief that the reaction chamber and throat liner were designed by a foreign power to fit their atomic fuel and were furnished to MacIlheny.

"I do not know why a foreign power should erect a space ship off its own territory. One possibility that occurs to me is that their fuel might be extremely dangerous from a radiological or explosive standpoint or both, and that the foreign power may be unwilling to risk a catastrophic explosion on its own ground or radiation sickness to large numbers of its own valued personnel."

He stopped and thought—but that was all there was to say.

Anheier said calmly: "Thank you, Dr. Novak. And now Mr. Clifton, please."

The engineer cleared his throat and said aggressively: "I'm August Clifton. I been a self-educated aero engineer for nine years. For Douglas I designed the B-108 air frame and I rode production line at their Omaha plant. Then I worked for Western Air, specializing in control systems for multijet aircraft. Last year I left Western and went to work for the A.S.F.S.F.

"My ideas about the A.S.F.S.F.'s backing and what they're up to are the same as Novak's. I been around the Society longer, so I can say more definitely than him that there is not one sign of any business or industry having any stake in what's going on out at the field. That's all."

"Thanks, Mr. Clifton. They'll be typed in a moment." The stenographer left. "I understand there's one prominent industrialist who shows some interest in the Society? Mr. Stuart?" There was a ponderously roguish note in Anheier's voice.

"Ya crazy, Anheier," Clifton said disgustedly. "He's just looking after his daughter. *You* think we're nuts? You should hear Iron Jaw take off on us?"

"I know," smiled Anheier hastily. "I was only joking."

"What about MacIlheny?" asked Novak. "Have you investigated him?"

Anheier leafed through the A.S.F.S.F. file. "Thoroughly," he said. "Mr. MacIlheny is a typical spy——"

"What?"

"—I mean to say, he's the kind of fellow who's in a good position to spy, but he isn't and doesn't. He has no foreign contacts and none of the known foreign agents in this country have gone anywhere near him—"

"What ya talking?" demanded Clifton. "You mean there's spies running around and you don't pick them up?"

"I said foreign agents—news-service men, exchange students, businessmen, duly registered propaganda people, diplomatic and consular personnel—there's no end to them. They don't break any laws, but they recruit people who do. God knows *how* they recruit them. Every American knows that since the Rosenberg cases the penalty for espionage by a citizen is, in effect, death. That's the way the country wanted it, and that's the way it is."

"Why do you say MacIlheny's typical?" asked Novak. He had a half-formed hope that this human iceberg might give them some practical words on technique, even if he refused to get excited about their news.

"Mata Hari's out," said Anheier comfortably. "You've seen spies in the papers, Dr. Novak." To be sure, he had—ordinary faces, bewildered, ashamed, cowering from the flash bulbs. "I came up via the accountancy route myself so I didn't see a great deal of the espionage side," Anheier confessed a bit wistfully. "But I can tell you that your modern spy in America is a part-timer earning a legitimate living at some legitimate line. Import-export used to be a favourite, but it was too obvious."

"Hell, I should think so," grinned Clifton.

Anheier went on: "Now they recruit whatever they can, and get technical people whenever possible. This is because your typical state secret nowadays is not a map or code or military agreement but an industrial process.

"The Manhattan District under General Groves and the British wartime atomic establishment were veritable sieves. The Russians learned free of charge that calutron separation of U-235 from U-238 was impractical and had to be abandoned. They learned, apparently, that gaseous diffusion is *the* way to get the fissionable isotope. They learned that implosion with shaped charges is a practical way to assemble a critical mass of fissionable material. They were saved millions of dead-ended man-hours by this information.

"Security's taken a nice little upswing since then, but we still have secrets and there are still spies, even though the penalty is death. Some do it for money, some are fanatics—some, I suppose, just don't realize the seriousness of it. Here are your depositions, gentlemen."

They read them and signed them.

Anheier shook their hands and said: "I want to thank you both for doing your patriotic duty as you saw it. I assure you that your infor-

mation will be carefully studied and appropriate action will be taken. If you learn of anything else affecting national security in the atomic area in your opinion, I hope you won't hesitate to let us know about it." Clearly it was a speech he had made hundreds of times—or thousands. The brush-off.

"Mr. Anheier," Novak said, "what if we take this to the F.B.I.? They might regard it more seriously than you seem to."

The big, calm man put his palms out protestingly. "Please, Dr. Novak," he said. "I assure you that your information will be thoroughly processed. As to the F.B.I., you're perfectly free to go to them if you wish, but it would be wasted motion. Cases in the atomic area that come to the F.B.I. are automatically bucked to us—a basic policy decision, and a wise one in my opinion. Technical factors and classified information are so often involved—"

In the street Novak said disgustedly: "He didn't ask us any questions. He didn't ask us whether we were going to quit or not."

"Well—are we?"

"I guess I am—I don't know, Cliff. Maybe I'm wrong about the whole business. Maybe I'm as crazy as Anheier thinks I am."

"Let's go to my place," Clifton said. "We oughtta go to the A.S.F.S.F. membership meeting tonight after we eat."

"Cripes, I'm supposed to make a speech!"

"Just tell 'em hello."

They got into Clifton's car, the long, tall, 1930 Rolls with the lovingly maintained power plant, and roared through Los Angeles. Clifton drove like a maniac, glaring down from his height on underslung late models below and passing them with muttered fusillades of curses. "Me, I like a car with *character*," he growled, barreling the Rolls around a '56 Buick.

His home was in a pretty, wooded canyon dotted with houses. Gravel flew as he spun into the driveway.

"Come and meet Lilly," he said.

Outside, the Clifton house was an ordinary five-room bungalow. Inside it was the dope-dream of a hobbyist run amuck. Like geologic strata, tools and supplies overlaid the furniture. Novak recognized plasticene, clay, glazes, modeling tools and hooks, easels, sketch boxes, cameras, projectors, enlargers, gold-leaf burnishers, leather tools, jeweller's tools and the gear of carpenters, machinists, plumbers, electricians and radio hams. Lilly was placidly reading an astrology magazine in the middle of the debris. She was about thirty-five: a plump, grey-eyed blonde in halter and shorts. The sight of her seemed to pick Clifton up like a shot of brandy.

"Mama!" he yelled, kissing her loudly. "I'm sick of you. I brought you this here young man to run away with. Kindly leave without making no unnecessary disturbance. His name is Mike."

"Hallo," she said calmly. "Don't pay him no attention; he always

yokes. Excuse how I talk; I am a Danish. How many letters you got in your full complete name?"

"Uh—twelve."

"Good," she dimpled. "I am twelve also. We will be friends, it means."

"I'm very glad," Novak said faintly.

"Mike, you've been factored?"

"I don't think I understand——"

"It's biomat'ematics. You know? You go to a biomat'ematicist and he finds the mat'ematical for-moola of you subconscious and he factors out the traumas. It's va-3-ary simple." Her face fell a little. "Only I got a Danish-speaking subconscious of course, so vit' me it goes a liddle slow. Funny"—she shook her head—"same t'ing happened to me years ago vit' di'netics. Cliff, you gonna give Mike a drink or is he like the other young feller you had here last month? Feller that broke the big mirror and you nineteen-inch cat'ode-ray tube and my Svedish pitcher——"

"How the hell was I supposed to know?" he roared. In an aside: "That was Friml, Mike. He got pretty bad."

"Friml?" asked Novak incredulously. "The ice-water kid?"

"He should go to a biomat'ematicist," sighed Lilly. "If ever a boy needed factoring, it's him. Make me only a liddle one please; I don't eat yet today."

She had a little Martini and Clifton and Novak had big ones.

"We all go to the meeting tonight I guess? First I want *bifteek aux pommes de terre* someplace."

"What the hell, Mama!" Clifton objected. "This time yesterday you was a vegetarian for life."

"I change my mind," she said. "Go get shaved up and dress you'self and we go someplace for *bifteek*."

When Clifton appeared—shaved, dressed, and subdued—Lilly was still in the bedroom, putting on finishing touches. The two men had another martini apiece.

"What about the contracts?" Novak asked.

Clifton understood. "If they try to hold us to them we could just lie down on the job and let them pay us. Hate to work it like that, though. It'd be dull."

"It's still the craziest business I ever heard of."

Lilly appeared, looking sexy in a black dinner dress with a coronet of blonde hair swept up from her creamy neck. Clifton let out a long, loud wolf-howl and said: "The hell with the beefsteaks and the meeting. Let's——"

"Later," said Lilly firmly.

As the maroon Rolls thundered down the canyon, Clifton said casually: "I may quit the space hounds, Mama."

"So what you gonna do for a yob?"

"Buy you a red dress and turn mack, I guess. Nah, ya too old and ugly. Maybe I'll open a radio shop or ship out again for an electrician; I guess I still got my card. I kinda hate to leave my best girl out there in the desert, but the whole thing's a joke. She's pretty, but she'll never amount to a damn."

Novak knew why he was lying about the reason. *I understand in these cloak-and-dagger things they kill you if you find out too much.*

VI.

They had dinner at a downtown restaurant and were at the A.S.F.S.F. meeting hall by 8.30. Novak was alarmed when the building turned out to be the Los Angeles Slovak Sokol Hall, rented for the occasion.

"Foreigners!" he exclaimed. "Does the A.S.F.S.F. go around looking for jams to get into?"

"Relax, Mike," Clifton told him. "The Sokol's strictly American by now. They got a long anti-Communist record."

Still, fretted Novak, foreigners—Slavic foreigners. The building was in the same run-down area that housed the Society's business office. It was liberally hung with American flags and patriotic sentiments. Inconspicuous on the lobby walls were a few photographs of group calisthenics and marchers in Czech national costumes, from decades ago.

A well-worn placard on an easel said that the A.S.F.S.F. meeting was being held at 8.30 in the main hall, straight ahead and up the stairs.

About a score of people in the lobby were having final smokes and talking. Novak could divide them easily into two types: juvenile space hounds and employed hobbyists. The hobbyists were what you'd see at any engineers' convention: pipe-smokers, smiling men, neat, tanned. The space hounds were any collection of juvenile enthusiasts anywhere—more mature than an equal number of hot-rod addicts, perhaps, but still given to nervous laughter, horse-play, and catchwords.

Their entrance had been the signal for the younger element to surround Clifton and bombard him with questions.

"Cliff, how she coming?"

"Mr. Clifton, need a good carpenter at the field?"

"How's the acceleration couch coming, Cliff?"

"Could we get that boring mill at South Bend?"

"Shaddap!" said Clifton. "Leave a man breathe, will ya!" They loved him for it. "What's the movie tonight?"

"A stinker," one girl told him. "*Pirates of the Void*, with Marsha Denny and Lawrence Malone. Strictly for yocks."

"They show a space-flight movie," Clifton explained to Novak. "There ain't enough business to kill the time and send everybody home in the proper state of exhaustion." He towed his wife and Novak

up the stairs, where a youngster at a card table challenged their membership. They were clamourously identified by a dozen youngsters and went in. The hall seated about four hundred and had a stage with a movie screen and more American flags.

"Better sit in the back——" began Clifton, and then: "For God's sake!" It was Anheier, smiling nervously.

"Hello," said the Security man. "I thought I'd combine business with pleasure. Marsha Denny's a great favourite of mine and I understand there's going to be a preview tonight."

"Well, enjoy yourself," Clifton said coldly. He took Lilly and Novak to the left rear corner of the auditorium and they sat down. He told his wife: "An A.E.C. guy we met. A creep."

MacIlheny climbed to the stage and called to stragglers in the back of the hall: "Okay, men. Let's go." They found seats.

Crack went the gavel. "The-meeting-is-called-to-order. The-chair-will-entertain-a-motion-to-adopt-the-standard-agenda-as-laid-down-in-the-organization's-byelaws."

"So move," said somebody, and there was a ragged chorus of seconds.

"All-in-favor-signify-by-raising-one-hand-any-opposed? The-motion-seems-to-be-and-is-carried. First-on-the-agenda-is-the-reading-of-previous-meetings-minutes."

Somebody stuck his hand up, was recognized, and moved that the minutes be accepted as read. The motion was seconded and carried without excitement. So were motions to accept and adopt reports of the membership, orbit computation, publications, finance, structural problems and control mechanisms committees.

"Making good time," Clifton commented.

Under "good and welfare" a belligerent-looking youngster got recognized and demanded the impeachment of the secretary-treasurer. There was a very mild, mixed demonstration: some applause and some yells of "Sit down!" and "Shuddup!" MacIlheny rapped for order.

"The motion is in order," he wearily announced. "Is there a second?" There was—another belligerent kid.

"In seconding this motion," he said loudly, "I just want to go over some ground that's probably familiar to us all. With due respect to the majority's decision, I still feel that there's no place for salaried employees in the A.S.F.S.F. But if there *has* to be a paid secretary-treasurer, I'm damned if I see why an outsider with no special interest in space flight——"

Friml was on his feet in the front row, clamouring for recognition on a point of personal privilege.

"Damn it, Friml, I wasn't insulting you——"

"That's for the chair to decide, Mr. Grady! I suggest you pipe down and let him."

"Who're you telling to——"

MacIlheny hammered for silence. "Chair recognizes Mr. Friml."

"I simply want a ruling on the propriety of Mr. Grady's language. Thank you."

"The chair rules that Mr. Grady's remarks were improper and cautions him to moderate his language."

Breathing hard, the youngster tried again. "In seconding this motion to impeach, I want to point out that there are members with *much* more seniority in the organization than Mr. Friml and with a long-demonstrated record of interest in space flight which he cannot match."

MacIlheny called for debate and recognized one of the engineer-types.

"It should be evident to all of us," the engineer said soothingly, "that the criterion for the secretary-treasurer's office ought to be *competence*. We're not playing with marbles any more—I'm happy to say. And I for one am very much relieved that we have the services of a man with a B.B.A., an M.B.A., and a C.P.A. after his name.

"Now, I may have more organizational experience than Mr. Grady, since I've been somewhat active in the A.S.M.E. and the aeronautical societies. I name no names—but in one of those groups we were unwise enough to elect a treasurer who, with all the good will in the world, simply didn't know how to handle the job. We were rooked blind before we knew what hit us, and it took a year to straighten the records out. I don't want that to happen to the A.S.F.S.F., and I seriously urge that the members here vote against the impeachment. Let's not monkey with a smooth-running machine. Which is what we've got now."

There was a lot of applause.

A thin, dark girl, rather plain, was recognized. Her voice was shrill with neurotic hatred. "I don't know what's become of the A.S.F.S.F. In one year I've seen a decent, democratic organization turned into a little despotism with half a dozen people—if that!—running the works while the plain members are left in the dark. Who is this Friml? How do we know he's so good if we don't know the amount and nature of the contributions he handles? And *Mr.* August Clifton, whom everybody is so proud of, I happen to know he was fired from Western Aircraft! The fact is, MacIlheny's got some cash donors in his hip pocket and we're all afraid to whisper because he might—"

MacIlheny pounded for silence. "The chair rules Miss Gingrich out of order," he said. "This is debate on a motion to impeach Mr. Friml and not to reconsider a policy of accepting contributions in confidence, which was approved by the membership as the minutes show. Miss Stuart, you're recognized."

Amy Stuart got up looking grim. "I want to make two statements. First, on a point of personal privilege, that Mr. Clifton was fired from Western because he was too high-spirited to get along in a rather conservative outfit and not for incompetence. More than once I've heard

my father say that Mr. Clifton was—or almost was—the best man he had working for him.

"Second, I move to close debate."

"Second the motion," somebody called from the floor.

Miss Gingrich was on her feet shrilling: "Gag rule! Nobody can open his mouth around here except the Holy Three and their stooges! We were doing all right before MacIlheny—" The rest was lost in shouts of disapproval and the whacking of the gavel. The girl stood silently for a moment and then sat down, trembling.

"Motion to close debate has been made and seconded. This motion takes precedence and is unamendable. All in favour raise one hand." A forest of hands went up. "Any opposed?" Maybe twenty. "The motion is carried. We now have before us a motion to impeach Mr. Friml, our secretary-treasurer. All in favour." The same twenty hands. "Opposed?" The forest of hands rose again, and a few kids cried: "No, no!"

"The motion is defeated. Unless there are further matters under good and welfare"—he was refusing to let his eye be caught, and half a dozen members were trying to catch it—"we will proceed to the introduction of a new A.S.F.S.F. full-time scientific worker. Dr. Michael Novak comes to us from two years with the United States Atomic Energy Commission. He has been working with high-tensile, refractory ceramic materials—a vital field in rocketry; I'm sure the application to our work is obvious to all. Dr. Novak."

He was on his feet and starting down the aisle to a polite burst of applause. They might be spies or they might not; he might be working for them tomorrow or he might not, but meanwhile there was a certain rigmarole you went through at these things, and he knew it well.

"Mr. President, members, and guests, thank you." Now the joke. "My field of work stems from very early times. It was a cave man who founded ceramic engineering when he accidentally let a mud-daubed wicker-basket fall into his campfire and pulled out, after the fire died down, the first earthenware pot. I presume he did not realize that he was also a very important pioneer of space flight." A satisfactory chuckle.

Now the erudition. "Basically, my problem is to develop a material which is strong, workable, and heat-resistant. For some years the way to tackle such a job has been to hunt the material among the so-called 'solid solutions'. An alloy is a familiar example of a solid solution—the kind in which both the solvent and the solute are metals.

"The substance tungsten carbide is well known to any of you who have machine-shop experience. It is a solid solution with one non-metallic constituent, and its properties have revolutionized industrial production. Dies and tool bits of this fantastically hard stuff have probably increased the productivity of this country by several per cent with no other changes being put into effect. Idle time of machine tools

has been reduced because tungsten-carbide bits go on, and on, and on without resharpening. Idle time on presses of all sorts has been reduced because tungsten-carbide dies go on, and on, and on without replacement.

"This is only one example of the way Mother Nature comes up with the answer to your particular problem if you ask her in the right way. She also offers among the solid solutions the chromium and cobalt carbides, which top tungsten carbide for refractory qualities, and the boron carbides with which I intend to work.

"In the solid solutions there is a situation that rules out dramatic, abrupt crystallizations of one's problem. An organic chemist trying to synthesize a particular molecule may leap up with a shriek of 'eureka—I've got it!' And so he may, for an organic molecule either is there or it isn't: a yes-or-no situation. But in working with solutions rather than compounds, there is continuous variation of solvent to solute. Theoretically, it would take an infinite amount of time to explore the properties of *every* boron carbide, even if their properties varied simply and continuously with the ratio of constituents alone. But it is more complicated than that.

"Actually the properties you seek in your carbides do not appear when you turn out a batch fresh from your crucible. There is the complicated business of ageing, in which the carbide spends a certain time at a certain temperature. Two more variables. And in some cases the ageing should be conducted in a special atmosphere—perhaps helium or argon. Another variable! And secondary properties must be considered. For example, the standard ceramic bond to metal is obtained by heating both parts to red heat and plunging them into liquid air. There are carbides that may have every other desirable property but which cannot take such a drastic thermal shock."

MacIlheny, in the front row, was looking at his watch. Time for the windup. "I hope I've given you an idea of what we're up against. But I hope I haven't given you an idea that the problem's uncrackable in a less-than-infinite amount of time, because it isn't. Experiments in some number must be made, but mathematics comes to the aid of the researcher to tell him when he's on the right track and when he's going astray. With the aid of the theory of least squares, plenty of sweat, and a little dumb luck I hope before long to be able to report to you that I've developed a material which can take the heat and thrust of any escape-velocity fuel which may some day come along."

The applause was generous.

"We have the privilege tonight," MacIlheny was saying, "of being the first audience in this area to see the new space-flight film *Pirates of the Void*—" There were a few ironical cheers. "—through the kindness of Mr. Riefenstahl of United Productions' promotion staff. Audience comment cards will be available on the way out. I think it would be only fair and courteous if all of us made it a point to get one

and fill it out, giving our—*serious*—opinion of the movie. And I'd like to add that Sokol Hall has made *two* projection machines available to us, so that this time there will be no interruption for changing between reels." The cheers at that were not ironical.

"I'm gonna the men's room," Clifton announced, and left.

"Cliff don' like movies much," Lilly announced proudly. "He'll be back."

The lights went out and *Pirates of the Void* went on with a fanfare and the United Productions monogram.

The film, thought Novak as he watched, was another case of the public's faith that space flight is an impossibility. It was a fable in which the actors wore odd garments: the men, shiny overalls; and the women, shiny shorts and bras. The time was far in the future—far enough for there to be pirates of space and a Space Navy of the United World to battle them. Space flight tomorrow, but never space flight today. *But MacIlheny had a fuel and knew its performance.*

He leaned back, wishing he could smoke, and saw Marsha Denny's problem unfold. Marsha was a nurse in the Space Navy and she had a brother (but there was a plant indicating that he wasn't really her brother, though she didn't yet know that), in the Pirate Fleet, high up. She was in love with Lawrence Malone, who took the part of the muscular G-2 of the Space Navy and had assigned himself the mission of penetrating the Pirate Fleet in the guise of a deserter from the regulars.

Somehow fifteen minutes of it passed, and Lilly leaned across the seat between them. "Mike," she asked worriedly, "you mind doing somet'ing for me? You go and find Cliff? He's gone an awful long time."

"Why, sure," he whispered. "Glad to get out of here."

He slipped from the dark auditorium and promptly lit a cigarette. *Men's Room*, said a sign with an arrow. He followed it to a big, empty washroom with six booths. One of the doors was closed.

"Cliff?" he called, embarrassed. There was no answer.

Cliff must be in the corridor somewhere. His eye was caught by the shine of gold on the corner of a washstand. A wedding band—Cliff's wedding band? Slipped it off before he washed his hands? There was no engraving in it and he didn't remember what Cliff's ring looked like; just that he wore one.

Maybe——

"Mister," he said to the closed door, "I found a gold ring on the washstand. You lose it?"

There was no answer. A thread of crimson blood snaked from under the closed door, slowly over the tiled floor, seeking a bright brass drain.

I understand in these cloak-and-dagger things they kill you if you find out too much.

To be continued

When the Moon is conquered geologists will slowly explore its terrain—its long-dead surface will give up any secrets. What significance could we put upon the finding of an artifact?

THE SENTINEL

By Arthur C. Clarke

The next time you see the full Moon high in the South, look carefully at its right-hand edge and let your eye travel upwards along the curve of the disc. Round about 2 o'clock you will notice a small, dark oval: anyone with normal eyesight can find it quite easily. It is the great walled plain, one of the finest on the Moon, known as the Mare Crisium—the Sea of Crises. Three hundred miles in diameter, and almost completely enclosed by a ring of magnificent mountains, it was never properly explored until we entered it in the late summer of 1996.

Our expedition was a large one: we had two heavy freighters which had flown our supplies and equipment from the main lunar base in the Mare Serenitatis, five hundred miles away. There were also three small rockets which were intended for short-range transport over regions which our surface vehicles couldn't cross. Luckily, most of the Mare Crisium is very flat: there are none of the great crevasses so common and so dangerous elsewhere, and very few craters or

mountains of any size. As far as we could tell, our powerful caterpillar tractors would have no difficulty in taking us wherever we wished.

I was geologist—or selenologist, if you want to be pedantic—in charge of the group exploring the southern region of the Mare. We had crossed a hundred miles of it in a week, skirting the foothills of the mountains along what was once the shore of the ancient sea, some thousand million years before. When life was beginning on Earth, it was already dying here: the waters were retreating down the flanks of those stupendous cliffs, retreating into the empty heart of the Moon. Over the land which we were crossing, the tideless ocean had once been half a mile deep—and now the only trace of moisture was the hoarfrost one could sometimes find in caves which the searing sunlight never penetrated.

We had begun our journey early in the slow lunar dawn, and still had almost a week of Earth time before nightfall. Half a dozen times a day we would leave our vehicle and go outside in the spacesuits to hunt for interesting minerals, or to place markers for the guidance of future travellers. It was an uneventful routine; there is nothing hazardous or even particularly exciting about lunar exploration. We could live comfortably for a month in our pressurised tractors, and if we ran into trouble we could always radio for help and sit tight until one of the spaceships came to our rescue. When that happened there was always a frightful outcry about the waste of rocket fuel, so a tractor sent out an S.O.S. only in a real emergency.

I said just now that there was nothing exciting about lunar exploration: but of course that isn't true. One could never grow tired of those incredible mountains, so much steeper and more rugged than the gentle hills of Earth. We never knew, as we rounded the capes and promontories of that vanished sea, what new splendours would be revealed to us. The whole southern curve of the Mare Crisium is a vast delta where a score of rivers had once found their way into the ocean, fed perhaps by the torrential rains that must have lashed the mountains in the brief volcanic age when the Moon was young. Each of these ancient valleys was an invitation, challenging us to climb into the unknown uplands beyond. But we had a hundred miles still to cover, and could only look longingly at the heights which others must scale.

We kept Earth-time aboard the tractor, and precisely at 22.00 hours the final radio message would be sent out to Base and we would close down for the day. Outside, the rocks would still be burning beneath the almost vertical sun: but to us it was night until we awoke again eight hours later. Then one of us would prepare breakfast, there would be a great buzzing of electric shavers, and someone would switch on the short-wave radio from Earth. Indeed, when the smell of frying bacon began to fill the cabin, it was sometimes hard to believe

that we were not back on our own world—everything was so normal and homely, apart from the feeling of decreased weight and the unnatural slowness with which objects fell.

It was my turn to prepare breakfast in the corner of the main cabin that served as a galley. I can remember that moment quite vividly after all these years, for the radio had just played one of my favourite melodies, the old Welsh air "David of the White Rock." Our driver was already outside in his spacesuit, inspecting our caterpillar treads. My assistant, Louis Garnett, was up forward in the control position, making some belated entries in yesterday's log.

As I stood by the frying-pan, waiting, like any terrestrial housewife, for the sausages to brown, I let my gaze wander idly over the mountain walls which covered the whole of the southern horizon, marching out of sight to east and west below the curve of the Moon. They seemed only a mile or two from the tractor, but I knew that the nearest was twenty miles away. On the Moon, of course, there is no loss of detail with distance—none of that almost imperceptible haziness which softens and sometimes transfigures all far-off things on Earth.

Those mountains were ten thousand feet high, and they climbed steeply out of the plain as if ages ago some subterranean eruption had smashed them skywards through the molten crust. The base of even the nearest was hidden from sight by the steeply curving surface of the plain, for the Moon is a very little world, and from where I was standing the optical horizon was only two miles away.

I lifted my eyes towards the peaks which no man had ever climbed; the peaks which, before the coming of terrestrial life, had watched the retreating oceans sink sullenly into their graves, taking with them the hope and the morning promise of a world. The sunlight was beating against those ramparts with a glare that hurt the eyes, yet only a little way above them the stars were shining steadily in a sky blacker than a winter midnight on Earth.

I was turning away when my eye caught a metallic glitter high on the ridge of a great promontory thrusting out into the Sea thirty miles to the west. It was a dimensionless point of light, as if a star had been clawed from the sky by one of those cruel peaks, and I imagined that some smooth rock surface was catching the sunlight and heliographing it straight into my eyes. Such things were not uncommon. When the Moon is in her second quarter, observers on Earth can sometimes see the great ranges in the Oceanus Procellarum burning with a blue-white iridescence as the sunlight flashes from their slopes and leaps again from world to world. But I was curious to know what kind of rock could be shining so brightly up there, and I climbed into the observation turret and swung our four-inch telescope round to the west.

I could see just enough to tantalise me. Clear and sharp in the field of vision, the mountain peaks seemed only half a mile away, but

whatever was catching the sunlight was still too small to be resolved. Yet it seemed to have an elusive symmetry, and the summit upon which it rested was curiously flat. I stared for a long time at that glittering enigma, straining my eyes into space, until presently a smell of burning from the galley told me that our breakfast sausages had made their quarter-million mile journey in vain.

All that morning we argued our way across the Mare Crisium while the western mountains reared higher in the sky. Even when we were out prospecting in the spacesuits, the discussion would continue over the radio. It was absolutely certain, my companions argued, that there had never been any form of intelligent life on the Moon: the only living things that had ever existed there were a few primitive plants and their slightly less degenerate ancestors. I knew that as well as anyone, but there are times when a scientist must not be afraid to make a fool of himself.

"Listen," I said at last, "I'm going up there, if only for my own peace of mind. That mountain's less than twelve thousand feet high—that's only two thousand under Earth gravity—and I can make the trip in twenty hours at the outside. I've always wanted to go up into those hills, anyway, and this gives me an excellent excuse."

"If you don't break your neck," said Garnett, "you'll be the laughing-stock of the expedition when we get back to Base. That mountain will probably be called Wilson's Folly from now on."

"I *won't* break my neck," I said firmly. "Who was the first man to climb Pico and Helicon?"

"But weren't you rather younger in those days?" asked Louis gently.

"That," I said with great dignity, "is as good a reason as any for going."

We went to bed early that night, after driving the tractor to within half a mile of the promontory. Garnett was coming with me in the morning: he was a good climber, and had often been with me on such exploits before. Our driver was only too glad to be left in charge of the machine.

At first sight, those cliffs seemed completely unscaleable, but to anyone with a good head for heights, climbing is easy on a world where all weights are only a sixth of their normal value. The real danger in lunar mountaineering lies in over-confidence; a six hundred foot drop on the Moon can kill you just as thoroughly as a hundred foot fall on Earth.

We made our first halt on a wide ledge about four thousand feet above the plain. Climbing had not been very difficult, but my limbs were stiff with the unaccustomed effort, and I was glad of the rest. We could still see the tractor as a tiny metal insect far down at the foot of the cliff, and we reported our progress to the driver before starting on the next ascent.

Hour by hour the horizon widened and more and more of the great plain came into sight. Now we could look for fifty miles out across the Mare, and could even see the peaks of the mountains on the opposite coast more than a hundred miles away. Few of the great lunar plains are as smooth as the Mare Crisium, and we could almost imagine that a sea of water and not of rock was lying there two miles below. Only a group of crater-pits low down on the skyline spoilt the illusion.

Our goal was still invisible over the crest of the mountain, and we were steering by maps, using the Earth as a guide. Almost due east of us, that great silver crescent hung low over the plain, already well into its first quarter. The sun and the stars would make their slow march across the sky and would sink presently from sight, but Earth would always be there, never moving from her appointed place, waxing and waning as the years and seasons passed. In ten days time she would be a blinding disc bathing these rocks with her midnight radiance, fifty-fold brighter than the full moon. But we must be out of the mountains long before night, or else we would remain among them forever.

Inside our suits it was comfortably cool, for the refrigeration units were fighting the fierce sun and carrying away the body-heat of our exertions. We seldom spoke to each other except to pass climbing instructions and to discuss our best plan of ascent. I do not know what Garnett was thinking—probably that this was the craziest goose-chase he had ever embarked upon. I more than half agreed with him, but the joy of climbing, the knowledge that no man had ever gone this way before and the exhilaration of the steadily widening landscape gave me all the reward I needed.

I don't think I was particularly excited when I saw in front of us the wall of rock I had first inspected through the telescope from thirty miles away. It would level off about fifty feet above our heads, and there on the plateau would be the thing that had lured me over these barren wastes. It was, almost certainly, nothing more than a boulder splintered ages ago by a falling meteor, and with its cleavage planes still fresh and bright in this incorruptible, unchanging silence.

There were no hand-holds on the rock face, and we had to use a grapnel. My tired arms seemed to gain new strength as I swung the three-pronged metal anchor round my head and sent it sailing up towards the stars. The first time, it broke loose and came falling slowly back when we pulled the rope. On the third attempt, the prongs gripped firmly and our combined weights could not shift it.

Garnett looked at me anxiously. I could tell that he wanted to go first, but I smiled back at him through the glass of my helmet and shook my head. Slowly, taking my time, I began the final ascent.

Even with my spacesuit, I weighed only forty pounds here, so I pulled myself up hand over hand without bothering to use my feet. At the rim I paused and waved to my companion: then I scrambled over the edge and stood upright, staring ahead of me.

You must understand that until this very moment I had been almost completely convinced that there could be nothing strange or unusual for me to find here. Almost, but not quite—it was that haunting doubt that had driven me forwards. Well, it was a doubt no longer, but the haunting had scarcely begun.

I was standing on a plateau perhaps a hundred feet across. It had once been smooth—too smooth to be natural—but falling meteors had pitted and scored its surface through immeasurable aeons. It had been levelled to support a glittering, roughly pyramidal structure, twice as high as a man, that was set in the rock like a gigantic, many-faceted jewel.

Probably no emotion at all filled my mind in those first few seconds. Then I felt a great lifting of my heart, and a strange, inexpressible joy. For I loved the Moon, and now I knew that the creeping moss of Aristarchus and Eratosthenes was not the only life she had brought forth in her youth. The old, discredited dream of the first explorers was true, there had, after all, been a lunar civilisation—and I was the first to find it. That I had come perhaps a hundred million years too late did not distress me: it was enough to have come at all.

My mind was beginning to function normally, to analyse and to ask questions. Was this a building, a shrine—or something for which my language had no name? If a building, then why was it erected in so uniquely inaccessible a spot? I wondered if it might be a temple, and I could picture the adepts of some strange priesthood calling on their gods to preserve them as the life of the Moon ebbed with the dying oceans; and calling on their gods in vain.

I took a dozen steps forward to examine the thing more closely, but some sense of caution kept me from going too near. I knew a little of archaeology, and tried to guess the cultural level of the civilisation that must have smoothed this mountain and raised the glittering mirror surfaces that still dazzled my eyes. The Egyptians could have done it, I thought, if their workmen had possessed whatever strange material these far more ancient architects had used. Because of the thing's smallness, it did not occur to me that I might be looking at the handiwork of a race more advanced than my own. The idea that the Moon had possessed intelligence at all was still almost too tremendous to grasp, and my pride would not let me take the final, humiliating plunge.

And then I noticed something that set the scalp crawling at the back of my neck—something so trivial and so innocent that many would never have noticed it at all. I have said that the plateau was scarred by meteors; it was also coated inches deep with the cosmic dust that is always filtering down upon the surface of any world where there are no winds to disturb it. Yet the dust and the meteor scratches ended quite abruptly in a wide circle enclosing the little pyramid, as though an invisible wall was protecting it from the ravages of time and the slow but ceaseless bombardment from space.

There was someone shouting in my earphones, and I realised that Garnett had been calling me for some time. I walked unsteadily to the edge of the cliff and signalled him to join me, not trusting myself to speak. Then I went back towards that circle in the dust. I picked up a fragment of splintered rock and tossed it gently towards the shining enigma. If the pebble had vanished at that invisible barrier I should not have been surprised, but it seemed to hit a smooth, hemispherical surface and slid gently to the ground.

I knew then that I was looking at nothing that could be matched in the antiquity of my own race. This was not a building, but a machine, protecting itself with forces that had challenged Eternity. Those forces, whatever they might be, were still operating, and perhaps I had already come too close. I thought of all the radiations man had trapped and tamed in the past century. For all I knew, I might be as irrevocably doomed as if I had stepped into the deadly, silent aura of an unshielded atomic pile.

I remember turning then towards Garnett, who had joined me and was now standing motionless at my side. He seemed quite oblivious to me, so I did not disturb him but walked to the edge of the cliff in an effort to marshall my thoughts. There below me lay the Mare Crisium—Sea of Crises, indeed!—strange and weird to most men, but reassuringly familiar to me. I lifted my eyes towards the crescent Earth, lying in her cradle of stars, and I wondered what her clouds had covered when these unknown builders had finished their work. Was it the steaming jungle of the Carboniferous, the bleak shoreline over which the first amphibians must crawl to conquer the land—or, earlier still, the long loneliness before the coming of life?

Do not ask me why I did not guess the truth sooner—the truth that seems so obvious now. In the first excitement of my discovery, I had assumed without question that this crystalline apparition had been built by some race belonging to the Moon's remote past: but suddenly and with overwhelming force, the belief came to me that it was as alien to the Moon as I myself. In twenty years we had found no trace of life but a few degenerate plants. No lunar civilisation, whatever its doom, could have left but a single token of its existence.

I looked at the shining pyramid again, and the more remote it seemed from anything that had to do with the Moon. And suddenly I felt myself shaking with a foolish, hysterical laughter, brought on by excitement and over-exertion; for I had imagined that the little pyramid was speaking to me and was saying: "Sorry—I'm a stranger here myself."

It has taken us twenty years to crack that invisible shield and to reach the machine inside those crystal walls. What we could not understand, we broke at last with the savage might of atomic power;

and now I have seen the fragments of the lovely, glittering thing I found up there on the mountain.

They are meaningless. The mechanisms—if indeed they are mechanisms—of the pyramid belong to a technology that lies far beyond our horizon, perhaps to the technology of para-physical forces.

The mystery haunts us all the more now that the other planets have been reached and we know that only Earth has ever been the home of intelligent life. Nor could any lost civilisation of our own world have built that machine, for the thickness of the meteoric dust on the plateau has enabled us to measure its age. It was set there upon its mountain before life had emerged from the seas of Earth.

When our world was half its present age, *something* from the stars swept through the Solar System, left this token of its passage and went again upon its way. Until we destroyed it, that machine was still fulfilling the purpose of its builders; and as to that purpose—here is my guess.

Nearly a hundred thousand million stars are turning in the circle of the Milky Way, and long ago other races on the worlds of other suns must have scaled and passed the heights that we have reached. Think of such civilisations, far back in time against the fading afterglow of Creation, masters of a universe so young that life as yet had come only to a handful of worlds. Theirs would have been a loneliness we cannot imagine, the loneliness of gods looking out across infinity and finding none to share their thoughts.

They must have searched the star-clusters as we have searched the planets. Everywhere there would be worlds, but they would be empty or peopled with crawling, mindless things. Such was our own Earth, the smoke of the great volcanoes still staining its skies, when that first ship of the peoples of the dawn came sliding in from the abyss beyond Pluto. It passed the frozen outer worlds, knowing that life could play no part in their destinies. It came to rest among the inner planets, warming themselves around the fire of the Sun and waiting for their histories to begin.

Those wanderers must have looked on Earth, circling safely in the narrow zone between fire and ice, and must have guessed that it was the favourite of the Sun's children. Here, in the distant future, would be intelligence; but there were countless stars before them still, and they might never come this way again in all eternity.

So they left a sentinel, one of millions they have scattered throughout the universe, watching over all worlds with the promise of life. It was a beacon that down the ages has been patiently signalling the fact that no-one had discovered it.

Perhaps you understand now why that crystal pyramid was set upon the Moon instead of on the Earth. Its builders were not concerned with races still struggling up from savagery. They would be interested in our civilisation only if we proved our fitness to survive—by crossing

space and so escaping from the Earth, our cradle. That is the challenge that all intelligent races must meet, sooner or later. It is a double challenge, for it depends in turn upon the conquest of atomic energy and the last choice between life and death.

Once we had passed that crises, it was only a matter of time before we found the pyramid and forced it open. Now its signals have ceased, and those whose duty it is will be turning their minds upon Earth. Perhaps they wish to help our infant civilisation. But they must be very, very old, and the old are often insanely jealous of the young.

I can never look now at the Milky Way without wondering from which of those banked clouds of stars the emissaries are coming. If you will pardon so commonplace a simile, we have broken the glass of the fire-alarm and have nothing to do but to wait.

I do not think we will have to wait for long.

THE END

The Literary Line-Up

Next month Cyril Kornbluth really gets into his stride in the second instalment of "Takeoff," as the plot develops and mystery piles upon mystery against the background of building a space ship.

To make things worth while for all those readers who have the patience to save their instalments and read the serial complete, there are some fine short stories headed by popular "Jack" Chandler's "Zoological Specimen" which should have been in this issue but was crowded out. It is a simple enough story of space flight—the only odd touch is that the ship is bringing a human body back to Earth for burial (at exorbitant freight rates). Some very startling things happen en route.

Such popular authors as Jonathan Burke, E. R. James and others will also be present in the line-up.

For those who are interested, story ratings in No. 19 were :

- | | | | | | |
|-------------------------|---|---|---|---|---------------------|
| 1. Golden Slumbers | - | - | - | - | Jonathan Burke |
| 2. Rockets Aren't Human | - | - | - | - | E. C. Tubb |
| 3. . . . Is No Robbery | - | - | - | - | Lan Wright |
| 4. The Prophet | - | - | - | - | John Christopher |
| 5. The Exterminators | - | - | - | - | Peter Hawkins |
| 6. Jetsam | - | - | - | - | A. Bertram Chandler |

List your story preference for this issue on a postcard and send it to the Editor.

The number of plots which can be evolved from the theme of Time travel are infinite. In this story noted author John Wyndham entangles his hero with two marriages—both legal.

OPPOSITE NUMBERS

By John Wyndham

Seeing the couple when I did was simply a matter of chance. Probably I should have run across them just a little later, anyway, but the results could have been quite different. It simply happened that I turned into the cross-corridor when they were up the other end of it, with their backs towards me, and I noticed them peering up and down the far main-passage in the manner of people making sure that the coast was clear. Jean I recognised at once; even the distant glimpse of her profile was enough. Of the man, with his back towards me, I registered only that there was something familiar about him.

But for the furtive, scouting look about them I doubt whether I should have paid much attention—at least, I should not have followed them—but once I had noticed that, it occurred to me that there was

only one place they could have come from, and that was old Whetstone's room—it is still known as 'old Whetstone's room' although he died more than two years ago.

There wasn't any reason why Jean shouldn't go there if she wanted to. After all, since Whetstone was her father, all the stuff in the room is, legally speaking, hers—although in point of fact it just stays there under dustsheets because nobody has liked to start taking it to pieces. The old man was always greatly respected for his work—his official work—in the labs up above, and although he was undoubtedly a bit—well, let's say obsessed, by his own project, and in spite of the fact that the project never did, nor ever seemed likely to do, what he wanted it to; yet, somehow, his prestige still protects the room and the apparatus. It is a kind of temporary memorial to him.

Besides, there is an idea among the several of us who helped him at different times that he really was on to something. There were some results, of a kind, enough, anyway, to suggest that if the old mule hadn't been so stubborn on his own theory he might have got somewhere by following them up. So this feeling, that someday someone with the time and inclination might find something there, has helped in keeping the room and the stuff just as he left it.

But I couldn't imagine any reason why Jean should want to be furtive about visiting the room—except, of course, that whoever her companion was, he wasn't her husband . . .

I shall have to admit that when I turned off my intended way and followed them, it was out of sheer snooping curiosity. After all, it was Jean, not anybody else, and I couldn't imagine her having the kind of hole and corner affair that had to be conducted in a dusty workroom among sheet-shrouded apparatus; so why . . . ?

When I looked round the corner they were well along the passage; not exactly furtive now, but still circumspect. I noticed him catch her hand, and press it encouragingly. I let them get round the next corner, and followed.

When I reached the door they were halfway across the quadrangle in the direction of the canteen, not furtive at all now, but looking about them at all the people in sight as though they might be searching for someone. I was still too far off to identify the man. They went into the canteen, and I followed.

They hadn't sat down at a table; they were standing a little way up the hall, with their backs to me, and from the way they were turning their heads there could be no doubt that they were searching. One or two people waved to them, and they waved back, but they didn't go to join them.

I began to feel a little foolish—and a trifle mean, too. Indeed, their business was none of mine, and there was nothing whatever clandestine about them now. I had just made up my mind to back out when I caught my first good look at the man's face, in one of the wall-mirrors.

There was something quite startlingly familiar about it, yet I failed to place it immediately: in fact, several seconds must have elapsed before I realised that it was the face I was accustomed to see every morning while I shaved.

The likeness was so exact, that I sat down on the nearest chair, with an odd weakness in my knees, and feeling, for some reason I didn't understand, a little scared.

He was still looking over the other people. If he had seen me through the looking-glass he'd not been interested. They both walked slowly on up the room, searching it as they went. Finally, they left by the door at the other end. I slipped back by the door behind me, and worked round the outside of the building. They had come to a stop on the gravel spread, a few yards from the door, and were deep in discussion.

I was tempted to go up to them, but—well, it was some time since Jean and I had been on chatting terms: and there is something rather fatuous about the idea of going up to a perfect stranger simply to announce: 'I say, you look just like me, you know!' So I waited.

Presently they came to a decision, and turned along the path that leads to the main gate. Jean was pointing things out, and seemed amused by them, though I couldn't see why they should amuse her. She moved closer to him, and linked her arm in his as they walked along.

I must say I considered that unwise. The Pleybell Research Institute holds together one of those intraregarding, not to say ingrowing, communities where nothing is missed. The unemployed wives can follow scents that would baffle a bloodhound, and the turn of an eye, let alone a hand on the arm, is enough to start people building law-courts in the air. The gesture, though possibly innocent, became almost flamboyant bravado in our milieu. I was not the only one to observe it. Indeed, people seemed to be in a rather observing mood that afternoon: several of them gave me an intense and rather puzzled look as we met.

Outside the gates the pair turned left, and I let them get a little further ahead—not that it greatly mattered, for even if Jean should look back and notice me, what more natural than that I should be found on a part of my regular homeward route? They had just turned the second corner to the right, which is that of the road in which my house stands, when there came a thudding of feet behind me, and a voice gasping: 'Mr. Ruddle! Mr. Ruddle, sir!' I turned to find one of the lab messengers. Through gasps he said:

"The Director saw you leaving, sir. He sent me to remind you that he must have your figures for the final co-ordination by five. He thought you might have forgotten it, sir."

Which was what I had done. I looked at my watch, and saw that it was getting on for four-thirty already. That drove Jean and her friend out of my mind, and I hurried back towards the Institute.

There were only a couple of minor calculations to finish off, and I had the results in the Director's office by 4.55. He looked at me rather hard.

"I am sorry to intrude business upon your—ah—domestic arrangements, Ruddle, but it is quite necessary that all these findings should be assembled tonight," he said, rather coldly, I thought.

I apologized for leaving it until the last minute. He received that somewhat coldly, too, considering that I was the right side of the last minute. It was not until I was outside his room that a possible explanation occurred to me. Even I had been surprised by the extraordinary likeness of Jean's companion to myself: it was scarcely a matter where I could make a mistake as to which was which, but others might . . . I recalled the arm-in-arm progress in full public view . . .

The best thing to do seemed to be to get home as quickly as possible, hoping to put my word in before gossip said hers . . .

There was only another twenty yards before I should reach my house, when I encountered Jean and her companion turning out of my own gateway, and we came face to face. Jean was looking flushed and embarrassed, and he was looking embarrassed and angry. Their expressions changed with astonishing speed as they recognised me.

"Oh, there you are! Thank goodness," said Jean. "Where on earth have you been?"

It was not the kind of opening I was prepared for. After all, it was nearly three years since we had exchanged anything more than a necessary politeness. While I was trying to collect myself I took refuge in a touch of dignity.

"I don't think I quite understand," I said, and looked from her to her companion. "Perhaps you will introduce me to your friend——?" I suggested.

"Oh, don't be so stiff and silly, Peter," she told me impatiently.

But the man was looking at me closely. There was a rather curious expression on his face: I did not greatly wonder at it; very likely the expression on my own was no less curious. For the similarity—no, it was more than that—the duplication, was uncanny. The clothes were different, certainly. I had none like those he was wearing, but apart from that . . . I suddenly caught sight of his wrist-watch: it, and the metal bracelet that held it were the exact double of mine. I felt my own wrist to make sure that it hadn't somehow got transferred. My own was still there, all right. He said:

"I'm afraid this is a bit complicated. And we've both pulled a most frightful gaff in your house. Both feet, right up to the neck. I'm terribly sorry. We just didn't know."

"Oh! That woman!" said Jean, furiously. "Oh, I could strangle her, cheerfully,"

With a feeling of drowning slowly, I grasped.

"What woman?" I inquired.

"The one in your house. That dreadful Tenter woman."

I stared at them.

"Look here!" I said. "This is going a bit far. My wife is——"

"She *is*? She said she was, but I couldn't believe it. Oh, Peter, not really! You couldn't marry *her*! Oh, you *couldn't*!"

I looked at her hard—clearly there was something much more than ordinarily wrong somewhere. I don't say that half the people you meet may not be *thinking* like that about other people's wives; but it is a thing that doesn't get *said*, not in the second person, at any rate. One can only meet it with anger—or compassion.

"I'm afraid you aren't well," I suggested. "Suppose you come indoors and lie down for a little while I ring-up for a taxi. I'm sure . . ."

Jean stared at me.

"Ha! Ha!" she said, in a decisively mirthless way.

"I'm sorry to say that is just where we put the feet in," her companion explained. "You see, we very much wanted to get hold of you, and there was nobody at home, so we thought we'd just sit and wait there until you came in. But then it wasn't you who came, it was Miss Tenter. We hadn't expected her at all, and then she wouldn't believe that I wasn't you, and she behaved atrociously—I'm sorry to say it, but it *was* atrociously—to Jean, and—oh, well, it all became very unpleasant and difficult . . ."

He kind of ebbed away, in confusion.

There certainly was something up the pole about this.

"Why on earth do you say 'Miss Tenter'?" I said. "Jean, at any rate knows perfectly well that she's been Mrs. Peter Ruddle for more than two years now."

"Oh, *dear*!" said Jean. "It is so confusing. But I never, never could have imagined that you'd marry *her*."

It wasn't easy to keep tolerantly in mind that she must be a bit off her rocker. Her *manner* was as normal as could be.

"Indeed!" I said coldly. "And who, may I ask, did you think I would marry?"

"Why, me, of course," said Jean.

"Look here——" began her companion, in a rather desperate way, but I cut him off.

"You pretty firmly shut the door an any chance of that when you took up with Freddie Tallboy," I reminded her—and not without a touch of bitterness; the skin on the old wound was still a little more sensitive than I had thought.

"Freddie Tallboy?" she repeated. "Who's he?"

That was too much for my patience.

"Mrs. Tallboy," I said. "I don't pretend to understand the reason for this fooling—but I've had enough of it."

"But I'm not Mrs. Tallboy," she said. "I'm Mrs. Peter Ruddle."

"I suppose you find that amusing," I told her, bitterly, "but to me it isn't very funny," I added. And it was not; there had been a time when what I hoped for above all else was to hear Jean call herself Mrs. Peter Ruddle. I looked at her, steadily.

"Jean," I said. "This is not your kind of a joke—it's a cruel kind."

She looked as steadily back at me for some seconds. Then I saw her eyes change; they glistened a little.

"Oh!" she said, as if she had seen something there. "Oh, this is dreadful! . . . Oh, dear! . . . I—— Oh, Peter, help me," she said—but the appeal was to the other man, not to me. I turned to him, too.

"Look here," I said. "I don't know who you are, or what's going on, but——"

"Oh," he said, as if suddenly enlightened. "No, of course you don't. I'm Peter Ruddle."

There was a longish pause. I decided I had had enough of being made to look a fool, and started to turn away. He said:

"Isn't there somewhere we can go and talk? You see, we're both of us Peter Ruddle, that's what's making it all so difficult."

"I look on 'difficult' as an understatement," I said, coldly, and started to walk off.

"But don't you *see*," said his voice behind me. "It's old Whetstone's machine, man. It *works*!"

My own house was evidently barred to us, and the only nearby place that I could think of at the moment was the upstairs room of the Jubilee Café. Most of the people who worked at the Institute would be knocking off about now, and still trickling out for an hour to come. I had no desire to confirm the impression of my private affairs that had already reached the Director, so I went ahead to the café, found there was no one in the upstairs room, and beckoned through the window to them. The girl who brought us tea was not a bright type. If she noticed our likeness at all, it made no perceptible impression on her. When she had left, Jean poured out, and we started to get down to things.

"You'll remember," said my double, leaning forward earnestly, "you'll remember old Whetstone's concept of time? He used to give that rough analogy about the sea freezing. The present was represented by the leading edge of the ice, gradually building up and advancing. Behind it was the solid ice that represented the past; in front, the still fluid water represented the future. You could tell that a given number of the moving molecules which represented the future would become frozen in a given space of time, but you couldn't predict which, nor in what relationship they would be to one another.

"About the solid stuff behind, the past, he thought you could probably do nothing; but he reckoned that somehow or other you ought to be able to find a way of pushing out a little ahead of the main freezing line, which is the present. If you could do that, you would be creating little advanced bridgeheads of frozen—that is to say, factualized—matter. This *must*, in due course, be overtaken by, and thus become part of, the advancing present. In other words, by going a little ahead you would create a bit of future which would *have* to come true. You couldn't choose which molecules you would bind together, but those that you found would be solidified by your finding them, and therefore become inevitable."

"Yes, I remember that well," I told him. "It was cockeyed."

"Certainly it was cockeyed," he agreed promptly. "Everyone who ever tried to give him a hand came to that conclusion sooner or later, and just cleared out. But he wouldn't see it. Obstinate as a mule over that, he was." He glanced at Jean.

"It's all right. I know," she said, sadly. He went on:

"He would keep on trying to make that machine of his support his theory—which, of course, it couldn't possibly do with a theory that was all up the pole. And because of that he wouldn't follow up the leads that the thing *did* give. Nothing would loosen him up on that theory, with the result that he overworked and worried himself by trying to pin down the impossible.

"And so he died—sooner than he need have done—and his stuff just stayed there, with no one quite liking to disturb it.

"Now, shortly after Jean and I got married——"

I felt the fog beginning to come down on me again.

"But Jean didn't marry you. She married Freddie," I objected.

"Wait a minute. I'm just coming to that. As I said, not long after we were married I had an idea, quite a different idea about this time business. Jean agreed that I should use her father's apparatus—as much of it as could be useful—to see if I could work the idea out, if possible. To some extent I have succeeded, and this is the result." He paused.

"I'm in just about as thick a fog as I was before," I told him.

"Well, here's the basis—mind you, I don't claim that it may not be misconceived in some ways, but the *empirical* result is that I'm talking to you now.

"Now, time is something similar to a quantum-radiation. The atoms of time are not dissimilar from radio-active atoms—that is to say, they are in a continual state of disintegration, or fission, and they throw off quanta. There must, presumably be a half-life, but, so far, I've not been able to determine it. Obviously it has to be something very, very much smaller than a second, so let's just call it an 'instant' for illustration.

"So every 'instant' an atom of time splits. The two halves then continue upon different paths and encounter different influences as they diverge—but they don't diverge as constant units; each of them is splitting every instant, too. The pattern of it is the radiating ribs of a fan; and along each of the ribs, more fans; and along the ribs of those, still more fans; and so, ad infinitum.

"So, here we have Peter Ruddle. An instant later, that atom of time in which he exists is split, and so there are two Peter Ruddles, slightly diverging. Both those time-atoms split, and there are four Peter Ruddles. A third instant, and there are eight, then sixteen, then thirty-two. Very shortly there are thousands of Peter Ruddles. And because the division must actually occur many, many times in a second, there is an infinite number of Peter Ruddles, all originally similar, but all different by force of circumstances, and all inhabiting different worlds—imperceptibly different, or widely different; that depends chiefly on the distance from the original point of fission. And, of course, there is also an infinite number of worlds in which Peter Ruddle never managed to get born at all . . . "

He paused a little to let me stop whizzing, and get the hang of it. When I thought I had, several points for argument immediately presented themselves. I shelved them for the moment, however, and let him continue:

"Well, then, the problem ceased to be that of travelling in time, as old Whetstone had supposed it to be. You obviously can't put split atoms together again to reconstruct a past: nor can you observe the result of fission among atoms that have not yet split—at least, I think not, though it would appear that multiple futures must be latent in the present.

"So the place of that problem was taken by another—was it possible to move from one's own branch of descent to one of the, so to speak, cognate branches? Well, I went into that—and here we are to show that, within certain limits, one can . . . "

He paused again for me to take it in.

"Yes," I admitted, at length. "I see it in plan, all right. But what I'm finding it really hard to feel is that we—you and I—are both equally—er—valid. I have to accept the theory, at least in the rough, since you are here, but I still feel that I am the real Peter Ruddle, and that you must be the Peter Ruddle I might have been. I suppose that's a natural subjective view."

Jean looked up and joined in for the first time.

"That's not how I see it, at all. We are the *real* Peter and Jean. You are what might have happened to Peter . . . " She sat looking at me for a long moment, then: "Oh, my dear! Why, oh why, did you do it? And you aren't happy with her, either. I can see that."

"This——" began the other Peter. Then he broke off as the door opened. Somebody looked in. A woman's voice said: "Oh, I'm

sorry !” and the door shut again. It was hidden from me where I sat. I looked inquiringly at Jean.

“Mrs. Terry,” she told me.

The other Peter started again: “Obviously we’re all equally real: it’s just that you and I normally exist on well, different ribs of the fan.” He went on expanding that a bit, then he said: “Although I’ve done it, I’ve only a very crude notion of how I’ve done it. So I had this idea: you know how one’s mind tends to work in a groove—well, it occurred to me that if I could start one of my ‘doubles’ working on this thing, too, it might lead to a better understanding of it. Obviously our minds must be like enough to be interested in the same kinds of things, but since part of our experience has been different they aren’t likely to run in exactly the same grooves of thought—that’s obvious, really, because if our lines of thought were exactly similar you would have made the same discoveries as I have, and you’d have made them at the same time.”

Certainly his tracks of thought were very similar. I have never had a swifter, clearer understanding of what another person was attempting to convey. It was due to more than the mere words. I asked:

“When do you reckon, in our case, that this fission took place?”

“I’ve been wondering about that,” he told me. He held out his left hand. “It must have been less than five years ago. We’ve both got the same watch, you see.”

I thought. “Well, it must be more than three years ago, because that’s when Freddie Tallboy first showed up here; and, judging by Jean’s question, he doesn’t seem to have shown up at all on your level.”

“Never heard of him,” he agreed, shaking his head.

“You’re lucky,” I told him, with a glance at Jean.

We thought again.

“It must have been before your father died, too, because Tallboy was here by then,” I said to Jean.

But my double shook his head. “The old man’s death isn’t a constant. It could have occurred earlier or in different streams.”

That point had not occurred to me. I tried again:

“There was a row,” I said, looking at Jean.

“A row?” inquired Jean.

“You can’t have forgotten that,” I said, incredulously. “That was the night that finished things between us. After I said I wasn’t going to help your father any more.”

Her eyes opened widely.

“Finished things!” she repeated. “That was the night we got engaged.”

“Of course it was, darling,” my double supported her. I shook my head. “It was the night I went and got dead drunk because the world didn’t have any bottom any more,” I said.

"Now we're getting warm," observed the other Peter, leaning forward, with the light of the chase in his eye.

I did not share his enthusiasm. I was remembering one of the more painful occasions in my life.

"I told you I'd had enough of helping your father because he would cling pig-headedly to a demonstrably absurd theory," I reminded her.

"And I said you must at least pretend to believe in it because he was getting to be an old man, and another disappointment might do him harm, and the doctor was worried about him anyway."

I shook my head decisively.

"I remember exactly what you said, Jean. You said: 'So you're just as callous as the rest of them; you're just going to walk out on a poor old man and leave him in the lurch.' Those were your exact words." They were both staring at me. "We went right on from there," I recalled, "until I said obstinacy seemed to run in your family, and you said that you were glad to have discovered in time the sort of selfishness and callousness there was in mine."

"Oh, no, Peter, never——" Jean began.

My double broke in excitedly:

"That must have been it—that was the moment! I never said anything about obstinacy in Jean's family. I said I'd give it another trial, and do my best to be patient with him."

We sat silent for a bit. Then Jean said, in a shaky voice:

"Just that! And so you went and married *her* instead of me!" There were almost tears in her eyes. "Oh, how dreadful! Oh, Peter, my dear!"

"You were engaged to Tallboy before I proposed to her," I said. "At least, I suppose I mean not you, of course. The other Jean."

She stretched out her left hand and took her husband's,

"Oh, dear!" she said again, in a half-frightened tone. "Think of that poor, poor other me . . ." She paused a moment. "Perhaps we oughtn't to have come at all. It was all right to begin with," she added. "And, you see, we thought that if we went to our house—your house, on this level, I mean—we thought we'd find you and the other me there, and that'd be all right. I ought to have known sooner. The moment I saw those curtains *she's* put in the windows I had a feeling something was wrong. I'm sure I wouldn't have chosen them—and I don't think the other me would, either. And the furniture—that wasn't a bit like me. And then that *woman*——! And this has all happened wrong, just because——. Oh, this is dreadful, Peter, dreadful . . ."

She pulled a handkerchief out of her bag, dabbed at her eyes, and blew her nose; then she leant earnestly towards me again, her eyes still swimming a little.

"You *can't* Peter . . . It wasn't meant to be this way . . . It's all wrong . . . That other me, the other Jean—where is she?"

"She's still here," I told her, "She lives a little outside, along the Reading road."

"You must go to her, Peter."

"Now look here——" I began, with some bitterness.

"But she loves you, Peter, and she needs you. She's me, and I know how she must feel—Don't you see that I *know*?"

I looked back at her, and shook my head.

"What you *don't* seem to know," I told her, "is how it feels to have the knife turned. She is married to someone else, I am married to someone else, and there's an end of it."

"Oh, no—no!" she said. Her hand sought her husband's again.

"No. You can't do that to her, or to yourself. It's——" She broke off and turned in distress to the other Peter. "Oh, darling, if only we could make him understand somehow what it means. He doesn't—he can't understand, how should he?"

The other Peter's eyes rested on mine.

"I think he does—well enough," he said.

I got up.

"I hope you'll excuse me now," I said to them. "I've had about as much of this as I can stand."

Jean got up quickly, too. Contritely she said:

"I'm sorry, Peter. I don't want to hurt you. I only want you to be happy—you, and the other me. I . . . I . . ." She choked a little. The other Peter put in quickly:

"Look, if you can spare half an hour or so, do come over to old Whetstone's room. It'll be much easier there to give you a rough idea of the adaptations his stuff needs. That's what I really came for, after all."

"What did you come for?" I asked Jean.

She had her back towards me now, and did not turn.

"Curiosity," she said, in an unsteady voice.

I hesitated, but he was right about the similarity of our minds—what had caught his interest caught mine, too.

"All right," I agreed, more than half reluctantly.

The street was almost empty when we came out into the dusk, and turned towards the Institute. The grounds beyond the gates were quite deserted: the building itself showed a few lighted windows where there were some people still at work. We walked along, with Jean silent, and Peter talking about time quantum-radiation, and explaining how the scope appeared to have quite natural limits at present—how it was possible, for instance, to move on to another rib of the fan only if there happened to be the space for you to do so.

One could, for instance, move only to a line of existence where old Whetstone's room was arranged in such a way that there was a clear area ready to receive what he called the transfer-chamber. If there

were something else occupying that space it would be destroyed, so there must always be a preliminary practical test to ensure that it would return intact. That established quite a narrow limit: go too far round the fan, so to speak, and you would hit a time-sequence in which the room did not exist at all because the Institute had never been built. The consequences to a transfer-chamber trying to occupy an already occupied space, or making its *début* in the new time-sequence in mid air, would be quite disastrous.

When we reached the room everything looked as usual except for the transfer-chamber itself, standing in the middle of the sheeted apparatus. It looked rather like a sentry-box with a door added.

We cleared the covers off some of the rest of the stuff, and the other Peter started explaining to me what he had done in the way of altering circuits and introducing new stages. Jean dusted off a chair and sat on it, smoking a cigarette patiently. We should have got along more quickly had we been able to refer to the old man's notes and diagrams, but unfortunately the steel filing-cabinet which held them was locked. Nevertheless, he was able to give me the general theory and a fair working idea of how to set about making the necessary changes.

After a time Jean looked pointedly at her watch, and got up.

"Sorry to interrupt," she said, "but we really must get back. I told the girl we'd not be later than seven—and it's half-past already."

"What girl?" inquired my double, absently.

"That baby-sitter girl, of course," she told him.

Somehow that brought me up more sharply than anything yet.

"You—you've got a baby?" I asked, stupidly.

Jean looked at me. "Yes," she said, gently. "And she's a lovely little baby, isn't she, Peter?"

"Definitely quite the best baby known to us," agreed Peter.

I stood there, blankly.

"Oh, don't look like that, my dear," Jean said.

She came closer. She put her right hand on the left side of my face, and pressed my other cheek against hers.

"Go to her, Peter. Go to her. She wants you," she whispered close to my ear.

The other Peter opened the door of the transfer-chamber, and they got in. It was a close fit for two. Then he got out again, and indicated a piece of the floor.

"When you've got it working, come and find us," he said. "We'll keep that area clear for you."

"Bring her with you," said Jean.

Then he got back, and pulled the door to. The last thing I saw as it closed was Jean's face, with tears in her eyes. . . .

While I was still looking at it the transfer-chamber vanished: it did not fade, or dim, it went in a split second. It might never have been, but for four flattened cigarette-ends by the chair where Jean had sat. . . .

I was in no mood to go home. I hung about the room, going over the apparatus and memorising what the other Peter had told me, trying to lose myself in the technicalities of it. The attention with which I went over the principles was rather grimly forced; I felt I should have had more of a chance to become absorbed if I had been able to get hold of the locked-up notes and diagrams.

After an hour or so I gave it up. I walked back home from the Institute, but I arrived with something more than a disinclination to go into the house. Instead, I got out the car. And then, somehow, I was driving out along the Reading road. . . .

Jean looked startled when she answered the doorbell.

"Oh!" she said, and went a little pale, and then a little flushed. In a carefully calm voice she said: "Freddie is working over in Number Four Lab."

"I don't want Freddie," I told her. "I wanted to talk to you—about your father's stuff in the room over there."

She hesitated, and then opened the door wider.

"All right," she said, in a non-committal voice. "You'd better come inside."

It was the first time I had set foot in her house. I followed her to a large, comfortable sitting-room which looked out on the back-garden. The interview began with as much awkwardness as anything I've known. All the time I had to keep on reminding myself that she was another Jean from the one of the afternoon. This Jean was a person I had not spoken to for over three years except when some Institute function forced us to recognise one another's existence. The more I looked at her, the more incredibly crass that barrier became.

I stumbled along, explaining that I had a new theory I would like to work on. I said that her father, in spite of his lack of success, had done a lot of groundwork which should not be wasted, and which I was sure he would not want wasted. . . .

Jean listened as though she were extremely interested in the pattern of the rug before the fire. After a while, however, she looked up and met my eyes. I lost the thread of what I had been saying, and floundered about after it. I grasped wildly at a few phrases and laboured on with a curious feeling that I was talking a language I did not know. After a long time I reached the end, not knowing whether I had been coherent at all.

She went on looking at me for a moment, but not quite so distantly as before, then she said:

"Yes, I think so Peter. I know you fell out with him, like all the others, but the apparatus will have to be used by someone sooner or later, or dismantled—and I think he'd sooner it was you than any of the rest. You'd probably like me to give a written consent?"

"It might be as well," I agreed. "Some of the stuff there cost a lot of money."

She nodded, and crossed to a small bureau. Presently she came back holding a piece of paper.

"Jean——" I began.

She stood, holding the paper out towards me.

"What, Peter . . ?"

"Jean——" I began once more. But then the wretched impossibility of the whole situation came home to me again.

She was watching me. I pulled myself together.

"It's—it's just that I can't get at his notes. They're locked up," I said, in a rush.

"Oh," she said, "oh, yes," as if she were somewhere a long way off. Then, in a different voice, she added:

"Would you know the key if you saw it? There's a box of his keys upstairs."

I was pretty sure I should. I'd seen it often enough when I had been working with old Whetstone.

We went upstairs. One of the rooms was unfurnished, a lumber-room, with a lot of old junk and half-a-dozen trunks in it. The box of keys was in the second trunk she tried. There were two of them that might fit, so I pocketed both, and we went downstairs again.

We were halfway down the stairs when the front door opened, and her husband came in. . . .

Well, there it is. . . .

Twenty or thirty people, including the Director, saw us crossing the Institute grounds arm in arm. My wife discovered me entertaining me ex-fiancée in my own house, during her absence. Mrs. Terry intruded upon us in the upstairs room of the Jubilee Café. Other people saw us in other places—and nearly everybody, it turns out, has had long-standing suspicions. Finally, her husband surprised his wife descending from the bedroom storey of his house with her ex-fiancé. . . .

So. . . .

And the nature of any evidence that I could produce to the contrary would, I think, sound somewhat unconvincing in court.

Besides, and rather importantly, we have both decided that nothing could be further from our wishes than to defend. . . .

THE END

On June 30th, if the weather is favourable, we may see one of those rare, spectacular, total eclipses of the Sun. Mr. Goldsmith, prominent science writer, explains in this article the importance of such an event.

ECLIPSE

By Maurice Goldsmith

A total eclipse of the sun—the most spectacular and impressive of all Nature's phenomena—is to occur on Wednesday, 30th June, 1954. The path of the total phase of the eclipse, for most of its length about 90 miles wide, makes its first contact with the Earth at sunrise in the United States, not far from Minneapolis in north-eastern Nebraska, and its last contact at sunset in India, near Jodhpur.

Its path lies across southern Canada, Iceland, the Faroes, the Shetland Isles, and enters Norway near Bergen, where the eclipse will take place shortly after midday. The shadow continues south-east across Norway and Sweden, and in the early afternoon passes Klaipeda (Lithuania), Kiev (U.S.S.R.) and later crosses the Caspian Sea in a south-easterly direction, passing over Asterabad (Persia), Farrah (Afghanistan) through Pakistan to India.

The eclipse will be visible over the whole of Great Britain. It will occur between 11.15 a.m. and 1.50 p.m. and will be at a maximum about 12.34 p.m. The time varies by only a few minutes for the

different areas of Britain. In the south of England, three-quarters of the sun will be obscured. As we go northwards, more and more of the sun will be eclipsed until in the northern parts of the Shetland Isles the eclipse will be total at 12.27 p.m., lasting for a few seconds.

Many millions of people will be able to see this great spectacle, because, unlike most total eclipses, its path of totality passes over more land than water. The moon is so small a body compared with the sun that its shadow tapers rapidly to a point. The diameter of its total shadow on the earth is rarely above 170 miles. This shadow travels over the ground at a speed of about 1,000 miles per hour. The total shadow of the moon does not rest in one place for more than 7 minutes, 58 seconds, and generally not more than 3 minutes. The path of totality may be as long as 5,000 miles, so that some 1 million square miles of the earth's surface may be covered. However, as the earth's surface is nearly 200 times as great, as over 70 per cent is ocean, and as much of it is inaccessible, the chances of seeing a total eclipse in a given town are pretty small.

How many of those who do see the eclipse will flee in terror, or will fall down in awesome worship, cannot be known. It is certain, however, that the world's leading scientists will be actively engaged in making observations.

The word 'eclipse' comes from the Greek, *ekleipo*, and means quite simply a hiding, or covering-up, of one object by another. A heavenly body is eclipsed when its light is cut off as a result of another body getting between it and the source of light, the sun. The moon, the nearest planet to the earth, in her monthly revolution, will hide any other object which happens to lie in her path. When she comes exactly between the earth and the sun, at the time of the new moon, there is a solar eclipse. (The new moon, by the way, is really invisible. What people call the 'new moon' is really 'the Crescent'. At this time, the surface of the moon facing the earth is dark because it is turned away from the sun. The moon has no light of her own).

We would get a solar eclipse at every new moon if the moon revolved about the earth in exactly the same plane that the earth revolves about the sun. But this is not so. The path of the moon is not in the same level as that of the earth. It is inclined at an angle of about 5 degrees. Only when the moon is near the intersection of these two planes, or paths, can a solar eclipse occur. The points where the level of the path of the moon crosses the level of the path of the earth are known as the Nodes. A total eclipse of the sun may occur in any month of the year, but the chance is greater as the earth approaches the greatest solar distance in July.

An eclipse of the sun can only occur when the new moon is crossing one of her nodes, not necessarily exactly at that point, but not more than $18\frac{1}{2}$ degrees from it. Whether the eclipse will take place depends upon the moon's latitude at that time, that is, on the distance the moon

is from the level of the earth's path. An eclipse is certain if the new moon is less than $15\frac{1}{2}$ degrees from a node, and its latitude not more than $1\frac{1}{2}$ degrees.

Let us assume that everything fits, that the moon, earth, and sun are in such a relation as to cause a total solar eclipse. We shall have a nearly similar eclipse if we count forward until the same situation arises again. What happens is that the two nodes slide backwards along the moon's path and complete the entire circuit in 6585.5 days, while the moon itself in 6585.3 days makes 223 revolutions through the sky. The moon returns more or less to the same position with respect to the nodes, and is in the same part of the sky with respect to the sun. It is possible, therefore, to say that given an eclipse on a certain date there will be usually another in 18 years 10 days 7 hours 43 minutes.

This period is called the Saros, and was known to the ancient Chaldeans. Knowledge of it was one of the means whereby the unscrupulous priest was able to maintain his power by proclaiming an alleged divine foresight. (For an interesting analysis of the Saros and of the Eclipse in ancient times, see "The Exact Science in Antiquity" by O. Neugebauer, published by Princeton University Press, 1952).

Astronomers talk of a long series, separated by the Saros, as a Family of eclipses. The life of such a family is about 1,150 years. The coming June eclipse was born on 10 March, 1179, and will go on for about another three centuries.

Above, we have said that there will *usually* be another eclipse after 18 years, etc. This qualification is necessary because the moon does not come back exactly to the same place. During the centuries, she will move so far from the original node that no eclipse will occur. Like human families, the family of eclipses must naturally come to an end. The life-cycle of an eclipse usually begins in a small way near one of the Poles. After each Saros, it becomes a little larger, growing slowly—that is, more of the sun is covered by the moon—for about two centuries. All the time it is moving further from the original polar 'birthplace', until after about 750 years it reaches the other Pole. Then begins the period of decline, with eclipses becoming smaller for about another two centuries, when they vanish. There are every year at least two solar eclipses, each belonging to a family. It is estimated that at any one period in history there will be between 39 and 48 families of eclipses.

A solar eclipse is caused by the dark moon covering up the surface of the sun. It expresses itself in three different forms. In a Partial eclipse: only part of the sun is covered by the moon. In an Annular eclipse: the moon looks as if she is surrounded by a ring of sunlight. This is because the eclipse occurs when the moon is in the further part of her orbit. She seems to be smaller than the sun and will not entirely cover it up. When, on the other hand, at the time of the

eclipse, she is in that part of her orbit which lies near to the earth, she will look larger than the sun and will cover his brilliant disc. This produces a Total eclipse, which is rarely more than two to three minutes in duration. For about an hour before and afterwards there is a partial eclipse.

Because to primitive people the sun was the source of life, an eclipse was regarded as a threat to the Life-Giver. It was averted as in ancient Mexico, by blood sacrifice to sustain the vigour of the god. The Sencis of Peru thought the sun in eclipse to be struggling with a savage animal, and shot burning arrows to drive the beast away. The Egyptian kings, during an eclipse, walked in a circle leaning heavily on staves to support the sun's faltering steps. The first eclipse recorded in history was one visible in China in 3126 B.C., and eclipse records are to be found on the oracle bones in 1100 B.C.

Herodotus tells us how an eclipse put an end to a battle between the Medes and the Lydians. "The war between the two nations had continued during five years with alternate advantage to either party. In the sixth there was a nocturnal combat; for after an equal fortune on both sides, and while the two armies were engaged, the day suddenly became night."

Dr. H. P. Wilkins, F.R.A.S., director of the lunar section of the British Astronomical Society, has kindly supplied me with the following vivid description of what happens during a total eclipse:

"When a total eclipse is about to take place the scene presents a remarkable spectacle. First, and before the eclipse begins, we may have an ordinary clear and sunny day, with the sun a brilliant round disc in the sky. At the predicted time the moon, which is itself quite invisible, touches the edge of the sun's disc and begins to pass in front of it. At first only a little 'bite' is taken out of the sun, on the right hand side, but this enlarges minute by minute as more and more of the sun is covered. If there happen to be any spots on the sun it is interesting to compare their darkness with the almost absolute blackness of the moon. Often this advancing edge of the moon is seen to be serrated, owing to the presence of mountains on the moon.

"Notwithstanding the steady advance of the moon, little effect is noticed until over half of the sun is covered. Then the temperature begins to fall and the light assumes a peculiar tint. When three-quarters of the sun are covered, the withdrawal of the light and heat becomes appreciable while the sun now appears as a brilliant crescent in the sky. About an hour elapses from the time when the moon begins to obscure the sun and the total phase. About 5 minutes before the total phase, the landscape has appreciably darkened and very often singular waves of light and shade can be seen dancing over the landscape or over the fronts of buildings. These are called 'Shadow Bands' and have never been photographed. Finally, the sun is reduced to a narrow bow of

light which does not vanish all at once, but breaks up into a number of isolated points, called 'Bailey's Beads'. These 'beads' are no sooner formed than they disappear one after the other and the eclipse is now total.

"While this is going on, if we turn to face the west, we see that the landscape there is very dark, often black as though a violent thunderstorm was coming on. This is caused by the mighty mass of the shadow of the moon rushing towards us at a speed of at least half a mile a second. Sometimes the shadow appears like a wall of blackness hanging in the air while, seen from a mountain top, it generally appears like a rounded ball of blackness crossing the low ground and fringed with a reddish border.

"With the disappearance of the sun there dart out around the moon scarlet sheafs of light, the sun flames or the 'Prominences', to use the correct term. Then, when the sun vanishes there suddenly appears around the darkened sun, the silvery halo of the 'Corona', with streamers stretching millions of miles into space. If there are many spots on the sun the corona is grouped evenly around the black moon, but if there are few or no spots, the corona is chiefly extended in two great plumes, one on each side.

"Meanwhile it is virtually night in the middle of the day. The brighter stars and planets appear in the sky; animals usually take up positions similar to those they assume at night. But the intensity of the darkness varies greatly. Sometimes it is very profound, as during the total eclipse of June 29, 1927; at other times the finest print can easily be read. All the time that the total phase lasts the corona and prominences generally disappear and suddenly a ray of actual sunlight strikes the observer. Occasionally the receding shadow of the moon is glimpsed as it flies away with the tremendous speed of its approach. The corona disappears and every minute more and more of the sun is uncovered until, about an hour after the total phase, the last portion of the moon draws away from the sun and the eclipse is at an end."

The famous French astronomer, Arago, describing the total solar eclipse of 8 July, 1842, told how "when the sun, reduced to a very narrow filament, began to throw upon the horizon only a very feeble light, a sort of uneasiness seized upon all; every person (there were more than 20,000.—*M.G.*) felt a desire to communicate his impressions to those around him. Hence arose a deep murmur, resembling that sent forth by the distant ocean after a tempest . . . at length the crescent disappeared, darkness suddenly succeeded light, and an absolute silence marked this phase of the eclipse . . . a profound silence also reigned in the air; the birds had ceased to sing. After an interval of solemn expectation, which lasted about two minutes, transports of joy, shouts of enthusiastic applause, saluted with the same accord, the same spontaneous feeling, the first reappearance of the rays

of the sun . . . To the majority of the public, the phenomenon had arrived at its term. The other phases of the eclipse had few attentive spectators beyond the persons devoted especially to astronomical pursuits."

These last hope always to take advantage of so important an event. The Joint Permanent Eclipse Committee of the Royal Society and the Royal Astronomical Society are arranging for parties of observers from four observatories in Britain to go to Sweden, where there will also be groups of Swedish, Dutch, Swiss and German astronomers. Russian astronomers will also be active in their own territories. Taking those parts of the totality belt which are accessible and in which the eclipsed sun will be fairly high above the horizon, weather records show that the chances of a clear sky (about 50 per cent) are greatest in south Sweden. Special observations are to be made from British aircraft at high altitude. In northern Canada there will be two Canadian parties.

The sun is a vast laboratory where exist pressures and temperatures far beyond anything we can produce on this earth. An eclipse presents a magnificent opportunity for specialised observation. The sun's outer layers can be photographed: the Corona (the inner part around the sun, the plumes connected with the poles, and the outer part which stretches sometimes millions of miles from the sun); the Chromosphere, or coloured atmosphere of the sun, made up of millions of plumes of glowing hydrogen or calcium, each over 3,000 miles in length, and rising from it the Prominences, the fantastic plumes of fiery gases.

Only at times of total solar eclipse can the stars close to the sun be photographed. This allows investigation of the problem of whether there is an undiscovered planet nearer to the sun than Mercury. Although this is not now believed, it was suggested that there was a planet, which was named Vulcan, near the sun. It was said to account for the behaviour of Mercury in not observing with complete accuracy Newton's law predicting the motions of the solar system. Einstein, however, calculated that there should be a slight departure to account for this discrepancy. Vulcan then disappeared.

Some of the most exciting observations were made during the eclipse in 1919. "Einstein concluded that light, like any material object, travels in a curve when passing through the gravitational field of a massive body", Lincoln Barnett relates in his book, "The Universe and Dr. Einstein". "He suggested that his theory could be put to test by observing the path of starlight in the gravitational field of the sun. Since the stars are invisible by day, there is only one occasion when sun and stars can be seen together in the sky, and that is during an eclipse. Einstein proposed, therefore, that photographs be taken of the stars immediately bordering the darkened face of the sun during an eclipse and compared with photographs of those same stars made at another time. According to his theory, the light from the stars surrounding the sun should be bent inward, toward the sun, in travers-

ing the sun's gravitational field; hence the *images* of those stars should appear to observers on earth to be shifted outward from their usual positions in the sky. Einstein calculated the degree of deflection that should be observed and predicted that for the stars closest to the sun the deviation would be about 1.75 seconds of an arc. Since he staked his whole General Theory of Relativity on this test, men of science throughout the world anxiously awaited the findings of expeditions which journeyed to equatorial regions to photograph the eclipse of May 29, 1919. When their pictures were developed and examined, the deflection of the starlight in the gravitational field of the sun was found to average 1.64 seconds—a figure as close to perfect agreement with Einstein's prediction as the accuracy of instruments allowed."

There is much the amateur observer can do during the eclipse. A word of warning first: he should never look at the sun without protecting his eyes. Smoked glasses are not good enough. They allow too many harmful rays to pass through, especially in the infra-red. Special deep tinted glasses should be used.

A diary might be kept of the whole event, with each second carefully marked and the events noticed carefully entered or sketched. The phases of the eclipse itself should also be drawn. Note should be taken of the temperature, and of what is happening to the birds, animals and vegetation. I am assured that the British Astronomical Association will welcome observations of interest.

If you miss this June eclipse, the next total one visible in Britain will take place on the morning of 11 August, 1999.

THE END

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also many other stories and articles of absorbing interest.

Technologically the planet was a primitive one, yet all the signs pointed to an ancient culture. But the natives were too incurious about the starship from Earth—it could be they had progressed beyond curiosity.

MUSEUM PIECE

By John Christopher

Illustrated by QUINN.

At the beginning there had been the great fleet, circling the earth, dipping through shadow and emerging again into the sunlight, like a shoal of twinkling fish. And afterwards the small fleets, setting off on their pre-arranged errands, heading outwards towards the infinite corners of the universe. And then smaller and smaller fleets as each group, accelerating far beyond the speed of light, split up into more and more specific routes. Now there was only 51-J-712—the *Pericles*—hunting forward through solar systems more than five hundred light years distant from the parent planet.

Strictly speaking the nav room was off limits to personnel not on duty. Lieutenant Don Parker felt a twinge of irritation in remembering this, for he was himself on duty and the groups of other junior officers, lounging in the transparent forward observation bulges, were an annoying source of distraction. He wondered what the duty officers on the Engines would say if he were to spend his own off-duty time getting in their way. But, of course, the Engines were a depressing enough surrounding to keep away casual idlers. The nav room was the only part of the ship that could possibly be called spacious; the forward telescopes housing demanded space. And then there were the observation bulges. The opportunity to see something once more of the natural universe, even if it were only the frozen flares of the



stars drifting towards them. He checked his figures again. Landfall in three days. Type 3b4 system; seven planets—one probable, one possible. There was nothing he could do at the moment except wait for the next spectroscopy report. He relaxed, and became aware of conversation from the nearest group of loungers. Someone had asked someone yet again why he had volunteered for the Exploration.

"Hell, the way I look at it, it's the only real chance for promotion. It's all right if you graduate with one of those top honour grades, see.

It's O.K. then. You move in on a nice easy Mars or Jupiter run. And promotion comes automatic. But I only got a Pass; I near as damn it flunked my math. So I take the Trip. Three years and I'm back as a certified Captain. And the future is very, very bright."

One of those with him, a tall Supply Lieutenant, laughed.

"With me, the ladies. A neat blonde and a very neat brunette, to be precise. I could not love them, dears, so much, loved I not honour more. When I get back maybe I'll look up their great grand-children, fifteen times removed."

The spectroscopy report came in, and he checked it mechanically. Hearing things like these he was never sure what kind of a fool he was. A fool for believing that they really meant what they said—that men could give up family, friends, six hundred years of history, for such trivial and ridiculous reasons? Or, if they were sincere, a fool for his own misguided idealism? He knew very well why he had volunteered for the Trip. It was the idea of the human mission; spreading the power and wisdom of Man through the shrinking universe. For that he had cut himself off from his own generation, from all that tangled web of human affection and inter-relationship.

And why was he disillusioned? There was nothing he could put a finger on, no more than a vague uneasiness. Everything had been as was to have been expected in the four successful landfalls they had so far made. In each case a struggling isolated culture had been given the tools—printing, electricity, atomic power—that would lift them in turn to the stars. It was all ideal and disinterested. There was nothing wrong with it.

"I hope," one of the group said emphatically, "that in the next joint the local hooch is somewhat better than it was last time."

The possible turned out a flop—an arid, frozen, planet-wide dust-bowl—but they made a good landfall on the probable. He was picked as one of the interpreters this time, and had the language pumped into him under hypnosis. On this planet, strangely enough, there was only one language. Lawrence, the G-2 Director, puzzled over the matter at a briefing.

"It's a planetary culture all right. The whole thing assimilated—there's not a trace of contributing ancestral groups. And it *smells* ancient. And yet technologically they're primitive. Windmills and water-wheels, and animals for draught and transport! Their towns and cities. That's a nice white stone they use—but every block hand hewn! There's something wrong about it. Whatever it is we've got to ferret it out."

Don stood with the half dozen other interpreters on the thick pile carpet that covered the whole of G-2 H.Q. Lawrence reviewed them intently:

"It's up to you to ferret it out," he said.

It was great to stand on crumbling earth again, and to breathe air uncontaminated by the staleness of artificiality. This atmosphere was a little high in oxygen, but that only increased the feeling of freshness. The great silvered body of the *Pericles* lay where it had come to rest, across the brow of the small, wooded hill. There was another hill perhaps three miles away, and the city stretched between them. He walked down towards it, luxuriating in freedom. Ordinary crew members were given rotas of leave to spend on visited planets, but leave hedged round by a thousand regulations and restrictions. As an interpreter his only duty was to examine the natives, and report.

He considered, as he walked down towards the city, the things that Lawrence had found puzzling. By all the more obvious signs the planet was at the stage of secondary husbandry; agricultural and eking out its own resources of labour with animals and primitive mechanical devices. But the preliminary reports had shown some peculiar gaps. No apparent recorded history and, possibly linked to this, no trace of arts.

The city before him corroborated this. The buildings were strictly functional; not untastefully so, but barren of any kind of ornateness or decoration. On its outskirts began the evenly spaced farmhouses which dotted the wide western plain to the distant horizon. They too were functional. There was one quite close to the dirt-track down which he was walking. One of the natives was forking some kind of crop into a heap in the yard. There were two young ones playing near by. None of them paid any attention to him, although his silver and black uniform must contrast vividly with their own loose, colourful clothing. That was another queer thing.

He gave a personal report to Lawrence three days later.

"They're so damned *incurious*, sir. They are polite and deferential and friendly enough, but the fact that we have come across five hundred light years of space neither surprises nor interests them. It's not that they disbelieve it, or can't understand it. At least I don't think it's that. It's so hard to get at what they do think."

Lawrence nodded. "They've given you some sort of a guide, I understand?"

"Yes. He calls himself Nuker. He's very friendly, too; and he answers all my questions without any hesitation. He's taken me all over the city."

"And you've found . . . ?"

Don shrugged. "There's very little in it. Only three buildings of any size—the Council House, the Hospital, and the Museum. And they're only bigger boxes than the ordinary houses."

"The Hospital," Lawrence said. "Much disease?"

"Practically none. The usual crop of accidents you would expect, though."

"And museum?"

"That's what they call it," Don said doubtfully. "But it's no more than gallery after gallery of racks of discarded implements—all kinds of spades, forks, scythes, and so on."

"An historical review of them?"

"No, that's just it. I went through half a dozen galleries but they were all the same. Nuker tells me there hadn't been any change in them as long as they can remember."

"Then why the display?"

"According to him, it's not a display. It's just that when the worker dies, his tools are put there. I don't get it."

"No," Lawrence said. "We don't get it, but it would be queer if we did. An abnormality like that is about the first really normal thing that's been reported on this planet. It doesn't satisfy me, but why should it? Anything further on technology?"

"Not a thing. What about the other interpreters?"

Lawrence flicked a small pile of papers with his finger. He said wearily:

"The reports tally. All right, Parker. You'll have another two days, but I don't expect anything more substantial than this. Then you've been chosen for a little job."

"Sir?"

"The ceremonial handing over of scientific books in their own language. With a culture as well-knit as this, we can give them the works—right up to atomic energy. You'd better have it laid on in the Council House."

He found himself getting more and more fond of Nuker. As with all planets approximately of earth type, the dominant race was anthro-poid. Nuker's people were on the whole shorter and stockier than man, they were olive skinned and hairless, but otherwise not unusual. At first, understandably, they had all looked alike. Now, after four days, he was beginning to appreciate the differences between them. Temperamentally these were far more extensive than one would have guessed from the stable, hard-working and inartistic life they all led. He was brooding on this minor paradox as they crossed the main square together. On the opposite corner stood the Museum, facing the Council House. As usual there was a steady stream of natives going in and out of it. He stopped walking abruptly, and looked at them.

Two streams, one entering, one coming away. And there was a difference between them. It was a subtle difference, and since one did not look for subtlety in these stolid, farming natives, it was not surprising that he had not observed it before. But now that he was aware, the difference was real enough. The natives coming out of the museum were transfigured by a strange kind of contentment. In the faces of those going in, on the other hand, there was expectancy.

He turned and saw that Nuker was watching him.

"I'd like to go back in there, Nuker," he said.

Nuker nodded silently.

It seemed that he must have been mistaken. Inside the natives moved in a slow incurious stream before the banked wooden shelves, piled up with worn and battered tools. Nuker led him along with the stream, pausing occasionally to tell him precisely how some particular implement was used. Gallery succeeded gallery, without apparent change. They were long, curving galleries, and light came into them from windows too high to provide a view of the world outside. The mass shuffled forward, and Don and Nuker shuffled with them. There was something, Don felt, that was vaguely wrong, but he couldn't find what it was. At intervals the gallery debouched into stairs leading up to the next floor, leading to another curving, crowded gallery with another array of discarded tools.

There was nothing unusual here. It was a waste of time.

And then he saw it.

A kind of spade, reproduced a thousand times on the shelves. But on one he had noticed, idly, without interest, a particular chip on the handle, shaped like a horse shoe.

And it was here again, the identical chip on the identical spade.

At the same time he realised what was so subtly wrong about the gallery. It sloped. Very gently, well nigh imperceptibly, effectively masked by the curving construction, but a downward slope. The pieces fell into pattern. Up the stairs, down the gentle slope curving right round the building, up the stairs . . . Quite an ingenious trick. But *why*? Why should the stolid farmers plan and perpetrate such a trick. The thought came home to him. Whatever they were, they were not just stolid farmers.

They reached the stairs again, and climbed them. At the top there was the gallery entrance, and Nuker moved towards it. Gently, firmly, Don resisted the pressure. He followed instead the other stream going straight on up the stairs. Nuker followed him. On the next floor Nuker made another attempt to shepherd him into a gallery, and again he resisted. As he continued up the stairs, Nuker said simply:

"It must happen."

It was clear that this was the very top of the building; there was no possibility of going higher. The stairs swept round into the entrance to another gallery, but one which, in contrast to those on the lower floors, shimmered with a hundred tints of colour from carpets and paintings and jewelled mosaic. The whole thing was fantastic. Don noticed that the stream of natives moved more slowly, with a thoughtful and abstracted purposefulness. They moved along the luxuriance of the gallery—the floor, he noted, was a veined blue stone, something like lapis lazuli—and round a curve, and it was before him.

It wasn't possible to look directly at it; the eyes were hurt and repelled. But from the corner of his gaze he could see something of its general shape. The high, wide golden arch came first—the machine was beyond it. If it were a machine. It seemed to be made entirely of crystal and was in continual, flickering motion, forming what looked like mechanical vortices and whirlpools. He could almost see through it, to something lying beyond. Almost but not quite.

The stream of natives went forward, through the great arch, and there his eyes lost them. It was as though they became merged with the spinning machine. Nuker's hand was on his arm.

Nuker said: "You must come now."

He nodded, surprised that he felt no fear. They walked forward together through the golden archway.

He often thought about it afterwards, seeking, for his own peace of mind, to remember and clarify the whole experience. But it was very difficult. They had gone through the archway, and in front of them the shivering, twisting mass of crystal had been so intensely overpowering that he had had to close his eyes. Then had come the vibration, the feeling of falling free, and his own cry of bewilderment and shock, answered by Nuker's friendly pressure on his arm.

He had opened his eyes, and he was in a different place.

It was not just a geographical difference. There was a difference in kind. Nothing here was still; everything was in vibrant, tilting motion, from the iridescent sky—if it were sky—overhead, to the ground, studded with brilliant, flickering flowers and gigantic, pulsating crystals beneath his feet. For that matter his feet—his body—his entire self—were changed. He was transformed into a creature of lightness and strength. He looked beside him for Nuker, and found him similarly transfigured. Nuker smiled, and touched his arm, and at the touch both of them floated up into the light and boisterous air.

After that he could remember nothing but impressions. Impressions of the great floating concourses swaying together in mass dances whose patterns and rhythms were tantalizingly near to his understanding. Impressions of the great floods of music, apparently answered by the air, the ground, by everything, until singers, song and the entire universe throbbed together in melody. Impressions of emotions, almost tangible in their impact: love and truth and knowledge, and an abiding friendliness. Time meant nothing. He did not know how long he had been there when Nuker led him through another gateway, and he found himself back in the gallery, shuffling forward towards the stairs that led downwards.

He said to Nuker: "Well?"

"We are a very old race," Nuker said. "We don't know how old. Once we kept histories. In those days we built many great machines;

we travelled across oceans and continents and, as you now do, across the spaces between worlds. But there was no contentment for us in it. The machines did our bidding and by their aid we travelled more and more swiftly and frantically from land to land, finding no abiding place. Then The Machine was discovered. I cannot explain its principles to you, nor the meaning of the world beyond the gateway. There is no way of making you understand what it is and how it works."

"But why hide it? Why all this deception? The museum hasn't just been built for our benefit; it's as though it were planned . . ."

"Of course," Nuker said. "In the far distant past we, too, travelled between the worlds, as I have told you. Perhaps even to your planet. We gave such things as fire and the wheel to many worlds in their infancy. So we knew that we would be visited in our turn. Once we had discovered the meaning of The Machine it was clear that, in all our cities, it must be so housed that visitors from other worlds would not be likely to find it. That isn't easy."

"And now," Don said, "it has been found."

Nuker looked at him. "Are you going to report on this?"

"It's my duty to do so."

Nuker said softly: "Do you realize what that will mean? Since you landed here we have surveyed your people; perhaps more thoroughly than you have surveyed us. You are far more sensitive than the majority—and even so the world beyond the gateway was flawed by your presence to-day. You could not be aware of it, but it was so. Should your people learn the secret we do not know what would happen. You must know that the higher is always, in many ways, at the mercy of the lower, as life is at the mercy of lifeless matter."

Don said: "So you want me to cut my people off from the gateway? To refuse them the chance of that experience?"

Nuker said: "In honesty . . . what do you feel?"

He thought of the world beyond the golden arch, of the wild, unearthly music, the great aerial sweep of the dances. Dimly he recognized that beyond the gateway the world itself was alive and conscious. He thought of the crew of the *Pericles*. "Hell, the way I look at it, it's the only real chance for promotion . . ." "With me the ladies. When I get back . . ." "I hope that in the next joint the hooch is better . . ." The two things could not live together; and he knew as surely as Nuker did which would crumple and fail.

"You win," he said. "I shall make no report."

Nuker smiled, a smile of relief and joy and the friendliness that flooded the world beyond the golden arch. And Don realized that he was cutting off himself, too, from those joys, those wonders.

He said: "If I could persuade them to let me stay here . . ."

Nuker said regretfully: "Even if you could do that without arousing suspicion—and you couldn't you know—it was true what I said about

the flaw. You would become aware of it yourself, and you would not be happy there long."

He said nothing further until Nuker had led the way outside into the city square. Then:

"But why do you work in the fields—ordinary, menial work? The machines could do all that for you."

Nuker said: "That is what I meant. You cannot understand our life. You must leave it at that; you can do nothing else."

The ceremony was quite impressive. In the square in front of the Council House he handed over the books and models that had been specially prepared. Nuker as solemnly accepted them. Quite a number of the natives watched in polite and friendly disinterest. Later he stood with Lawrence, watching the planet shrink away from the G-2 observation panels as the *Pericles* lifted in power and majesty through the atmosphere towards the next objective in the Exploration.

Lawrence shook his head.

"There was something wrong there. I wish I knew what. I'd like to know what they do with the knowledge we've given them, too. Nothing, I'll bet. It's a pity the Trip doesn't allow for return visits. To my mind they're stuck in some kind of premature decadence. I don't know if they could be shifted, but I'd like trying."

Don was watching the outlines of land beneath the ship coalesce into misty formlessness. He had an aching feeling of loss, and a suspicion that it would be with him the rest of his life. Some essential part of him remained down there, beyond the golden arch.

"If we could have had more *time* . . ." Lawrence said.

He could go back. This was his last opportunity. He could tell Lawrence now, and have the great vessel settle back, to root out the final secrets of Nuker's people. It almost seemed worth it. The world beyond the gateway might dissolve in agony, but first he would go back there.

Lawrence said: "Your reports were well presented. I'll use you again."

The ache was savage, but he saw how it could be worse.

He said: "Thank you, sir. Am I relieved?"

"Relieved, Parker."

The nav room, as usual, was crowded.

THE END

In any war—land, sea, air or space—safety precautions have to be taken in combat. Men and machines are always expendable, but they come expensive in space.

ONLY AN ECHO

By Alan Barclay

Illustrated by HUTCHINGS.

Don Lingard twitched his uniform jacket straight and knocked on the door of the C.O.'s office. He hoped his knock would appear to contain the correct proportions of decisiveness and deference, which you must admit is expecting rather a lot of a mere rat-tat on a dural panel.

The knock was followed by a loud indecipherable noise of human origin from behind the panel. Don assumed it to mean "Come in." He entered. The room was long and narrow, and the C.O. was seated at a desk near the far end, head bent over some papers. Don paced forward firmly, not altogether an easy thing in the "minimum working gravity" of Cepha III Asteroid. He halted exactly opposite the middle of the C.O.'s desk, and a yard from it, and saluted. After about half a minute the C.O. raised his head. He had a rather haggard humorous face and eyes of a tired washed-out blue. The eyes examined Lingard, noted his rigidly correct stance, the impeccable black uniform and the single stripe.

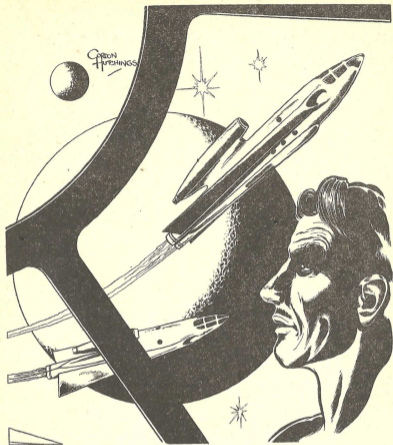
Lingard for his part noted with disapproval the C.O.'s unbuttoned jacket collar.

"Great Jupiter!" the C.O. exclaimed at last, "Who the heck are you?"

"Junior Lieutenant Lingard, sir," the latter replied. "Posted to Cepha III Advance Base . . . Reporting for duty, sir."

"Junior Lieutenant, eh?" the C.O. asked, almost admiringly; then unexpectedly: "My poor child—park yourself in that chair and tell me all about it—go right ahead, you're not in a training squadron now." He swung his long legs up on to the top of his desk and tilted the chair back. "How old are you? Twenty? . . . What's your training record?"

"I'm nearly twenty-one, sir . . . I passed out second in my class in basic training. Category A in pilotage and navigation, six months' advanced fighter training from Moon Training Station; plus A rating in gunnery."



"Well ! Well ! . . . and dying to have a crack at the enemy, I'm sure ?"

"Yes, sir—naturally."

"Why ?" the C.O. shot at him with unexpected force.

Lingard fumbled for an answer to that one. "There's only one possible reason, sir, isn't there ? To do my share defending humanity—to help defeat the invader." He felt just a little embarrassed at having to say this at all.

"Very proper, my boy, very proper," the older man approved. "And of course to win a spot of fame for yourself, no doubt ? Well, you'll get your chance, although I think you'll find the death and

glory atmosphere rather more prevalent in Rear Training Units than out here. But I must decide what to do with you . . . Plus A in gunnery, you said?" He pressed a button as he spoke and the desk speaker croaked deferentially in response.

"Hawkins? Is Captain Stinson off duty?"

"Yes sir."

"Then dig him out . . . Ask him will he be good enough to see me at once."

"Yes," the C.O. continued, "I don't hold with too much Death and Glory. I look at it this way. We've had a space war on our hands since—let me see—it must be nearly four years now since the enemy was found hanging round the outer fringes of the system, and nobody can claim to see any sort of decision in sight even now. So while I agree it's necessary for you youngsters to do your tour of service here, I feel it's only right to give all my boys every chance of lasting their time out so they can get back home to Mother Earth. I'm happy to say the rate of loss on my station's very low indeed."

"But, surely, sir, it's vital to carry on the fight resolutely?" Lingard queried.

"Resolutely," the C.O. repeated, half to himself. "Yes, a good word, though it seems to imply a possibility of reaching a conclusion. However, we'll talk about it some more later on. For the present I'm listing you as Number Two in Captain Stinson's ship."

"But, sir," Lingard protested, "I'm a qualified Class A fighter pilot. I'm not a Number Two."

"I'm aware of that—nevertheless, you'll do your first dozen patrols as Number Two to Stinson."

"Very good, sir," Lingard replied woodenly.

The C.O. grinned. "The experience you'll get with Stinson will just about double your chance of survival. Stinson's not impressive to look at, but he's a good man. Cautious—calculating. He'll be along in a moment."

Lingard waited. He felt a little bewildered by the C.O.'s attitude, by his informal manner, and by his unbelligerent conversation.

Stinson, when he appeared, was another surprise. To begin with, he was very old—to one of Lingard's age anyone over thirty appeared almost senile—and he was small and crumpled looking. That is to say, not only was his uniform considerably creased, but the man inside it appeared to be hunched into a depressed slouch.

"Ah, Stinson," the C.O. exclaimed, as the latter managed a negligent salute, "meet Lieutenant Lingard, just posted here. He's qualified as pilot, but I'm assigning him as your Number Two for a spell."

Stinson looked at Lingard sourly. "Another of them?" he asked. "I'd rather have an experienced N.C.O. gunner."

"You'll find Lingard first-class," the C.O. said amicably. "He has an excellent gunnery classification."

"Against sitting ducks," Stinson retorted. "I've nearly got my time in now, sir. Why lessen my chances by unloading trainees on to me?"

"It's an order," the C.O. replied, still amicably.

"Very good, sir," Stinson answered, bringing himself sketchily to attention. "May I formally submit my application for a transfer to another unit, sir?"

"You must submit in writing," the C.O. pointed out. "With reasons—and it won't be granted. Now take Lingard down to the mess and make him at home."

"Very good, sir," Stinson saluted. "Coming, Lieutenant Lingard?"

The Officers' Mess was a large cheerful circular chamber, some hundred feet beneath the surface of the asteroid. It contained quantities of enormous armchairs, from most of which projected the legs of apparently unconscious occupants, and a bar. Pinned on the walls were numbers of illustrations of the sort usually found in junior Officers' messes, and some rather fine original coloured cartoons. These latter were obviously all the work of one artist, and they all dealt with the same topic. One of them bore the title: "Is this the Enemy?" It depicted an octopus-like creature with large unfriendly eyes scowling out through the viewpoint of a very alien-looking sort of space-scooter. Another, captioned "Or this perhaps?" showed a crocodile-type actually mounted astride a pencil-thin scooter with a long narrow blue tail jet. The crocodile was in the act of firing a D-wave disintegrator. A third drawing showed a plump and streamlined but intelligent marine animal afloat in a bulbous liquid-filled ship.

"Then it's really true that no-one's ever seen them?" Lingard asked. "Well, at least nobody's lived to tell what they're like?"

Stinson didn't appear to wish to discuss the subject. "Come and have a drink," he invited.

Next day—the Unit operated on a day of twenty hours—Lingard reported to the crew chamber a full half-hour ahead of time, and made his way through the outer lock and thence into the ship where it lay in the blast tunnel. Early though he was, however, he found Stinson there already. The little man was checking over equipment and greeted him simply with a grunt. Lingard crawled down to the gunner's position and began to work over the guns. Watching through the view-port he saw the long sleek muzzles slide out in their mountings and swing right and left as he operated the controls. The shot-loading mechanism swung its steel arms with a clatter as he tested its functioning. Finally he took the covers off the gunsight, and discovered to his surprise and disappointment the old Mark I type instead of the new Mark III Ewing Automatic Tracker.

He mentioned this to Stinson as they helped each other into their crash suits.

"There's about half a ton of junk in the Ewing; it cuts down our acceleration," the latter explained. "We've the C.O.'s approval to dump it. Better get strapped in now." He settled himself in the pilot's take-off position and began calling Control for clearance.

Lingard kept an eye on the chronometer. As its second-hand swept round to the final moment, Stinson made no ceremony of take-off, but reached out casually and punched the firing button.

An instant bellow of sound from the jets and then a giant hand gripped the ship and flung it with incredible force along the tunnel and out into the silence and blackness of space. A moment later Stinson cut the motors to a whisper, levelled off with the plane of the ecliptic as horizon, and set course for his patrol area on the outer fringes of the asteroid belt.

"Well, Lingard," he asked presently, with rather less than his usual sourness, "this is the moment you've lived for and trained for all these years. How does it feel?"

"Not much sense of reality," the other admitted frankly, "except every so often something in my head tells my tummy this is the real thing, and then a whole flock of butterflies stir round."

"Same with me," Stinson agreed, "except that I have them all the time. Anything you want to know?"

"About a million things," Lingard replied eagerly. "For a start, where's our patrol area?"

"It's there on the chart," the other nodded. "Not that it matters to a thousand miles or so. The patrol scheme works more or less as taught at Training Base. The enemy tries to sneak inside from the direction of Aries, so you must first draw a line from Sol towards Aries; then take a point on that line just outside the asteroids and draw a circle with that point as centre at right-angles to the line. Now if you give that circle a thickness of two million miles you have our outer patrol volume."

"Except you haven't told me the radius of the circle."

"Forty million miles at present—you can calculate the number of ships required to scan the volume if you assume each scout's locator is good for a quarter million miles instead of half a million, like the book claims."

"They gave us calculations at Base which had a whole lot of double integrals in them," Lingard objected.

"I expect if you try to calculate maximum duration of patrol in terms of fuel consumption, food and air requirements for crew, you can have quite a lot of harmless mathematical fun, but the fact is we stay in position one hundred and fifty standard hours." Then he added bitterly: "The experts have already proved mathematically that we don't need much food on patrol, and I shouldn't be surprised if they didn't come up soon with a proof that we can get along without air as well."

"Do many enemy ships get through the patrol screen?"

"Quite a few, for our job is primarily to detect and report, and only after that to liquidate if we can. But few get past undetected, and once we've signalled their track the boys at Rear Defence get them. Mind you, more get through than you hear about on the news, and I've met chaps who swear some have touched down on Mars." Stinson paused, then added: "And there you have lesson Number One—detect and signal back, then attack if you have the advantage. And here and now I'll give you rule Number Two. It isn't an official rule, just one of my own, but it's vital—a beneficent and well-meaning government has provided us with crash suits—the things we're wearing now—complete with built-in jets. The fuel's supposed to be sufficient to get us back to Base if . . ."

"Why supposed?" Lingard interrupted with some irritation. "We *know* it will. It's been designed for that purpose. Seven years ago Captain Abrahams got back after five and a half days of cruising . . ."

"All right, all right," Stinson protested. "It's designed to get you home, and I'm just as happy about it as you are. It'll get you home *if you keep your head after you've baled out; if you remember your own position and velocity; if you remember the position and velocity of your Base, and if you're able to do some spherical mental geometry and plot a course by eye.* I agree utterly with you about that and I think science is just wonderful—now can I get back to what I was saying?"

"Sure," Lingard nodded.

"If we get hit just once by the enemy's D-wave we're a couple of cooked chickens. You know it disrupts the fuel in the motors and tanks and turns the ship into a small brief glow of light that nobody is likely to notice—but from strike to final detonation there's a quarter-minute time-lag while the stuff comes to the boil—get me?"

"I get you," Lingard agreed.

"Right. Now get this too and get it straight—if ever I see we're cooked I'll give the word to bale out, you'll hear me all right for I'll yell my blooming head off. As I give the word I'll hit the crash button and blow the lock out. When that's gone I'll tell you again to bale out—that's twice. The second time you ought to be on your way almost before I open my trap. Quite clear?"

"Quite clear. You give the word to bale out once as you hit the button and a second time after the lock is blown."

"Exactly. And spend a bit of time getting it fixed right in the front of your mind, for when it happens it'll be real sudden, and I promise you I don't intend to hang around long enough to warn you three times. If ever you hear me a third time it'll only be an echo."

Lingard swallowed an exclamation of contempt.

They reached position after forty hours economical cruising at accelerations designed to give them a zero speed relative to the Sol-

Aries line. Once in position they set their locator-beam operating and lay motionless while it scanned a sphere of space around, above, and below them.

They kept watch in three-hour shifts; Stinson devoted his free time to calculating the amount of back pay and gratuity due to him, and to making complex plans concerning his future in civil life. When he tired of that he read books on photography. During his first hour Lingard watched the pale violet glow in the three-foot diameter indicator globe with a sort-of quivering eagerness, but as the hours passed—and the days—his enthusiasm settled to a lower level.

"Take it easy, son," Stinson advised, looking up from his book. "We might do four or five patrols without picking up a thing, and then as like as not just when you've got yourself in a state to believe the Jackoes are a myth, you'll see one of them about a hundred yards away."

As a matter of fact, they picked up no indication of the enemy at all that trip. On their next patrol, however, on the second last day of it, two dark quivering blobs floated into the fringes of their globe.

"That's them," Stinson said, "that's a couple of Jackoes all right." He spoke quite unemotionally.

"Then let's get after them," Lingard urged.

Stinson watched the blobs for a long moment.

"No use. They're on the fringes of our sphere and they'll pass out of it in twenty minutes. All we need do is signal track and speed to Base."

He proceeded to send a signal accordingly, and half a day later they learned that the intruders had been wiped up by Rear Defence.

On their fourth patrol a single enemy scout passed through. Although this one passed rather closer Stinson declined to go after it.

After their sixth patrol when the same thing occurred, Lingard applied for a transfer to another ship. The C.O. just grinned. "Refused," he said, "and don't imagine that's because we love you, my young fire-eater—it's taken a whole lot of United Government money to train you and build the ships you use, and you've got no entitlement to commit suicide—we're not running this war for your entertainment, you know."

"Sir," Lingard asked desperately, "may I ask a question?"

"As many as you like."

"Suppose, instead of this cautious, safety-first policy we hunted them like hell, chased them hard, fought them right back to their hide-out, kept hammering at them without pause, don't you think they'd very soon lay off and go back home? Don't take this for foolish heroics, sir—it seems to me, in the long run it would be cheaper in men and ships."

"It's a good argument," the C.O. admitted, "but there are reasons why it won't work. The most important one is that in my opinion they've got no home to go to."

Lingard looked his question.

"I mean—this is merely a personal opinion—they've come across space from another system. I reckon they, or perhaps the great-great-grandfathers of the present generation of Jackoes, have had to abandon their home planet. I reckon the whole race of them have been cruising across space from their own star for tens or hundreds of years. They've been looking for another home. I'm willing to bet that if you got through their outerscreen—a thing that no-one's done so far—you'd find a whole fleet lying out there a few million miles off—big ships—rows of them—stacks of them, full of Jackoes of every shape and size, sitting on whatever they have to sit upon, and staring in here and wondering if at last they've come to their promised land. No, Lingard, nothing we do to them will make them go back. To stay is their only hope."

"Then where does it end?"

"I don't know," the C.O. answered. "It could go on for ever."

Two days later Lingard and Stinson were again in patrol position; they were both watching the scanner-globe. On the fringe of their sphere, almost vertically above them as they lay, a single small blob was being chased by three larger ones.

"That's a Jacko scout that's got inside our screen. He's had his look-see and perhaps he's been as far as Earth—and now he's trying to get outside again. The three bigger blobs are our own pursuit ships. They'll get the poor so-and-so in about five minutes. Watch!"

The four blobs swam swiftly in the luminous interior of the sphere. Of the three pursuers one was slightly above the Jacko, and its two fellows were below, but all were on a gradually converging course.

"These are the new Pluto Class pursuit destroyers," Stinson said. "Crew of eight, mounting D-wave projectors. It'll be any moment now."

"I've never understood how they manage to mount D-wave stuff on small ships like that. How come the crew escape the back-lash of hard radiation?"

"Well, of course, the ships are a good deal bigger than this sardine-can, and they carry the projector mounted right in the nose. It's operated by remote control, with a great hunk of screening material between it and the crew-stations."

"Come to think of it," Lingard reflected, "the Jacko scouts mount D-wave pipes."

"That's right," Stinson agreed. "Mean to say you've only just thought that out?"

"But . . .?"



"There's two answers to that question. The easy answer is that Jackoes take quite kindly to hard radiation. I know our H.Q. staff favour that theory; in fact, they talk as if Jackoes like nothing better than to bathe in hard radiation two or three times a day."

"You don't, I gather?"

"I certainly don't. I'll tell you what I think. I think any Jacko who squirts his D-wave from close-quarters, say from one of their scout ships, dies about six weeks after same as we would. What's more, I reckon Jacko fighter-pilots know it. That's why they always fight to a finish—and why they always blow their ships up. Look, this fellow's turning." He pointed to the scanner. "He's going to try for one squirt at our ships before they mop him up. I reckon he hasn't got a chance . . . Look, there he goes."

As they watched, the small blob which had started swinging a moment before in a tight arc seemed to swell enormously in size, then it winked out. It was no longer there.

"Poor——!" Stinson exclaimed.

Lingard looked at him in some irritation.

"Sometimes I think you love these creatures," he protested.

"I don't hate them the way you do," was the reply. "Even if they look like crocodiles, or like octopuses, or have two heads and mouths in their stummicks, I still think they're pretty good guys. Before one of their scouts sets off he must know he hasn't a fat chance of living. If he fires his projector he cooks himself—even if he doesn't his chance of getting past our screen and out home again is pretty slim. Yet still they come."

"Then why do they keep on coming?"

"That's easy. Out there somewhere beyond they've got their big ships, full of mummies and daddies and kid brothers and sisters and perhaps girl friends and wives, if their biology operates that way, at any rate, they have their fellow Jackoes—they're trying to find a home for them. Wouldn't you do the same? Even if some other creature, some other sort of animal, persisted in getting in your way?"

"I suppose so." Lingard thought it over, then asked: "Why doesn't anybody back home on Earth or Mars talk this way?"

"They're still scared by the 'Monsters from Space' angle."

"And how's it going to end?"

"I'll tell you," Stinson said unexpectedly. "You know what happens when a couple of big kids meet for the first time? As like as not they make faces at each other; they stick their tongues out; they fight, and give each other bloody noses; but as a result they get better acquainted; they learn one another's strength; they discover they're both human and decent and ordinary, and interested in the same things. And pretty soon they're friends, and busy swapping marbles and pocket-knives. Well, I reckon that's the state of affairs between ourselves and the Jackoes at present. We're punching each other on the nose—a certain amount of blood is flowing—just too bad it happens to be yours and mine, but in the end both races will decide that the other is ordinary and decent and deserving of respect, and after all, there's room for both sorts even in this small system."

"When you get to the stage of believing it's just a game; when you've done at least eight or ten patrols and the Jackoes just seem like a myth to you, then at last you'll meet one, probably you'll see him no more than five hundred yards off on the starboard quarter." So Stinson had told Lingard several times. Actually it happened on Lingard's ninth patrol. Stinson spotted them.

"This should stir your heroic soul," he said. "I think we've got something coming our way at last."

Lingard moved over so he could see the scanner.

"Where?"

"See that blip—the one that's moving across?"

"That's just another hunk of rock," Lingard protested.

"It's a hunk of rock all right, but if you look carefully you'll see it change shape . . . there! Notice those two smaller specks behind? Sometimes they merge with the main blob, but every so often they seem to detach themselves. That must be a couple of Jackoes trying a new trick. They've picked up a chunk of asteroid moving on a suitable inward course, and they're hugging it in hopes of riding right through our screen undetected."

Lingard watched closely. Now he could see clearly that although the little flecks seemed most of the time to be part of the main mass, every so often they became detached for an instant. He estimated their course, and saw that they must pass very near.

"They'll pass very close to us—shall we signal?"

"Not yet," Stinson said. "First of all, let's put ourselves as near as possible in the path of that bit of building material."

He fingered the firing buttons and set the ship in motion, slanting downwards into the orbit of the asteroid. The moving blob near the middle of the luminous mass swung up and forward until at the end of ten minutes it was moving directly in towards the centre. The chunk of rock—it seemed to be about two thousand feet in average diameter—was now dead in line for the ship.

"We'll switch the scanner off for a moment," he said. "The rock's between us and them now, but there's just a chance they have the tip of one of their antennae sticking over the top. In half an hour we should be able to see it in the telescope direct."

In half an hour they did spot the rock in the telescope and twenty minutes after that they were able to see it with the unaided eye, a rugged monster rolling smoothly over and over with great metallic crystalline plates glittering where the sun struck them.

Stinson began swiftly to match speed with the rock and to jockey the ship nearer.

"Now, son," he said, "on the other side of that hunk there's two Jacko scouts. I'm going to swing round its side and get you in line for a no-deflection shot with the nearer of the two. There must be no delay, no discussion. You must plug him with your first salvo, and the moment that's done I'll line you up with the next, and you plug him too. It'll be fast, clean no-deflection shooting, no fancy stuff. Just *wham! wham!* and finish. O.K.?"

"O.K., Captain," Lingard agreed enthusiastically. He slid forward to the gunner's position and grasped the gun controls.

"Got your crash suit clamped shut?" Stinson's voice came over the radio intercom. now.

"Sure," he replied.

"Remember, we just might get hit . . . Remember what I said about baling out?"

"There'll be no baling out," Lingard cried. "Just give me half a second in line with each of these monkeys. I'll plug 'em for keeps."

"You'd better," the other growled. "Here we go."

The jets murmured briefly and the little ship slid close in along a shadowy wall of rock. Then a burst from the jets flung them out into the sun. Another burst from the lateral tubes spun the ship round with a jerk . . .

And there were the Jackoes. One crimson bulbous shape lay no more than a hundred yards away, another, further over, and below, another . . .

"Hell!" Lingard shouted. "There's three of them."

"We can't turn back now," Stinson gritted. "I'm giving you the nearest—get him."

The ship jerked and bucked as he lined it up. Lingard gripped the gun control with sweaty hands. The yellow cross of the gun-sight centred on the belly of the nearest ship.

He never remembered pressing the firing button, but the ship shuddered as the tiny pellets of Fissionable flung the steel slugs screaming along the gun-barrels. The Jacko ship seemed to burst open.

"Next!" Stinson yelled, and jerked the nose of the ship round.

The second enemy ship lay further away, and it's pilot had had a few second's warning. A thin blue flame jetted from its underside. Its nose swung up and round.

"Get it," Stinson shouted. Lingard swung the guns and tried a deflection shot. The target accelerated just as he fired, and the slugs missed by a few yards. He jerked the re-loading lever and felt the thud-thud-thud of heavy projectiles sliding home into the breech. The Jacko ship accelerated and twisted sideways to port with short spurts from its lateral jets.

"Don't fire now," Stinson ordered calmly. "You can't get a hit while he's accelerating and spinning, but when he starts to veer back in the opposite direction there'll be one single instant when he lies steady. Wait for that."

Lingard waited, trailing the red ship with his sight. He waited a long moment—long enough to wonder where the hell the third ship was—then the target steadied. Its relative motion dropped near to zero. Lingard jabbed the thumb-levers and the slugs screamed out. During the next few split seconds the enemy's nose fell off a little in the sights, but not enough to take it out of the flight path of the steel projectiles. Six gashes tore themselves open in its side. It spun round violently under the impact, then blew up with a flash of white flame.

"Hit," Lingard cried.

Stinson didn't spare him a word. He was playing tattoos on the

firing buttons. The ship whirled round and up in a tight turn. Lingard was crushed down against the seat.

"Where's the third ship?" he called.

"It's right on our tail, sonny," Stinson still sounded surly. "Get a good grip on something. I'm liable to toss you about a bit."

The ship plunged and bucked and swooped in great circles; the asteroid where the battle had started was now many hundreds of miles away. Three times a flicker of steely blue flame lanced past the side observation ports.

"He's not so clever with that D-wave of his," Lingard managed to gasp. "Can't you turn hard so I can get a shot at him?"

"Not a hope. Those Jackoes are able to stand more G than we can take; they turn in tighter circles . . ."

Once more the blue needle of light lanced past. A second later it flashed just ahead, not a momentary flash this time but a beam which lay like a sword across their path. Stinson gave a full burst of the belly jets to lift the ship over it.

"The advantage of a beam is he can lay it ahead so we fly into it—What's that? Great Jupiter! We've been hit! He flicked our tail section that time."

There was a rending explosion aft as one of the jets blew up.

"We're cooked, son," Stinson yelled. "Bale out."

He clapped a hand on his helmet valve to check that it was tight, then brought his fist down hard on the crash button. The lock blew outwards with a *'thunk.'*

Lingard was already on the move.

"Bale out," Stinson's voice shouted once more.

The escaping air lifted Lingard and puffed him out into space.

"You O.K., son?" Stinson's voice asked on the intercom, a moment later.

"I guess so," Lingard replied.

"Good! I expect you know all about making a crash-suit return to base?"

"I'd be glad for you to tell me, Captain," Lingard asked. He was floating on nothing in black empty space. Although Stinson could not be many yards away he was unable to see him.

"Very well. Listen. Take Sol-Aries Line as datum. You remember the co-ordinates of Base at the time we set out?"

"Sure." Lingard recited them.

"And our ship's co-ordinate position before our attack started?"

"Yes, but we've shifted a bit since then."

"Not so much that it matters. You can make an approximation. Right? The most difficult job is to make a periodic estimate of your own velocity. You use that little jigger fixed in the outer pocket of your suit; make as many velocity checks as you can. Make 'em all the time. You've nothing much else to do. When you think you'r

within a thousand miles of base start sending on the intercom. They have a fellow listening out all the time. Don't stay switched on. Send, switch off, wait ten minutes, and send again. Now just you keep calm; verify your velocity all the time and you'll get home in no time."

"Thanks, Captain," Lingard said gratefully. Stinson's sour, matter-of-fact voice had steadied him up considerably.

"Are you listening, Lingard?" Stinson's voice spoke again a moment later, urgently this time.

"Sure."

"I saw a flicker of that so-and-so's jet over my shoulder a moment ago. Apparently he's prowling around still. So long as you don't accelerate we'll look the same in his locator as a couple of chunks of debris from our ship."

For ten minutes Lingard drifted. He spent his time trying to estimate his velocity. He knew the ship's speed and direction before the attack commenced, but what it had built up to during the manoeuvres he had little idea, and then, of course, an additional component of velocity must have been added when the escaping air had puffed him out of the ship. The asteroid, large though it was, could no longer be seen, and the only piece of debris in sight was a ragged curved plate of dural from the hull which hung about two hundred feet above him.

"Are you hearing me, sonny?" Stinson's voice queried. There was an odd resigned note in it.

"Yes," Lingard answered.

"That Jacko has me spotted. His ship's drifting quite close now. Not a doubt of it. Just then he gave a touch on his port jet to bring him round. Wonder if he can detect my radio? My best chance is to stay where I am and hope he'll take me for dead. D'you know the ship has a glass nose and I can actually see something moving inside . . . Perhaps I'm going to be the first human to meet a Jacko . . . Seems to be turning his weapon-turret round, but I expect that's just a pre . . ."

The radio went dead. Out of the corner of his eye Lingard saw a tiny flicker of light. A few minutes later he observed a long thin flame of a ship's exhaust sweeping up and around and disappearing towards the Outside.

Lingard made a careful course back towards Base, and was picked up three and a half days later. Two months after that he was back on patrol, this time as Number One in charge of a scout.

". . . And another thing," he told his new Number Two on their first run out, "if you ever think you've heard me tell you a third time to bale out, it'll only be a ruddy echo."

For countless centuries the Edril had exacted tribute from Earth as a benevolent Overlord, seldom visiting the planet, but always aware of plots to overthrow them. Then the Earth people united their mental strength and went out to meet the Edril.

RELAY RACE

By J. T. McIntosh

Dal, the Edrin, was bored. Or at least, in that indifferent language, English, which was so characteristic of the world he was visiting, that was the best word for his state of mind. He had never troubled to learn more than one Terran language, so he was unable to describe himself as *lebensmude*.

He looked at the people thronging the streets—there by his order, for Earth could not be allowed to be indifferent to him—and realised that they were intelligent enough now for the ceremonial pretence to be utterly nonsensical. But the pattern had been set a thousand years before, and he was no more capable of changing it than the Terrans were.

Yet he was looking at his world—*his*, to treat as he liked, on behalf of Edris. He was the overlord. The fact that he was bound to tradition as securely as the people who silently, sullenly, unwillingly lined the streets was neither here nor there (what a stupid, meaningless Terran idiom that was !)

Sitting back in the car, he saw that there were going to be two attempts on his life. ("Saw" was another poor word that would have to do). One of them was interesting enough to alleviate his boredom considerably.

But the attempt which would come first was ordinary. A fanatic, too fanatical and of too low intelligence to know that Dal would naturally anticipate the attempt, was waiting a mile ahead, a warp gun hidden in an artificial paunch so that he would get in his shot before the Terran police knew he was armed.

The other attempt would come as Dal reached the Capitol. It was highly significant. It differed from the other in that there was only one way in which he could survive it. How he was protected when it came would make no difference to its effectiveness, for it involved the seventh level of scientific progress.

Could they really have reached the seventh level already? Dal asked himself in wonder. In a mere thousand years?

He was still musing on this as the car swept past the first assassin. There was a faint, terrifying noise, like space being torn asunder (which, in fact, was part of it), and police closed in round a man who no longer resembled a man, yet had harmed no one but himself. Dal pretended to see nothing.

He had already forgotten the first assassin. He was thinking about the attempt which would come at the Capitol. The man was a Nith, of course, who had taken matters into his own hands. He had no backing. It was not revolt. That was a relief.

The car approached the Capitol. Wryly Dal reminded himself that the only way for him to survive, the use of the eighth level, was all highly theoretical. Basically, even the highest science is simple. All the assassin needed was knowledge of Dal's exact location. If Dal permitted him to know it as he made his attempt, it would be more than an attempt.

But Dal, for a moment, was back on Edris. No one noticed. It was only for such a tiny fraction of time that when he returned, the air had not begun to fill the space that was empty for an instant.

The attempt, however, failed.

Dal wondered how long it would take the fanatical but brilliant Nith to reach the correct conclusion: that Dal had known about the attempt and exactly when it would take place; that Dal had knowledge of a science beyond the seventh level; and therefore that when the irresistible force was applied, there was no immovable object for it to react against.

Dal took no action against the brilliant Nith. It would be a crime to destroy a scientific mind of that order, and Dal was no criminal—merely the overlord of Earth. The attempt would not be made again. A genius like that would know he hadn't the answer yet, and would look for it. He wouldn't diminish himself by repeating a failure which

would always be a failure. He would look (though he might not know that that was what he was looking for), for the eighth level. He would never find it, Dal reflected. A man can only run so far ahead of his fellows.

Dal went on into the Capitol to arrange Earth's tribute to her conqueror for the next five years.

II.

When Arthur and Lida turned the corner and found themselves in the thick of the battle they made it clear right away that they didn't want any part of it.

The Edrin had gone. Half Earth had seen his ship go. Nobody knew whether his ship was manned by Edril or whether he was alone on it. No one now alive had seen any Edrin but Dal, though a few old people remembered their parents talking of Harr, Dal's predecessor. The Edril were longer-lived than Terrans, but they had never claimed to be immortal.

When Dal had gone, it was natural, in fact inevitable, that part of the crowd gathered to greet him should act out the old controversy. Where men gathered, there were Niths and Enwyes—for every man, woman or child was Nith or Enwye. Where there were Niths and Enwyes, there was a fight. That followed as night followed day.

Arthur and Lida had stumbled into the battle as anyone might, even the most timid and law-abiding of citizens. For it was a strange battle in which hundreds, perhaps thousands, fought with all the power of body and mind and spirit and tradition, but in which there was no sound and no one was hurt. It was the only possible kind of battle in this world, at this time. Green and red flashed and mingled until it seemed there were no colours in the world but green and red.

No one was hurt—physically—because Earth was no longer a savage world, because people (or the work they could do) were more valuable than any dispute, because the Edril might not like it, because no one wanted to hurt.

Arthur and Lida wore the red of the Enwyes, but they didn't dash into the fray. A man in a green tunic merely looked at them, that was all. Before he could have observed whether they were young or old, anything but the colour of their clothes, Arthur had his red shirt over his head and Lida ripped her blouse to ribbons and dashed it to the ground. The Nith looked away in disgust.

They stood still, lost, frightened, and completely ignored. Neither Nith nor Enwye would touch them, but they were still afraid. They clung together, shivering, though the day was hot, Arthur looking skinny and weak in his too-large shorts and Lida like a frightened

slave from distant history before women stepped up to take their rightful place beside men. They saw a ramp leading up from a garage and slunk towards it.

"Rats!" muttered an Enwye as they passed. He would have said the same if the ribbons still hanging from Lida's skirt had been green, not red. He didn't know he was likening them to an animal. There had been no rats in the world for hundreds of years. The word to him meant humans like Arthur and Lida who were sunk below pride and ran from conflict. It was a battle which would hurt no one, but exhaust everyone, set nerves a-jangle for days. That was what the two cowards could not take. They ran not from blows, but from words, thoughts, feelings, convictions.

Arthur and Lida ran down the ramp, tore open the door at the bottom and threw themselves gratefully into warm, friendly darkness.

There were not many like Arthur and Lida. Anyone who blundered as they had into the battle joined it automatically, without having to make a decision. It was individual against individual, group against group, whole party against whole party. For most, nothing would come of the battle except exhaustion and, later, an infinitesimal increase in keenness of mind—for the human brain, stretched to its limit, could only collapse or grow stronger. But some who were red would become green, and some Niths would become Enwytes.

No, there were not many like Arthur and Lida. But among as many as there were in that open space, there must always be a few cowards.

Joe and Crystal Olson found themselves in the battle unexpectedly, as Arthur Hever and Lida Smith had done, and re-acted exactly as they had reacted, if not so quickly. Olson took off his green shirt slowly and calmly, looking about him. However, his gaze, apparently fearless, wouldn't meet anyone else's. And Crystal, merely fingering her green tunic reflectively, spoiled the effect of her calm by wrenching it frantically out of her belt whenever a group of Enwytes turned in their direction.

Joe didn't look at all like Arthur. He was big and powerful, and in his shorts he was so strong and commanding that many people, perhaps irrationally, were even more disgusted as he dragged his sister to the ramp. At the bottom, he pulled the door open and pushed Crystal inside.

The lights went on automatically as he closed the door. The garage was big and bare. Facing Olson was a man with dark hair and soft, feminine eyes, and a girl whose keen, searching gaze showed that anything she had lost when beauty was being handed out had been made up in intelligence.

Arthur saw a tall, deep-chested man with unexpected dimples and a girl so beautiful that for a moment he forgot everything but the joy of looking at her.

III

Olson looked on in disgust. "The most important five minutes in history," he murmured, "and all the Enwyes' leader can do is stare at a girl."

"Nothing is ever so important," said Arthur mildly, "that one should forget beauty."

His colleague was much more business-like. "You are Olson?" Lida demanded. "We can talk absolutely freely as long as the battle goes on. Nothing, absolutely nothing, can penetrate the barrier those seven hundred minds above us are putting up."

"The first combined operation," Arthur murmured, removing his gaze from Crystal at last. "The very first combined operation in a thousand years."

Olson saw he was a dreamer, an idealist. But then, most of the Enwyes were. Very roughly, the Niths were reckless, pleasure-loving, extravert, the doers; the Enwyes cautious, ascetic, introvert, the thinkers.

"How many of yours know why?" Arthur asked curiously. The question was clear enough to Olson. It meant, how many of the Niths above knew they were fighting a battle that didn't matter, merely as a smokescreen for a conference of Earth's leaders?

"Not a dozen," said Olson grimly.

"We have more who can control their minds, it seems," said Arthur thoughtfully. "Nearly fifty of ours know."

Olson took a deep breath, and smiled suddenly. "If you want a fight," he said, "nothing would suit me better. Frankly, nothing ever does."

"And you would fight, here and now, over that?" asked Lida coldly.

"Any excuse for a fight is good, but no excuse is best of all."

Crystal, apparently, was not of the same mind as her brother. Her breast was heaving with bottled-up emotion. She let some of it out. "I could cry," she said vehemently. "We have to wait a thousand years for this meeting, and when at last it happens we sniff suspiciously at each other and quarrel like children."

"We can't slough a thousand years of strife in ten seconds," Arthur remarked in his characteristically mild tone.

"And while we're getting around to sloughing it," said Crystal bitterly, "seven hundred people are exerting their last grain of mental strength to give us the chance."

Lida nodded in agreement. Arthur grinned wryly at Olson's truculent brow, Lida's cold disdain, Crystal's vehemence. The situation was not new. It must have happened hundreds of times before that traditional enemies joined forces, completely, unreservedly, to fight the menace to both. Only this time the menace was older than either side, older than the Niths and Enwyes, older than history.

All Earth agreed at last that it was time to throw off the Edril. For a thousand years the Niths had said *Now is the hour* and the Enwyes

Not yet. There had never been any quarrel about the aim, only about the time. Now, if this meeting had any meaning, the Enwyes were surrendering everything, even their name.

The Edril, of course, in their world which might be Mars or Venus, or a hundred thousand light-years away, knew all about the Niths and the Enwyes. They had always known. It was said that they had instituted the two groups to keep Earth for ever divided on the question of fighting back. It had been said, too, that the Enwyes were traitors, spies, collaborationists, cowards. That was inevitable.

But no intelligent Nith had ever believed it. The war between Niths and Enwyes had been incessant, but only occasionally bitter. It was obvious, now, that the Enwyes had been right a thousand years ago, five hundred years ago. Five centuries ago, let alone ten, the Edril had held so many more secrets of the cosmos than Earth that perhaps a single Edrin could have crushed a united Terran revolt—and crushed it so completely that Earth would have been set many centuries back.

So always, at the back of the intelligent Nith's mind, had been the thought: They were right a hundred years ago. They said wait. *Maybe they're still right.*

All this Arthur knew as well as if he had been a Nith himself. For Arthur Hever was above all an observer. Always, however deeply he was concerned in anything, he watched what went on about him.

"This has been a relay race," he said thoughtfully. "For the whole period of recorded history—the Edril made sure we had no record of a time before they came—the Enwyes have been in command"

Joe protested violently. Crystal grabbed his arm. Arthur merely smiled, waiting for him to be silent.

"The Enwyes have been in command," he repeated. "There has been no revolt, so the Enwyes must have been in command."

"We had to wait for you," said Crystal. "Half the human race was never enough to handle the Edril."

"Do you think so?" asked Arthur thoughtfully. "Do numbers really matter? We have no idea how many Edril there are. Whatever we guess, they may be a million times as many, or a millionth. I believe that any time the whole human race could beat the Edril, if there ever is such a time, half could do it, or a quarter, or a tenth. It would be a battle of knowledge, power and intelligence. Not of cannon-fodder."

He looked round at them, savouring the moment for what it was, one of the climaxes of history. "No, I think you waited for us, sensibly, because while you believed you were right, you always knew you might be wrong. I said it was a relay race. We have been carrying the baton since there were Niths and Enwyes—since, in fact, the Edril came and first exacted tribute. Now it is your turn. We are passing the baton to you."

"You're not," said Joe. "You're coming along with us."

"Certainly. To ensure a smooth pickup. But it's your party now, Joe. You are the men of action, we the thinkers, the doubters, the idealists."

He sighed. "This always was, after all, the function of the Enwyces. We existed and we fought not merely to say throughout the ages 'The Time is not yet,' but to say at last 'The time is now.' The Niths have always been ready. We have watched. We have seen the end of the wheel age, the stage of the warp, of power, of telepathy, of mind over matter, the stage of the body, the stage of the mind, and finally the ultimate—the stage of the body and the mind. We have touched on these secretly, not developing them, for we know that the Edril can see us any time, anywhere, from their own world. We have advanced rapidly, secretly, inevitably —"

"Keep the rest of the speech," said Joe savagely. "We needn't go back a thousand years in history. Do you stick by the agreement? Do we revolt?"

Arthur looked pained. "Of course."

Everybody settled in relief. Joe's black frown lifted and for the first time humour came into his eyes.

"Now I needn't be so careful," he said, "not to tread on anyone's toes."

IV.

"I must look into your mind," said Joe.

"Why?" Arthur asked, surprised.

Joe saw Lida wasn't surprised. "Let Lida tell you," he said.

Submissively, Arthur looked at Lida.

"Because," she told him, "this could be a plot to break the Niths for ever. The Enwyces leaders, at least, just possibly might be in with the Edril. To the extent of condoning a revolt doomed to failure so that the Edril could crush it and the Niths."

Arthur looked disgusted. "Don't say anything," Lida said wearily. "We don't want a real fight."

"There won't be one," Joe promised largely—more at ease now. "I won't fight. When I say I won't fight, I mean I won't fight, and if anyone tries to make me, I'll break his neck."

"It's not low and despicable and inhuman," Lida told Arthur, "for Olson to suggest such a thing. It is natural and right. He would be a fool if he had not fully considered the possibility."

Arthur mulled that over. Finally he nodded and turned back to Joe. Everything but concentration disappeared from his face and his mind reached out to Joe's . . .

Joe knew completeness for the first time. His mind and Arthur Hever's fitted. They would never agree on much except that Earth

should be free. But that was because they were complements. Everything that was strong in him was weak in Hever, and vice versa.

There was a startling idea in Arthur's mind that the Niths and Enwytes were not merely set up to handle the problem of the Edril, but to last for ever. There was a conviction that the Edril, when and if conquered, now or in some future revolt, must not be subjected as Earth had been subjected, or the whole thing would be played out again, the backward race forced to develop, forced to jump ahead, forced to conquer . . .

Arthur saw blinding, frightening courage. Joe did not believe that Terrans were anywhere near the Edrin level, but he was ready to fight and trust in his and his race's determination, courage, resources and stamina. He did not see defeat because there could be no defeat. The fight would go on as long as there was anyone left to fight. When the last Terran was dead, Earth could no longer win the battle.

But she would not have lost it.

When the contact was broken, Arthur and Joe looked at each other with a respect which would last as long as they lived. Fusion of minds didn't always lead to that respect.

"You would fight the Edril yourself," said Arthur wonderingly.

"Certainly I would. I'd take on the whole Edrin race, give them a start and win it. But I'm not sorry," Olson admitted, "to have some help."

"Now you and I, Olson," said Lida coolly. She met Joe's startled glance with a hard stare. Fusion of minds between the sexes took place only between lovers, and not often then. It shook some of the confidence out of Joe even to think of mental contact with Lida. His was a male arrogance. The idea of a woman knowing him inside out frightened him as probably nothing else could.

"I don't think it need bother you," Arthur told him, half seriously, half ironically. "Your rough exterior hides a heart of gold."

"Heart of gold!" Olson exclaimed, with something like his old spirit. "I've never been provident, Lord knows, and if I'd had a heart of gold I'd have spent it all long ago."

"You're stalling," said Lida coldly. "We're going to work together. We're going to be closer than brothers and sisters. We've got to *know* each other, every one of us—you and Arthur, you and I, Crystal and I. Who introduced this in the first place, anyway?"

Olson and Lida stared stubbornly at each other, neither ready to give way an inch. But what gave every indication of developing into a tense situation, if the circumstances didn't change, dissolved rapidly as the circumstances did change. All four of them noticed suddenly that the tension overhead was dying.

The battle was over. If they had wasted the time of freedom they had been given, it was too late to do anything else now.

V.

Once the Edril had been able to read every human mind like a book, without coming near Earth. They could still read most minds. But Earth's leaders, both Nith and Enwye, had for the last century been men and women who could shut a part of their minds and know that it stayed shut. The Edril, they knew, could still see and hear what they did and said. But what went on in that dark corner of their minds neither the Edril nor anyone else could take from them. It was when they knew that that the Niths really began to believe in victory and the Enwyes thought for the first time that though the time was not yet, it might be soon.

Plans could hardly be effective when the enemy might know the plan. But when the enemy knew neither the plan nor the planner, there was always hope.

If the Nith genius who had nearly killed Dal had had the ability of Earth's leaders to hide some of what went on in his mind, Dal would have been dead. But Arthur and Lida and the Olsons knew nothing of that, and if they had they would have been glad that the thing had happened as it did. For the mere assassination of one Edrin was no part of their plan.

In a sense they had no plan. There was no secret Terran fleet, no mighty weapon, no brilliant stratagem. In so far as there was a plan, it was for two Niths and two Enwye leaders to get together, work together, and *find out*. They even had to find out what they needed to find out. But they knew they would have to go well into the galaxy to begin.

When the four of them met again, it was in the shadow of a spaceship. It wasn't the first spaceship that Terrans had made, not by many millions. Most of the population of Earth was engaged in making ships and the cargo they carried—whatever the Edril happened to want. Long ago most of Earth's raw material ready to hand had been used up. Since then, Earth made pilotless ships which the Edril took over with their unfathomable radio controls (without an Edrin visiting Earth), and loaded on some unknown world with raw materials. When the ships returned, the people of Earth unloaded them, manufactured what the Edril demanded, and loaded it. The ships then departed and were never seen again.

The people of Earth did this solely because they knew what would happen if they didn't.

But the ship beside which Arthur, Lida and the Olsons met was not a radio-controlled cargo ship. It was not even remotely like them. Small and sleek, it was a marvel of theory. Terran science had passed far beyond the method of trial and error, for it had had to.

The development of space travel—apart from the cargo ships which were made blindly, to orders, for the Edril and the Edril alone to

handle—was forbidden. Therefore the Edril could not be allowed to know it had been developed. It was as if a race had evolved without thinking of clocks, and then, suddenly needing them, had made master chronometers without passing through the stages of sundials, hour glasses, water clocks, pendulums and clockwork.

There was no need to test the ship, just as there was no need for a name for it. It was the only ship, the first ship, the first interplanetary ship, the first interstellar ship, the first intergalactic ship. If it had been necessary to test it, its manufacture would have been premature.

It hadn't been built by ordinary workmen. They would have known, however dimly, what they were doing, and thus the Edril would have known. It had been built by top Niths and Enwytes under cover of Nith-Enwyte battles.

Meanwhile, Arthur, Lida, Joe and Crystal had died, one by one. People had seen them die, and the thoughts from their minds had stopped. As far as the Edril were concerned (if any Edril on his far-off world chose to devote a little attention to those four insignificant humans and their deliberately insignificant life-histories), they were dead.

No one knew the intensity of the Edril check on Earth. All that Terrans knew was that up to two centuries ago the Edril had periodically come and nipped revolt in the bud, wherever it might be, in whatever form. Retribution had been swift and effective.

For two hundred years there had been no need for the Edril to come, except to exact the five-yearly tribute. There were thoughts of revolt in Terran minds, certainly, but no concrete plan.

At any rate, not for Edril to see.

Theory is all very well—in theory. But it was comforting when the ship took off as it was supposed to take off, and long minutes passed without Edril action. The Edril had never played the cat-and-mouse game. At the first hint of revolt they had come down like a ton of bricks.

The four Terrans were reasonably satisfied, less than an hour after take-off, that since nothing had happened nothing was going to happen.

Terrans had escaped from their world, their prison, after a thousand years, and the Edril didn't even know.

VI.

Olson and Lida were on watch, Arthur and Crystal resting. The ship was nearly three light-months from Earth, and decelerating. So far, it was as perfect as a ship could be. No one was surprised.

"If you would show one little sign of being human, Lida," Olson remarked casually, "I think I could love you."

It was the first time he had said anything of the sort, and perhaps he meant to see Lida taken aback for once. If so, he didn't.

"That would be convenient," Lida said dispassionately, and without irony. "What kind of sign would you like?"

"What kind have you got?"

She shook her head impatiently. "None of that casual sparring. I can't be bothered with it."

"No more can I," agreed Olson. "But I thought if you could flirt you must be human. So you can't. Well, that leaves us where we were, with nothing proved or disproved."

"Do you think we should be talking as if our feelings mattered, in the shadow of what might be the greatest thing in history?"

"Certainly I do. Who are you to have no feelings? Do you think you'll overthrow the Edril by being emotionless?"

"Yes," said Lida simply. "I think they, like me, always relate everything to an ultimate goal. I think . . ."

She told him at great length what she thought.

Olson didn't entirely ignore what she was saying, but he used the fact that she was talking chiefly as an excuse to look at her and try to see beneath the surface. He failed, as usual.

Lida became aware at last that she didn't have his full attention. "Are you listening?" she demanded.

"Half and half," he said. "I'll tell you what I've been thinking, Lida. I've been thinking that in thirty seconds—for it wouldn't be fair to give you no warning—I'm going to kiss you, to see what it's like."

"Why warn me?" she asked.

"To see what you do."

"An experiment? That's reasonable. But you're going the wrong way about it. If you want to know me, you should open your mind to me, which you've been avoiding."

She was standing by the controls, hands in the pockets of her slacks. He rose and kissed her. He couldn't put more into it than he did. She did precisely nothing. She didn't resist, relax, strain back, cooperate, or take her hands out of her pockets.

"I might have known it," he said savagely, pushing her away.

"What did that prove?" she asked curiously.

"That you run on little atomic motors," he retorted. "You don't eat, you refuel."

She laughed, and he stared incredulously. She had never done that before. At his expression her laughter became uncontrollable, and she hung on to a stanchion.

"You don't . . . you don't understand at all," she gasped.

"You're damn right I don't."

With a sudden effort she stopped laughing. "To me, only one thing is important," she said. "Can you understand that? Only one thing has ever mattered. Freeing Earth—as a people. A people who should be free to live their own lives, shape their own destiny, make their own mistakes. Do you see?"

"Sure. I feel the same. But . . ."

"Would you give every last thing you have to give, for that?" Lida insisted.

Joe surveyed her for a long moment. Then he said, with a gesture of surrender: "I suppose it had to come. You're right, I suppose. We should know each other. Come in, Lida." He opened his mind.

When it was over they stared at each other in wonder.

"How wrong can you be?" Lida murmured. "That's how wrong I've been."

Olson said nothing.

"I never knew," she said wonderingly, "that the more interests you have, the more you've done, the more you've left, the more you have to fight with. You're not right in everything, Joe. Nothing like it. But you're so much righter than me that I feel like going down on my knees to you."

She smiled at his startled expression. "Only by loving a thing can you really understand it, and you love quite a lot of things. You said you could love me if I showed one little sign of being human. Well . . . have I?"

The second kiss was very different from the first. Now Lida knew that her feelings mattered, in the shadow of what might be the greatest thing in history.

VII.

When the other two joined them, Arthur and Crystal, both hypersensitive to atmosphere, knew at once what had happened.

"Never mind that now," said Olson hastily. "There's work to do."

They had done nothing, could do nothing, until they were three light-months from Earth. Direction didn't matter.

They looked through a telescope which was more than a telescope. They looked at Earth, but it was not Earth that interested them. It was the tiny spot that was Dal's ship. It was so far away that the infinitesimal Terran measuring unit, the mile, was useless. They saw it because although it had reached Earth three months before, they were three light-months away. It was the only way to trace it.

The little Terran ship was still travelling so fast that in a few hours they saw where it had come from, tracing it backwards. Their velocity away from Earth reversed time. If they had stayed motionless, they would have seen things as they happened, at the speed they happened. But instead they chased light-waves of the day before, the week before, and saw Dal's ship earlier and earlier on its trip to Earth.

They could have calculated (but didn't) its speed and course. All they were interested in was its starting point.

"Anton," said Olson exultantly. "So the star we call Anton is the sun of Edris."

"Possibly," Arthur remarked cautiously. "Not necessarily. Remember the ship's route when it left Earth. We were in the wrong position, as it happened, to see where it led, but it wasn't the same. So Dal came one way and went another."

"But we must go to Anton first."

"Perhaps. Nevertheless, we must continue tracing Dal's ship back over its route. Where it came from to Anton—if it came from anywhere. Where—"

Olson's brow gradually went black. "Sure," he exclaimed. "We could do that. We could also trace all the robot ships from Earth. We could chart the universe. We could hop over and see what Andromeda's like. We could have children and start a new race. Anything but get on with the job. Enwytes!"

He spat the word out in disgust. "I might have known this would happen. Enwytes are not just a group that kept Earth from revolting too soon, but people who always, everywhere, croak 'Not yet' whenever something has to be done."

"And Niths," said Arthur mildly, "are not just a group that wanted to revolt against the Edril a thousand years ago, when we were probably still in the age of the wheel, but people who always, everywhere, want to act first and think afterwards."

"Hold it," said Lida. "Arthur's right, Joe."

Olson glared at her, then whirled on his sister. Crystal merely nodded. Arthur protested laughingly at his expression. "You wouldn't fight your own sister, would you, Olson?"

Humour gradually crept back to Joe's face. "Fight Crystal?" he retorted. "I'd fight my own mother, only she has an arm like the Rock of Ages, and I'm not foolhardy. Well, it seems I'm outvoted on this. But are we going to take a vote on everything? Seems that some time, something might have to be done in a hurry."

Arthur glanced at the two women and reached agreement with them without the need for words. "If that happens," he said, "you have our mandate to do it, Olson. In an emergency you're in command. But if there's time—definitely no. Okay?"

In a few minutes they saw that Dal's ship had indeed reached Anton from somewhere else. Joe showed no sign of it, but he knew then that the others had been right.

For long hours they coasted on while they traced Dal's ship. The Edrin had come to Earth from Anton, to Anton from Zwon, to Zwon from Sillon and to Sillon from yet another world. But that first journey they could not trace. On what was evidently a much longer run than any of the others, the Edrin ship had gone up to such velocities that the Terran equipment (which depended to a large extent on the knowledge and experience of the people operating it), was baffled.

They traced the last flight of robot ships, before Dal visited Earth. That was easy—there were a lot of them, and they kept together. But

they didn't go to Anton, or Zwon, or Sillon, or the other world. They went to a nameless system, never named because the sun was dying and had long been invisible from Earth.

Crystal, the imaginative, was most impressed by the last discovery. "That system is old," she murmured, "and the Edril must be old. On just such worlds the Edril must live. Driven by necessity to go out and fight and conquer —"

"Bull," said her brother derisively. "Anyone who can fight and conquer can put things right at home first. The Edril could shape that system, any system, to their own design. Those are storehouse worlds, workhouse worlds, perhaps. Dal didn't go there. Come on, let's move around a bit and see where he did go."

They used power enough to disintegrate a planet in tearing their ship from its course and putting it on another which would enable them to get another sight of Dal's ship before it arrived at Sillon.

They traced it back to Monel. There, again, they lost it. It came to Monel from another world, but this time they knew that for the moment they were beaten.

Only in primitive science doing simple jobs did machines do all the work. Even before the end of the wheel age it began to be clear that machines could not economically and usefully rival the human mind in power, complexity and versatility. And at the fourth level it was plainly demonstrated that further progress involved not the development of machines to make fullest use of the mind, but the development of the mind to make fullest use of machines.

There was nothing wrong with the four minds available save inexperience. It was decided, again on a vote, that they trace back Dal's route; and by the time they reached Sillon, they might have gained in experience enough to know what to do next.

VIII.

When the ship was close enough to Anton for them to see what kind of a world it was and what happened on it, without any apparent risk of the Edril discovering from their distant planet that a check was being made, Arthur and Crystal were on watch together. They would always be on watch together, now that Joe and Lida were married, or living in sin, depending on the point of view.

"We should really waken them," Arthur murmured reflectively, as he eased the ship into an orbit well clear of the Anton atmosphere, "but without disrespect to your brother, Crystal, I'd like to see what we're going to see here and come to some conclusions before he's around."

Crystal smiled. "I don't find that impossible to understand."

Once, three centuries since, Earthmen had begun to examine Mars and Venus to the very texture of the coarse Martian grass and the

bacteria of the steaming Venusian soil, without moving from Earth. That had been applied fifth-level science, and it had brought Amon, the Edrin of the time, to rap knuckles, take a few ringleaders back to Edris, and make it plain for the future that investigation of anything outside the planet Earth itself, beyond primitive astronomy, was forbidden on pain of death. In the next fifty years or so quite a few men and women had paid for that offence of curiosity. Then no more; it was clear that such investigation could not be done without Edrin knowledge.

When the Terran ship approached Anton cautiously, closely, it was not because Anton couldn't have been investigated from afar. It was that it couldn't have been investigated from afar without the Edril knowing about it.

Arthur and Crystal bent forward eagerly as the surface of Anton grew in a vision plate . . .

. . . And by the time Joe and Lida joined them, which was only an hour or two later, they knew all they needed to know about Anton.

Joe was incensed. "Why didn't you waken us?" he raged. "Suppose you'd sprung a trap? Suppose you'd found —"

"Don't you want to hear," said Arthur placidly, "what we did find?"

Olson grinned unwillingly. "Okay, what did you find?" he demanded.

The Antons were human; if there was any major physical or mental racial difference between them and the Terrans, Arthur and Crystal had failed to find it. And not only was their world similar to Earth, and the people themselves, but also their circumstances.

"You mean to say the Edril rule them too?" asked Joe.

"Not only that," Arthur said, "but exactly as they rule us. Knowledge of how things are on Earth made it easier for us to find the differences—because there's so many similarities. Dal comes here, as he does to us, every five years—seven Anton years. He arranges tribute exactly as on Earth. The Antons make pilotless ships as we do. The only real differences we've found are that the Antons are only in the middle of the fifth level, and they don't seem to have anything like our Niths and Enwyies.

Arthur stopped speaking, but his words resounded through their minds. Another human race—circumstances identical; each of them felt on the verge of grasping the whole galactic setup intuitively, but it eluded them all.

"Are you sure they're only at the fifth level?" asked Lida. "I mean, we —"

"I know. If we can conceal our real status, why not the Antons? Well, I could be wrong. Maybe the Antons are fooling us as well as the Edril, but I don't think they can. Set a thief to catch a thief. I think a conquered race could find out more about another conquered

race at a glance than the conqueror could in a century."

They didn't take Arthur's word for it. They checked and double-checked on the Antons. In the end they agreed. The Antons' struggle was the same as theirs. But Anton was so much weaker, so much more backward than Earth, so much more under the Edrin thumb that there was no question of contacting the Antons and working with them against the Edril.

"Maybe this job will take us five years," said Joe. "But with Anton help we could do it in twenty. Let's go."

The ship left the vicinity of Anton as secretly as it had entered it.

IX.

Anton . . . Zwon . . . Sillon . . . Monel . . .

The circumstances of them all were so similar that the natural thing to do was list differences, not similarities. The Monellians were the only race not remotely human. The Zwons had almost certainly been human once, but their complex twin-sun system had produced changes. The Sillons, like the Antons, were distinguishable from Terrans only

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by the tiniest of details: an unearthly tint of skin, abnormal height, undue narrowness of waist, slightly luminous eyes. Evolution, apparently, was a slow business.

Obviously Terrans, Antons and Sillons were of the same stock. Zwons, probably; but it wasn't so obvious.

The ship orbited well clear of Monel, and the four Terrans looked at each other with a wild surmise.

"If we *did* beat the Edril," Arthur murmured, "we'd have this new problem on our hands. What to do with the Zwons, just entering the fourth level, the Monellians nearly at the fifth, the Antons in the middle of the fifth, and the Sillons, nearly through the sixth."

"That's it," said Crystal. She gulped and stared round at them defiantly, knowing no one was going to agree with her. "This is too big for us."

She was right—no one did agree with her. She forced her usually soft voice above the protests. "We don't understand! Just a little while ago, it was all so simple. The only thing that mattered was freedom, and all we had to do to be free was conquer our conquerors. Now—suppose we did just that, would we be free? Are we ready for a universe as complex as this? We know now about Anton and Zwon and Sillon and Monel. We don't know yet about the other worlds ruled by Edris, perhaps two, perhaps two million! Shouldn't we go back and think things over for another thousand years?"

Joe spoke first. "You're no sister of mine, Crystal," he said flatly, "if you give up before the fight starts."

Crystal loved her blunt, demonstrative brother. The tears sprang to her eyes and her voice wasn't quite under control when she said: "I'm not afraid we might lose the fight, Joe. I'm afraid we might win it."

"I can never understand this talk about not being ready," said Joe violently. "Anyone or anything is always ready for anything, if it's only extinction."

"That's nonsense," murmured Arthur.

"No, it's not!" Joe blazed at him, glad of the opportunity to turn his vehemence from Crystal. "Can't you understand plain common sense? Suppose we turn back now—not ready. Who's going to make us ready? Who directs us? No one but ourselves. Will we *ever* be ready? No, we'll —"

"Calm down, Joe," said Arthur quietly. "That's only an apparent point. Look at the progress we've made. Is that going to stop?"

For a moment it looked as if Joe was going into a frenzy. Instead he calmed down.

"Looks as if I'll have to put it in words of one syllable," he said. "Frankly, I never thought you were all so dumb. Look, isn't the premise that if we go on we might beat the Edril and have to take over from them?"

Arthur nodded.

"Right. And the proposition is that we forget the whole thing and go home."

"I don't know that it's really a proposition," objected Arthur. "It's just —"

"Give me patience!" exclaimed Joe, raising clenched fists. "Are we, or are we not, talking about being ready or not being ready to take over from the Edril? All right, then. If we go home, what's our position? It's that we may or may not be strong enough to break free, but anyway we don't want to, because we don't know if we can handle the responsibility if we do."

He let himself go again, having stated his point of view with unaccustomed lucidity. "Is that any attitude," he demanded, "to produce strong men and geniuses? Is that going to produce future generations of Terran *leaders*?"

There was silence in the little cabin for perhaps ten seconds. Then Arthur said in a surprised tone, looking at the two women: "You know, Joe's right."

Lida raised her eyebrows. "You mean you didn't see that before Joe put it in words?"

"Oh, no. I didn't think Joe could be so reasonable, that's all."

"It's just as well," said Joe in a strangled tone, "that I'm an even-tempered man."

X.

On their journeyings the four Terrans, by tracing ships, had been adding world after world to the Edris-Earth-Anton-Zwon-Sillon-Monel pattern.

Yes, they knew now where Edris was. But they had learned caution. Even Joe had learned caution. Once at some evidence of it Arthur laughed aloud and said: "You know, if things are ever as they used to be again, I think Joe will be an Enwyc."

They knew where Edris was, but they all felt they still had something to learn before they went there: something to learn, and other worlds to visit. The one below was one of them.

They surveyed the dead world in wonder and anger. Only here and there could the dead rock be seen. The whole surface of the planet was packed thickly with ships—ships made on Earth to the Edrin pattern. They had never seen anything like it.

"They didn't need our labour," said Joe. "They've been building up stores."

Someone had done a neat job of manoeuvring and landing by remote control. There wasn't space for a man to walk between the packed ships. There were no lanes for inspection. The ships lay nose to tail, tombstones to the labour of a world through ten centuries.

They reacted to the sight in their different ways. "All that labour," Arthur mused, "for nothing. It might have been directed to anything—immortality, the banishment of disease, the ultimate philosophy. And whatever the goal was, it could have been reached."

Lida took it more personally. "There's some of *my* work there," she raged. "I've worked on those ships, knowing they were going to the Edril, knowing they were part of the tribute a beaten world had to pay—but at least thinking they'd be *used*, not piled on a dead lump of rock out of the way! I wonder if they're even unloaded?"

"Of course not," said Arthur, surprised. "Don't you see? They were never meant to be unloaded."

"And you never worked on any of those ships, Lida," said Crystal. "Look more closely. Those ships were made hundreds of years ago. There are small differences—I don't know whether the Edril changed the design, or whether Earthmen, having to do the job anyway, decided it might as well be done better."

"But they're brand new," Lida objected.

"On an airless, windless world they'd stay like that for ever. No, those are part of the early tribute to the Edril."

Joe and Lida looked at each other. "There's something big here," said Lida, "that we're missing. Something immense, and our two dreamers have dreamed the answer and we haven't."

"I think I've dreamed it too, Lida," said Joe in an absolutely expressionless voice. "Big, yes. I suppose. But don't let's talk about it yet. We've all got our whole lives to put in order again first."

Lida started as she suddenly sensed the resentment, wonder and power behind his words. But Arthur and Crystal weren't even listening. They were staring down at the graveyard of ships.

They surveyed the whole world rapidly. In another part they saw slightly different ships, made on another world—Anton, perhaps, or Monel. Like the Terran ships, they stretched for miles, each ship representing the labour of years of fifty to a hundred men. It didn't seem possible that there could be as many ships in the galaxy.

They moved to the next world in the dead system and found the same story. The ships there were later. Again there were ships apparently made on Anton, Monel, Sillon or some other world under the dominion of the Edril. But always the Terran ships predominated.

A check without landing showed that Arthur was right. The ships had never been unloaded. The ships themselves, and the cargo they had been made to bring, had been brought straight from Earth and all the other planets and dumped straight on the scrapheap.

"Which is very interesting," said Joe.

His tone made Lida look at him with interest, forgetting her anger at the wasted effort all this represented.

Joe took her absently in the crook of his arm, not noticing what he was doing. She remembered him telling her her feelings mattered.

She liked the way he touched her when he wasn't thinking of her at all.

"A thousand years ago," Joe said, "Edris conquered a lot of worlds. It had to keep them all under. There are two main methods of doing that. One is the secret police method, everyone watched, everyone a potential spy. But that takes a lot of work. The other is to keep the conquered people so busy that they don't have time for anything else."

Crystal took it up there. "Keeping them working so hard," she murmured, "that at the end of the day all they can do is tumble into bed and sleep. That's how it must have been, once."

"The Edril chose that method," Joe went on. "And I think I can see why. They're lazy. They didn't mind a little supervision from armchairs, an occasional punitive expedition. But no more. They were never cruel because they were too lazy to be cruel."

He looked out at the packed ships below.

"Our labour was never anything but something to keep us occupied," he said. "They never used any of the stuff we made. They didn't need it. That way they kept us quiet with the minimum of supervision."

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Arthur said: "You don't go far enough, Joe. Year after year, century after century, they had to give us more to do. Whatever the job, we became better and better at it. They tried to occupy all our time, but we always found a way to do the job quicker. They increased their demands. We increased our production. Eventually they couldn't deny us leisure. We were filling fantastic orders, and still had time on our hands."

Lida nodded. "I see. Then, of course, they'd failed. Once we started having leisure, it was only a matter of time before this ship was built. Then . . ."

"Then we'd see this," said Joe. His tone was no longer angry, but exultant. "Then we'd know that they'd failed. Then, knowing the Edril weren't so efficient and infallible and invincible after all, we'd be on our way to Edris." He stared at them all in turn, daring them to oppose him.

But there was no opposition. What they had seen in this dead system somehow seemed to be what they had been waiting for.

XI.

They were approaching Edris. As galactic distances went, they were almost there. And suddenly a voice spoke—in English, but the accentation was Edrin. It spoke calmly, with immense confidence.

Crystal froze in terror. Arthur hardly moved, but every muscle in his body had gone taut. Joe whirled, as if looking for a visible enemy to attack.

The Edril had been watching them from long before they left Earth. In fact, said the dispassionate voice, sounding without receiver as if the Edrin were in the control room, the project had been known to the Edril from the first tendril of thought which led to the first plan. Every moment of their journey they had been . . .

It was Lida who understood first. Her laugh was shaky, but the others turned in wonder that she could laugh at all.

"In essence," she said, "that's a phonograph record. So you can stop shivering, all of you."

"Of course," said Arthur. "We can be reasonably sure that we're not triggering anything, but we can't avoid something like that which presumably goes on all the time. I wonder why it's in English, though."

"Easy," retorted Joe, confidence flowing back into him. "They knew we'd be first. Then the Sillons, the Antons, the Monellians."

"We must go back," said Crystal abruptly.

The voice had stopped.

"Naturally," Arthur agreed, and turned to the controls.

For the first time in his life Arthur was hurt, physically hurt, not by accident but by someone else's intent. Joe's closed fist hammered the side of his head and sent him staggering against the wall.

But Arthur was alert at once, and there was not even an instant of anger. "Thanks, Joe," he said. "Lida, watch Crystal!"

Lida, a little dazed, was slow. But Joe moved rapidly again, and it was no fraternal slap that rocked Crystal's head on her shoulders. Crystal cried out and then shook her head as if trying to clear a fog from it.

"I see," said Lida. "An emotional attack this time, automatic like the last. But why didn't they make it just a little stronger, and it might have succeeded?"

"I expect they made it as strong as it could be," said Arthur. "We're not mental weaklings, you know. It's still going on, you see, but once we recognise it it has no further effect."

There were other emotional attacks. They distinctly felt fear, anxiety, remorse, shame, guilt, humility; and the fact that the attacks were ineffective against them didn't mean that they were not powerful weapons.

Then the ship decelerated fiercely. It had been nosing along slowly and very cautiously, but the stop was still abrupt.

Strictly none of the four was a scientist or technician in that none was an expert in any branch of science or technology. On the other

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hand, they were all scientists and technicians in that they could each have built up an eighth-level technology alone, starting from scratch; the principles were what counted.

It was Lida who examined the controls to see why they had stopped. If one of them was more technology-minded than the others, it was she.

"Oh," she said. "We suspected this and prepared for it." Unfortunately our infinite wisdom didn't tell us what to do about it when it happened. The Edril have set up a dual screen here. One part of it is good enough to handle any first-to-seventh level attack. The other part merely detects eighth-level activity."

Joe frowned. "You mean this is a sort of doorbell that we can't help ringing?"

"Exactly that. Remember, we've already passed hundreds of other doorbells that we could, and did, avoid ringing."

"But we can't help ringing this one, if we go on?"

Lida shook her head.

"All right, then. Let's ring it."

"Wait!" said Arthur. Joe turned on him slowly. "Not yet?" he asked grimly. "Always to-morrow, but never to-day: Enwyes for ever?"

Arthur looked at him steadily. "This is the real turning point," he said. "The time when it really matters whether the answer is Nith or Enwyie."

"And now you want to change your mind?"

"It's not fair to put it that way. New facts were being presented all along. The right decision at one point wouldn't necessarily be right at them all."

Joe stood legs apart, hands on hips, eyes blazing. But his voice was unexpectedly gentle. "Didn't we have this out before," he asked, "when Crystal said we weren't ready?"

"That wasn't the same thing."

"It never is the same thing," said Joe, still in that surprisingly gentle voice. "If every decision has to be taken afresh when a new fact is added, you never reach a conclusion before it's time for the next. You sit eternally thinking, reviewing everything that ever happened, and the world crashes about your ears. Didn't we decide, when Crystal said we weren't ready, that we were as ready as we were ever going to be? Are we going to surrender without a fight? Are we?"

"No," said Lida.

"No," added Crystal, after a moment's hesitation.

"Have you considered," asked Arthur, "what's going to happen when we go on?"

"A proper consideration of that," Joe pointed out, "would take months."

"Exactly. We go forward, and instantly the Edril know that one of the races under their dominion has reached the eighth level."

"— the eighth level!" he blazed at Arthur. "Forget the scientific claptrap of gadgetry and elaboration for a moment and the infinite satisfaction of knowing everything and a little over, and see the problem as it is. A dictator, a tyrant, a despot—and the peoples under him who want to be free. Is there any argument? We've got the greatest chance in history of over-throwing the tyrant—that's obvious. Do we spend six months here arguing about whether that would be a good thing?"

"Well . . . no," said Arthur, "in a surprised tone, as if puzzled to find himself agreeing with Joe."

Joe nodded to Lida, and the ship edged forward. Almost at once they knew that they had indeed rung Edris's doorbell.

XII.

The suddenness should have been the most surprising thing about it, but it wasn't. The transition, which was instantaneous, seemed gradual because it took them quite a while to realise it.

The ship was gone; gravity was gone. There was nothing but an

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empty world without sensation. Yet without sensation there was comfort, warmth, light, air. Not real, however; reality had no more place in this kind of existence than gravity.

Not real, Arthur thought quizzically. If they lived at all, this was hallucination. Or was it? He was perfectly aware of his companions around him. No, not exactly around. Space had ceased to exist. Things were no longer near or distant. The common element was time.

And he was aware of Dal, no further away, no nearer.

The circumstances of the meeting, he now realised, didn't matter nearly so much as the fact. They were interesting, but unimportant.

"Naturally you don't quite understand it," said Dal—and yet, he didn't quite speak either. "This is an eighth-level meeting, and it will be a long time before your race or mine understands the eighth level. We believe it is the last—but men have often believed the latest discovery to be the ultimate."

There was a kind of movement without change in their positions. The movement was the thought of Crystal Olson. "It is impossible to meet on this level without agreement," she said. "That's obvious. Is Edrin dominion over, then?"

They were aware of movement again. It was the convulsion of Joe Olson, for a moment lost on the eighth level, nowhere, because of a thought which had no place there.

"No, you're not quite ready, Joe," came what wasn't quite Dal's voice. "You're not stable on the eighth level. Do you see? Your sister is at home here. So is Arthur Hever. Your wife is like yourself."

Arthur felt Joe and Lida striving: they didn't understand. What was needed was acceptance, trust, certainty, knowledge, freedom, faith, truth, and one could not simply have these things by deciding to have them.

"Try to understand this, Joe," Dal went on. "Something Hever and your sister already know. Intelligence can be perverted, brilliance turned to destruction—but not great intelligence, not the clearest brilliance. Science and knowledge likewise can be destructive, cold and emotionless. But only until a certain point is reached and passed.

"You have reached that point, Joe, but not passed it. When you have—and you will—you'll know that in the end beauty *is* truth, truth beauty, and that that is all you need to know. The scientist, the philosopher, the psychologist, the anthropologist, the mystic, the theologian, the biologist, the hedonist, all merely have to go far enough and they meet in the same place—the eighth level."

The questions, the doubts, the seething of emotion in Joe's mind began to subside. He knew that there would be no answer to his questions. More, he was beginning to see, as Arthur and Crystal had seen almost from the beginning, that there was no need for answers.

"I see a figure of speech in your mind, Arthur Hever," Dal continued. "The figure of the relay race. That was genuine insight. Yes, your Niths and Enwytes were in a relay race.

"But there was a much bigger relay race. Even we don't know where and when it started. We weren't going to take part in it. We didn't want to. Yes, Joe Olson, perhaps you were right to call us lazy.

"We had to take the baton from a people who were rash and cruel and unstable and capricious. A little over a thousand years ago they were in a fair way to rule the galaxy—if not with a rod of iron, at least with a big stick. We had to take it from them."

Important facts could not be concealed in such a kind of communication. Arthur gasped. He was the first to see, behind Dal's words, that the race who had ruled, the people who were rash and cruel and unstable and capricious, were the Terrans.

Nor could Dal conceal the fact that the Edril, lazy as he said, had worn themselves out in their thousand years of dominion. No, they were not a dying race—yet. But they were long past their prime. And . . .

"Yes, Arthur Hever," said Dal. "You are no longer rash and cruel and unstable and capricious. If you were, we still could not stop you bursting your bonds. But I don't think our plan has failed. I think Earth is really ready."

The eighth-level contact began to fade. The Terrans were aware of their ship again, taking them towards the planet Edris, a real world populated by real people. But, still on the eighth level, they heard Dal's last words: "The race goes on. Come, Earthmen, and take the baton!"

That was sentiment. They had met on the eighth level; it was rather ridiculous and foolishly sentimental that after that they should meet in the flesh and talk over small points of understanding and agreement, like lovers remembering to say hello after they had embraced.

But if Arthur and Lida and Crystal and Joe understood, there were others who would not. And Terrans and Edril would have to run together for a while, to ensure a smooth pickup.

THE END



BOOK REVIEWS

Since publishing the celebrated Ley Bonestell book *The Conquest of Space* (25/-), and the equally absorbing symposiums edited by Cornelius Ryan, *Across The Space Frontier* (21/-) and *Man On The Moon* (25s.), Sidgwick and Jackson Ltd., have established themselves as the leading publishing house specialising in non-fiction books connected with the field of astronautics. It is not surprising, therefore, that the most outstanding books published during the last few months should be non-fiction and that this particular publisher has contributed largely to the list.

Firstly, they have the highly authoritative *Man In Space* (30/-), by Dr. Heinz Haber, a former German research scientist now residing in California, who devotes his book to the scientific possibilities of human beings surviving in space under the anticipated conditions of a journey outside our atmosphere. More simply explained is their *Flight Into Space* (12/6), by Jonathan Norton Leonard, science editor of *Time*, which, covering the whole field of astronautics with particular emphasis on experiments at White Sands, New Mexico, can aptly be termed "the philosophy of space flight."

Most noteworthy, however, is their latest contribution *The Complete Book Of Outer Space* (10/6), which is a picture symposium plus factual and theoretical articles by almost every expert in the field.

Equally as important in the non-fiction list is William Temple's excellent juvenile *The True Book Of Space Travel* (Frederick Muller Ltd., 6s.) a simplified explanation of the development of space flight and the theories of its future development. The book's interest is heightened by an outstanding jacket design and interior illustrations by our own artist Quinn.

Turning our eyes backwards from the future and worlds beyond immediate visitation to the lands of myth and legend may seem somewhat out of place, but the de Camp and Ley book *Lands Beyond* (Sidgwick & Jackson, 21/-), which won the 1953 International Fantasy Award in the non-fiction class, is just as fascinating. Here, laid out rather in the manner of a colourful geography lesson, is the fact and fiction of all the lands that "never were." Or were they? Atlantis, Eldorado, the Sargasso, and the journeyings of Sinbad, Prester John and other fabulous characters.

In the fiction section there are a number of titles vying for first place, of which the most outstanding are probably Clifford Simak's

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City (Weidenfeld & Nicholson, 9/6), a collection of stories dealing with the ultimate inheritors of Man's knowledge, *dogs*—the fiction title which won last year's International Fantasy Award trophy; and Alfred Bester's *The Demolished Man* (Sidgwick & Jackson, 9/6), the powerful scientific detective story which won a \$5000 contest award in America last year. Two other novels hotly contend for top honours—Wilson Tucker's *Long Loud Silence* (Bodley Head, 9/6), deals with a partitioned America after part of the country is atom-bombed and the inhabitants in the affected area are isolated from the rest of the country, and our own British writer Eric Frank Russell's *Dreadful Sanctuary* (Museum Press, 9/6), a chilling story of attempts to get a successful rocket into space constantly being thwarted by — but that's the secret.

For book lovers who liked van Vogt's *The Weapon Shops Of Isher* (9/6), Weidenfeld & Nicholson have recently published the second volume, *The Weapon Makers* (also at 9/6), which is an inter-related story and not a sequel. For readers who like their stories spiced with plenty of well-thought-out action Weidenfeld have also published P. Schuyler Miller's collection of eight stories under the title of *The Titan And Other Stories*, and another excellent short story collection of Henry Kuttner's entitled *Ahead Of Time* (both at 9/6 each). Kuttner (who also writes under the name of "Lewis Padgett"), is one of America's most outstanding writers in the short story field.

Reviewing anthologies and collections of short stories by individual authors is becoming more and more difficult as the number of books mount, especially as so many of the original American editions have been specialising in one particular "theme." Despite the possibility of being called 'old-fashioned' (by American standards), it is refreshing to come across two books where the only theme is that the authors are British. John Christopher's first collection of his own short stories, *The Twenty-Second Century* (Grayson & Grayson, 9/6), is a delightful change from Americanisms, although many of the stories were originally published in American magazines as well as in our own *New Worlds*.

The second anthology of British material edited by John Carnell, *Gateway To Tomorrow* (Museum Press, 9/6), is equally as good as his first (*No Place Like Earth*, which has just been produced in a cheap edition by T. V. Boardman at 2/-). Apart from excellent stories by top British writers Clarke, Wyndham, McIntosh, Christopher, and Chandler, it is good to see stories by some of the more promising British newcomers such as Tubb, Hawkins, James, and others, who learned their trade in the pages of *New Worlds*, being considered worthwhile for a permanent place between hard covers.

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