

STARTLING STORIES

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A Complete Novel



THE BLACK GALAXY

By MURRAY LEINSTER

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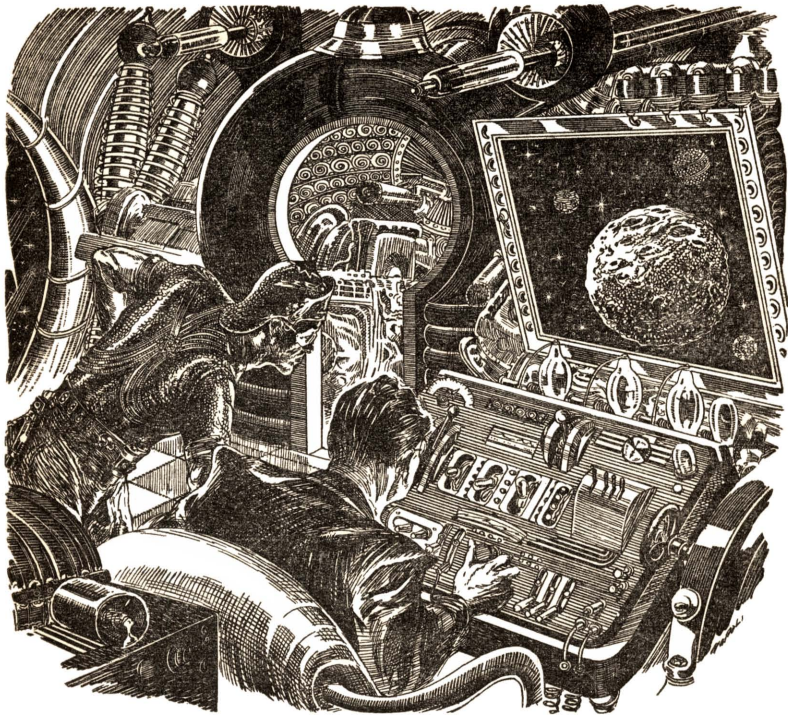
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"You won't hit the moon unless you change course"

EMIT TURNOVER

By NOEL LOOMIS

*Fated to miss the moon, a
rocket-ship's doomed to
be lost in space, unless—*

BRAMBILLA was a big man filled with energy, which at this moment he was expending on Professor Smith. "I may say, Professor, that as a member of the board of regents of U. S.

Technological Institute I would feel it—shall we say keenly?—if my only son should be failed in one of your classes?"

Professor Smith had no inclination to smile at the unobtrusive threat. Smith was a young man to be a full professor in the College of Space Engineering in the finest technical school on Earth. He was also a man of calmness and dignity for his age, but more than that, he was well aware that men's

motivations sometimes were small in stature.

If a teacher expected to be head of the Department of Astrogational Mathematics, for instance, or director of one of the numerous research programs, he would do well to have friends on the board of regents. Professor Smith looked steadily across his glasteel desk at the big sandy-haired man who was trying to bulldoze his son through a diploma. He did not show how much Brambilla's threat had disturbed him.

"It does not seem to me that your son is particularly suited to pilot an interplanetary ship. Why didn't he go into economics?" Smith almost said more about Richard Brambilla's qualifications, about the fact that the boy was much too lazy ever to be an interplanetary pilot, but he remembered Brambilla's immense fortune and reconsidered.

"The field is very small," he said instead, "and in the next few years, when man reaches past the moon with his ships, then certainly the field will be limited to those who pass the most exhaustive mental, physical, emotional, and philosophical tests. On a fifty-million-mile trip to Mars one will want everything, especially the pilot, as near perfection as humanly possible."

Brambilla ignored his words. "You've got a good job here, haven't you, Doc?"

Smith nodded. Any sort of instructorship with U. S. Tech carried great prestige, and a professorship was enough to make one almost legendary. Yes, Professor Smith enjoyed his position.

"Getting a good salary?"

"Adequate," Smith said dryly.

"Okay!"

ABRUPTLY Brambilla moved forward to the edge of his chair. He was sitting militarily erect, and his aggression and self-confidence impressed even Smith. His next words were blunt:

"Don't play hard to get with me, Professor. Everybody knows you teachers have the easiest jobs in the country. You sit on your rear end, and read somebody else's book and tell the kids to learn it. You never do anything constructive. You don't take any part in world affairs. You don't make any of the decisions that run the world."

Professor Smith tried hard to conceal the humiliation he felt at Brambilla's indictment. "The integrity of the teaching profession—" he started, realizing this was a well-worn angle but feeling impelled to speak.

"Integrity, hosh! You can be had, just like anybody else." His eyes narrowed in a knowing look. "You've *been* had, Doc. I know about Freddie Yonnicks. You passed him and he's a pilot now—but he was failing in one of your courses and everybody knew it. Now listen, Doc. You've got a soft, easy job and when anything comes up you pass the buck to somebody else. That's why you're a teacher." His lip curled in simulated disgust. "Sure, I'll make it worth your while. You pass Dick and you'll find ten thousand dollars under your door on Christmas morning. Okay?" He rose and put on his hat with a firm, unwasteful movement.

Professor Smith let him go without a word. He sat for a moment at his desk, trying to compose himself from the indignity to which he had been subjected and attempting to overcome the precipitate and severe depression into which Brambilla had plunged him.

It was true that teachers were not hired to make decisions. It was their job to train the men who would make decisions. But the accusation hurt, because it implied that a teacher was a spineless person who could not apply the things he taught.

Well, it was of no use to pity himself. He got control of himself. The pressure eased slowly in his throat. Professor Smith got up and walked across the big room to the tall Gothic windows. For a moment he looked out at the vast campus and its many great buildings.

The College of Space Engineering alone had twelve thousand undergraduates and three thousand graduate students—one tenth of the total in U. S. Tech. Across the automatic walkway—for no vehicles were allowed on the campus—and across a small park and outdoor aviary, the administration building of the college filled a solid block with its white limestone bulk, and its thirty stories went almost as high as Professor Smith's office in the Astrogational Math Building.

Professor Smith much preferred, he thought, the spires and towers of his building to the modern and perhaps more functional Ad Hall, as the students called it—perhaps because he himself was tall and slim.

The professor sighed and turned. With long, firm steps he went across the floor to the part of his suite that had been made into a library by enclosure within filled book-cases. He went through a passageway formed by the cases and stepped onto a thick

rug. A man in the distinctive deep blue uniform of the United Nations' military service got up.

"Sit down, General," Smith said.

General Osborne, Chief of Staff for the Interglobal Defense Committee, fixed his icy blue eyes on Smith. "You seem to have your own troubles, Professor." He shook his grizzled, bullet-like head. "One would think that a professor in this school—"

"It isn't often that this happens," Smith said.

"I notice you didn't give him an answer."

"No. I need some time."

"What *will* you do?" Osborne asked curiously.

"Frankly, I don't know. Should I be practical and consider my prestige and economic position, or should I be idealistic?"

"He talked about a Fred somebody," Osborne suggested.

SMITH accepted a cigarette from the general. "That's the worst of it. I did pass Fred Yonnicks in Rocket Navigation Eight—Fixed Orbits, when I should not have," Smith said. "Class of Nineteen Sixty-six." Professor Smith blushed a little. "To tell the truth, Freddie's father passed *me* some eighteen years ago when I was giving too much attention to the class play and the championship gym team and the homecoming queen." Smith smiled wryly. "I thought—well, if there ever was an excuse, I had one. Freddie was a good boy—just suddenly began to major in bowling, I guess. But now Brambilla holds that over me as a threat and any tant of anything is a threat to a professorship in this school."

"Probably Freddie won't be accredited as a full pilot," the general said soothingly.

Professor Smith fixed his gray eyes on the general. "On the contrary, Freddie last week was promoted to pilot on the lunar passenger run. So you see what can happen if Brambilla starts talking." The professor blew a rolling smoke ring the length of the mahogany table. "Well, General, let's get to your business."

For a moment he heard the general talking, but he was really thinking about Brambilla. Perhaps it was possible that prudence should overcome scruples this time. Brambilla had seemed determined. Then the professor's mind became aware of General Osborne's words:

"—not generally known, but for twenty

years we have been receiving microwave messages from Mars at each period of opposition, every seven hundred and eighty days or so. We never have been able to decode them. Incidentally, at each time of opposition we also have tried to transmit messages to that planet."

Professor Smith looked up. "Yes?"

"This is nineteen seventy-one. On August twenty-three, day after tomorrow, Mars will be the closest since nineteen fifty-six. And for the first time, the fifteen-hundred-centimeter reflector on the moon is in operation." Osborne paused impressively.

"That's a fifty-foot mirror," Smith observed, and smiled. "With no air on the moon to interfere, observation of Mars will be like watching your neighbor take a bath with a three-inch telescope."

Osborne grinned. "The staff at Lunar Observatory have had the thing aimed at Mars for two weeks now, and they have gotten some—well, interesting pictures. They have advised us pretty steadily, and last week a batch of films came in on the *Satellite*. Patterson called a quick meeting of the Interglobal Defense Committee, and three days later they called me."

"What was on the films?" Smith asked sharply.

Osborne drew a heavy breath. "That fifty-foot disk shows things pretty big, comparatively. There are a lot of cylindrical-shaped objects on Mars, millions of them, and they all seem to move at high speed. The defense council is worried, more so because at this particular opposition there aren't any radio signals. Some communications men claim those signals didn't come from Mars anyway, but nevertheless we can't be reckless when the safety of the whole earth is involved."

"Do you consider that likely?"

"*Likely* is a poor word, Professor. I like *possible* better myself. Suppose there are entities on Mars who have developed space-travel to the point where they can send a whole fleet across forty million miles of ether to Earth. They're probably two hundred years ahead of us there—and why not at least that much ahead of us in development of weapons?"

"To say nothing," Professor Smith added soberly, "of the likelihood that they would have no set of moral values comparable to ours."

"You're getting the picture. To cut it

short, if those are space-ships, it means an interplanetary invasion. The defense council has been up nights for three weeks now, and they have decided it is better to attack than to be attacked. For just one possibility out of dozens, we don't know what kind of deadly diseases or viruses or what-not they might bring."

"So?" Professor Smith was fully alert.

"So they have ordered me to fire two hundred iron-bombs at Mars from our base on the moon two days from now." He glanced at his watch. "Fifty-one hours, to be exact. By decimal time, which we use on the moon, of course, F-hour is eighty-one-fifty, August twenty-three."

Professor Smith shuddered. "Iron bombs are something like eighty per cent fissionable. Two hundred would destroy any planet."

"That's right. So I argued. I figure it's time for men to ease off from shooting first and looking afterward, especially in the case of a planet. I don't think it's smart in the first place to go starting an interplanetary war. These fellows, if they have ships that can reach earth, may also have a defense against atomic bombs, and they might get mad at us for trying it."

"Very good reasoning," said Smith. "I'm glad you are not in favor of propagating war past our global boundaries if it can be avoided."

"I'd like to see a chance for peace, anyway. How do we know that any other species anywhere knows anything about fighting? Man might be the only dominant fighting species in the universe."

"Possible," observed Smith. "Where do I come in?"

Osborne stood up. He was a tremendous man, and when Smith watched him he thought of one word—iron.

Osborne said, "Professor, I made a deal with the committee. This is a touchy thing, you know. It's not the sort of thing the public can decide. It has to be done by men who know their business. You're the most capable man in the world on interplanetary relationships. You can look at those pictures and tell whether those are space-ships or not."

"Smith gasped.

"I?"

"Yes, you." Osborne smiled. "You're not going to refuse to make a decision, are you?" he said pointedly.

"Well, no, but—"

"In this field, you're what Einstein was to the field of space and time. You would know, Professor," Osborne continued earnestly. "You are also a man of undeviating honesty. The council will accept your judgment."

Professor Smith felt faint. "Oh, no. They can't decide the fate of a world on one man's word."

"They're going to."

"We'll get a committee!"

"The only two men on earth qualified to sit with you on a committee—Nonal and Zine—are out of the picture. Nonal is on the south polar expedition, and Doctor Zine is somewhere in his bathysphere at the bottom of the Mindanao Deep investigating the dispersion of hard radiation. That leaves you, Professor." The general looked again at his watch. This time it was only a gesture. "We shall have to leave New York tomorrow morning on the *Satellite* to reach the moon in time for you to make a decision. They want you at the observatory by Seventy-two Hundred. They will have just finished developing the close-ups, and if you think they may be space-ships, we fire the bombs. Okay, Professor?"

Professor Smith arose to his feet. He went to a section of the bookcase and pressed it. It turned. On the back side was a shelf with a bottle of Scotch and some glasses. The professor poured a drink for the general and one for himself.

"This is something I do most rarely," he muttered. He tossed it down. "If I say they are space-ships, Earth will disintegrate the planet Mars. If I say they are not, and they should later turn out to be that, our *own* planet might be disintegrated." He poured another drink. "Look, General, how about the public?"

"The time is short," Osborne pointed out. "I have firing orders. And I'll say that I would consider it unwise at this time to release any information on such a thing as possible visitations from Mars. The public is inclined to be hysterical when it suddenly faces unknown danger. No, Professor, it is all up to you. Shall I pick you up in the morning?"

PROFESSOR Smith repressed a shiver as he put down the glass. "The *Satellite* will blast away at seven, I believe. How about reservations?"

"I have them," said Osborne, picking up his officer's cap. "I'll be by at six. And by the way, have you ever made the trip to the moon?"

Professor Smith grinned engagingly. "At a tenth of a cent per pound per mile, my calculations indicate that a round-trip to the moon would come to sixty-five thousand dollars. And that, my friend, is not the kind of money a professor can spend for luxuries." He added wistfully, "I always wanted to ride one of the rockets, too."

Osborne nodded. "Your baggage will be gratis, but the limit is twenty pounds. You can pick up special lightweight equipment in the big store at the field, if you wish."

"Thanks," said Smith. After Osborne had gone, he poured himself one more drink, and sank heavily into a big chair. He did not want responsibility of that sort, but he saw no immediate way of avoiding it. With firing orders already issued, it would be a gross act of negligence for him to refuse to give an opinion.

Also, he knew how touchy the U. N. committees were. He could appreciate, without being told, how hard Osborne must have argued for even this concession, and he knew that the least indication of confusion on his part would upset it. But he wished he could have been picked for something else, because Astrographic Interpretation or the reading of extra-terran photographs was the one course Professor Smith had slighted in his undergraduate days; that was the course in which Professor Yonnicks, eighteen years before, had been affected by Smith's personal magnetism and had given him a passing grade without Smith's earning it.

Glumly Smith wondered if a man's smallest missteps invariably required an accounting. It was considerably too late to wish he had worked harder under Yonnicks. What he had to do now was figure out some way to give an intelligent answer. . . .

The rocket terminal at 6:30 a.m. was like any airport—a big area paved with concrete and fenced in with steel. A group of buildings was at the entrance, and hundreds of persons rushed importantly from one place to another, pursued by a raucous agglomeration of sound from horns, bells, and loud-speakers.

He was deeply impressed, however, by the *Satellite*, a giant ship, sleek and shiny in beryllium and magnesium, poised in her great launching-rack in the center of the field. To

be truthful, he was overwhelmed. He was about to see in action the things he had taught for eight years. He applied for and received one of the pamphlets listing technical details of the ship. While General Osborne took care of the tickets, Smith went through the leaflets.

As atomic power was still inapplicable to rocket propulsion, liquid fuels were used, and that fact was the reason for the high importance of Smith's subject, Orbits and Trajectories. The passenger limit for this ship was thirty-one thousand pounds—approximately two hundred persons. And after baggage, and supplies for the ship, were loaded, there would be a margin of exactly two point one per cent of the weight of ship and fuel available for carrying new equipment for the Lunar Observatory.

Smith explained to Osborne as they were standing in the weighing-in line, why exact weights were important.

A SPACE-SHIP was loaded with enough fuel to accelerate to escape-velocity, plus the amount required for the mid-point turnover, plus one hundred gallons reserve.

"After we reach escape-velocity, we coast. At exactly the point where gravitational attraction is equal between earth and moon, we make the turnover. That is, we change ends. This is so the end that holds the rockets will be presented to the surface of the moon for a braking effect in landing. It takes a good deal less weight and therefore less fuel to do it that way than it would take to install a set of blasting tubes on the front end."

"But why," asked Osborne, "is the exact turnover time important? The direction and velocity is all calculated before we leave, isn't it, so we shall hit the moon?"

"Yes, provided turnover takes place at the exact given time, because the effect of the turnover blasts on the ship's speed must be considered. Exact weight, velocities, time, and direction—all are vital to the computation."

"What happens if something goes wrong?"

"An error in turnover time by a few seconds, without a compensating adjustment, would mean our missing the moon's gravitational field. The ship must come very close, to be influenced by the moon's mass. We go into an orbit around the moon while we cut down speed with rocket blasts and interactors with the moon's gravitational

forces, but it takes almost as much fuel to reduce our speed as it takes to build it up in the first place.

"Now, obviously in astrogation a pilot can't sit there and guide his ship to the moon by sight. It must all be done by mathematics. One full blast on the rockets would consume several hundred pounds of fuel, and if he should carry enough fuel to allow for seat-of-the-pants maneuvering, he wouldn't have any room for a pay load. So here's the thing in a nutshell: the margin allowable for a pay load anyway is very small—something like four per cent all told—which makes it impossible to allow a safety margin of fuel for a ship which misses the moon. The moon's gravity *must be used*. If the ship goes by the moon outside of a certain limit, it will go into outer space and coast forever, because the pilot has barely enough fuel to stop the ship, to say nothing of getting it back and landing it."

"It sounds like a ticklish proposition," Osborne said soberly.

"It is," the professor assured him.

In a big room they were weighed, their baggage weighed—to the ounce—and passed through a gate. "That's Patterson up ahead there," Osborne whispered, and Smith looked as soon as he could, seeing a white-haired, vigorous-looking man with a big briefcase. "He'll be with you," said Osborne, "all the time, probably."

It gave Smith a sinking feeling, which was partially relieved a moment later when the last man in the line, number two hundred, was refused passage because he would have made the ship twenty-eight pounds overweight.

Smith was impressed to see that space navigation was as exacting as he always had taught it should be.

The *Satellite* stood on her tail, and the passengers climbed a long magnesium stair in the center of the ship to the lounge, which was just above the midship section. Above—or forward, Professor Smith noted. It was a little queer to see how quickly the usual designations of space became meaningless. The takeoff was easy. Compressed air launched them, and when the jets took over there was a moment of sickness but no noise. It seemed almost at once that they began to float. Professor Smith drew a grateful breath and relaxed.

They were coasting free at twenty-five thousand miles an hour.

OSBORNE introduced him to Patterson. The white-haired, square-faced president of the Interglobal Defense Committee was blunt.

"No, we don't know that any other sentient species is belligerent—and on the other hand they might be nothing *but* a fighting machine. We can't take a chance. If there is any reasonable doubt, the order to fire will stand. After all, gentlemen, we are discussing the safety of the earth. The answer is up to you, Professor Smith, and only because we on the committee are honestly divided. We don't know. You will. All I have to say is that we cannot afford a mistake."

He turned his piercing eyes on Smith, who said carefully, "We'll see," while at the same time he was inwardly tense. Why must they put a poor teacher on the tightest spot in Earth's history? Osborne seemed to read his thoughts.

"You are a teacher," he said gravely. "You are accustomed to viewing things objectively and giving an unbiased opinion. We are willing to depend on you."

The weight of that responsibility became depressing. Brambilla had been right. Teachers did not make decisions. Perhaps it was because they were not temperamentally suited for it. Perhaps that was why they were teachers.

Patterson did not help. "You will have to use a magnifying glass to examine the pictures," he said. "Our best estimate is that the objects are in the nature of a thousand feet in length, and even the six-hundred-inch reflector on the moon could not see that small an object thirty-four million miles away if it were not for the nucleonic screens and the new cosmic-ray photos, something like radar plus a radical new fine-grained film that will record anything the mirror can see."

Professor Smith excused himself. He needed to be alone. To recover his inner composure he went to the chart-room and examined the posted figures. He began to jot them down. Here was a real problem in turnover time, with the fate of two worlds hinging on it. He sat down and calculated.

Presently his figures indicated that turnover time would come at exactly 64:21:45, decimal time. He checked his space watch, a present from the class of '60, with the ship chronometer, which was marked off in tens and centitens and millitens, then sat back

complacently to await turnover time. This was familiar ground. For the first time since Osborne's visit, Professor Smith had to admit that he was getting what the undergraduates might once have called a "large charge" out of the trip.

At 64:10 he looked at his watch. At 64:20 he braced himself, but the warning light did not flash until 64:46.

The turnover itself was gentle. The *Satellite* swung in a big arc, and centrifugal force was nicely used; only one glass of water, on the edge of a table, was spilled. But Smith was worried. He checked his calculations. They were correct. He went back to the chart-room and checked the data. That too was correct. Smith's chest began to tighten. Twenty-five centimeters was plenty to make them either crash or miss. In this case it would be a miss!

He stopped the first officer and asked him if the posted data was accurate. The officer said it was, even to the name of the pilot. "New pilot this trip," he noted. Professor Smith read the placard in the lower right corner of the bulletin board and went cold. The sign said, "Pilot, Frederick H. Yonicks."

Professor Smith sat down. He was suddenly too weak to stand, even in the mild artificial gravity of the ship. Freddie Yonicks, the boy who had slighted Fixed Orbits and Trajectories. Presently Smith arose and went to the captain's cabin, showed his identification, and secured permission to visit Freddie. He went down the magnesium ladder and found Freddie sitting comfortably in a nitrofoam chair watching the mass of blinking lights and wavering dials, and the growing reflection of the moon in a ground glass screen.

FREDDIE shook hands with a glad smile. He invited the professor to sit down and showed him all the gadgets, including the new differential calculator, the one item with which the professor was not familiar. Freddie remembered the time when the professor had taken the entire class for a "ride" in the trainer and one rocket-firing button had gotten stuck. The trainer had turned completely over and they had all slid around the walls and ceiling until the professor oriented himself long enough to punch the deactivator button.

"You'd have made a good pilot, Professor," Freddie said warmly.

Professor Smith thanked him, thinking that without doubt this was the glamorous end of the profession. He even envied Freddie just a trifle. The assistant pilot went off duty, and Professor Smith said casually, "How do you figure turnover time?"

Freddie looked at him curiously. "Why, just the way you taught me."

"You didn't learn how to do that in my class." Smith was fighting to keep his voice level.

Freddie grinned. "We have the electronic brain here that does it quicker and better."

"You surely check it manually."

"Well, no—I don't."

Professor Smith swallowed hard. "You mean you left it all up to the calculator?"

"Sure." Freddie began to be a little defensive.

"May I see the readings on the instruments?"

"Yes, I guess so." Freddie was a little doubtful but he showed Smith the tape, and for the next hour the professor calibrated speed, azimuth, declension, weight, time, and acceleration. Then with the Astronautic Guide he checked the position of the moon against the arrival time of the *Satellite*. When he finally looked up at Freddie, his face was taut.

"You delayed turnover for twenty-five centimeters. When you reach rendezvous point, the moon will be far past it. At your present azimuth"—He looked at the thin, slowly wavering band of sodium light projected against a calibrated scale—"you're off course about fifteen Angstroms."

Freddie's eyes began to narrow. "Are you telling me I don't know how to hit the moon?"

Smith said sharply, "I'm telling you you won't hit it unless you change course. And that must be done quickly. The angulation is constantly increasing."

Freddie licked his lips nervously. Then he said, "Professor, if we're off course, that's my job."

But Smith was insistent. "You are off course, and within a matter of half an hour it will be too late to correct it."

Freddie's jaw set. "I must ask you to leave, Professor, if you are going to interfere."

The professor leaned forward. His eyes were almost hypnotic in their intensity. "Freddie, has your experience in the Space Service taught you to have respect for me

as a teacher?"

"Yes, of course, but—"

"Then I'm telling you now that you are off course! Set that problem up on the calculator again."

Freddie began to look pretty sober. He tried the calculator, and this time he swore soundly when the result came out different. Smith looked over his shoulder. The new result agreed with his own. Freddie began to turn haggard.

"What shall I do now?"

"As soon as you get back to Earth you will come to my office for a private course in Fixed Orbits and Trajectories, but for the present, do what I tell you."

By now Freddie was thoroughly scared. At Smith's direction, he fired two bursts from the No. 1 port rocket. The light-calibrator swung sixteen Angstroms and settled. Then at Smith's direction, he fired a quarter-burst from the No. 2 starboard jet, and they settled down to wait.

By the time the assistant pilot returned, the *Satellite* was quite plainly in an orbit about the moon.

THEY flashed over Goddard Point in the middle of the Mare Tranquillitatis, with its cluster of huge other-world domes. Four times over. On the fifth run, Freddie gave a series of reverse bursts. The angle of decline was on the red line.

The receiving cushion on the pock-marked surface of the moon looked like a pin-point. The golden ball danced up and down, left and right, back on the cross-hairs. Forward velocity was low. The cushion came up. The *Satellite* hit with a jar. The pneumatic cushions took the first shock, then the hydraulics picked it up and the *Satellite* settled like a feather.

Professor Smith shook hands with Freddie, who was fervently grateful, and left. As he went down the ladder, almost floating from his less than thirty pounds of moon-weight, the tension left him and he felt limp. The knowledge of what he still had to face began to smother him, but he found Osborne and Patterson and they joined the passengers going down the ladder.

At the ground level, they stepped out onto the surface of the moon, but they were under a great dome of plastiglass that now covered the ship and contained oxygen and heat. They walked under a broad plastic canopy to the dormitory.

Yes, this was the moon. They actually were on another planet, but Professor Smith was so weighed down with the responsibility to be given him the next day that he was unable to be thrilled. And he slept poorly all night, beating old, forgotten paths of knowledge for some clue, some remembrance, or some reasoning that would give an answer to the problem.

At seventy-one-fifty, decimal time, he was called to the photographic laboratory of the huge fifty-foot reflector. Mr. Patterson met him with a thick stack of negatives and as many prints. Patterson himself looked strained and weary.

"The launching racks have orders to fire two hundred bombs at eighty-one-fifty," he said. "That's about two and a half hours. I'll leave you here. Press the button when you come to a decision."

Professor Smith was suddenly almost frantic. "I can't—"

"Never mind," said Patterson. "I know it's tough, but we didn't ask for it either, you know. Go ahead. We trust you implicitly. And of course all you can do is your best." He left quietly, his rubber heels making no noise on the wide silent reaches of the composition floor.

Professor Smith looked up at the high ceiling. It was a very high ceiling. He looked at the stack of negatives. He reached for the first print and focused it under a magnifier. Yes, he saw the spots—hordes of them. But they were so small. How could anybody tell what they were? If those were space-ships, there were enough to blow the earth apart. If they weren't—How could he tell? He looked at the tiny dots and got cold feet. How could they expect him to make a decision like that? What could he base it on?

"Hi, Professor!" said Freddie Yonnicks' voice. "Thought I saw you come in here. I sneaked in past the guard, myself. I just found your book on Fixed Orbits and Trajectories in the library. Now, in Chapter Four here, where it talks about ellipses and hyperbolas, it says the ellipse is the cheapest way from a standpoint of fuel, but the hyperbola is the quickest—Professor, is something wrong?"

The professor blinked. "No-no. No, not at all." He suddenly seemed to awaken and become very business-like. "I've just thought of something, Freddie. I know what's puzzling you—how to balance the expense of

fuel against the expense of time, and I think I can explain that better than I did in the book. But right at the moment I am very busy. Could you meet me at the library, say, in an hour or so?"

"Sure. I'll see you there." Freddie left, while Professor Smith glanced at a couple of the prints. Then he smiled and pressed the bell-button. Certainly he could make a decision. He had made one on the ship. So had Freddie made one. He could make one now, especially now that he *knew*.

AT EIGHTY-ONE Hundred Professor Smith was talking to the white-haired Gilbert Patterson, the iron-framed General Osborne, and their staffs.

"These are not space-ships," Professor Smith said positively. "The mechanics of space-travel eliminate that possibility." The stiffness went out of Gilbert Patterson suddenly, and he looked old and tired but relieved.

"In the first place," Smith said, "it is unlikely that the Martians have developed space-travel more than just enough to reach Earth, or we should have had a visit from them already. In the second place, at such a stage of development they would find it essential to conserve fuel. In the third place, even by hyperbolic orbit the trip from Mars to Earth would require somewhere around ninety days—I haven't the exact figures. At the start of the trip Earth would be a quarter of its orbit ahead of Mars in going around the sun; the ships would shoot past the sun to meet Earth three months later, and by that time Earth would be still farther ahead because Earth moves faster. So you see, gentlemen, the physical impracticability of the two planets' being together when Mars dispatches her ships. There can be no immediate danger."

"What do you mean—immediate?"

"The danger would come three months from now."

"We could fire the bombs now and catch them before they could dispatch their fleet," Osborne said thoughtfully.

"We're not in position now. Celestial mechanics will show that from Earth to Mars, the quickest orbit is available when we are about one third of the circle behind Mars. To be quite vulgar, gentlemen, you can't get there from here. And anyway," he said more quietly, "they are not space-ships."

"They moved at high speed," said Osborne.

"No, they move at very *low* speeds. That's what fooled us, just as the spokes of a wheel traveling at a certain speed appear to turn backward in the tri-dimensional movies. If we assume the high speeds these objects at first indicate, we must also assume that any ship of any possible metal, even pure beryllium, which is heavier only than hydrogen, helium, and lithium, would acquire too much kinetic energy to change course as these objects do.

"No, gentlemen, the speed has to be low, and even then, the only sort of object that could do that would be an insect of some sort, very light, and at Mars' gravity, about one third of Earth gravity, it might be possible for insects to grow to enormous size. We do not know what conditions there are on Mars to either facilitate or retard such a development, but in my opinion, gentlemen, these are huge beetles!"

GILBERT PATTERSON was very pleased, but General Osborne looked speculative. "What about the people on Mars?"

"I think it is rather obvious," said Smith, "that these *are* the 'people' of Mars. They're highly specialized or they wouldn't have developed such light bodies. They must dig the canals with mandibles, they undoubtedly have developed a means of sending electromagnetic signals from their antennae. Why is it so astonishing, gentlemen? Did you expect something familiar?"

"Well, what do you know!" said Osborne.

"Okay," said Patterson. "Thanks, Professor." He turned to Osborne. "Cancel Firing Order One Hundred."

"You're entirely welcome," said Professor Smith. "And now if you will excuse me, gentlemen, I have to meet a former pupil of mine to discuss old times."

He strode out tall and slim and self-possessed. He seemed to be a very decisive man. And he was. He was going to coach Freddie. He was going to fill in his own education with a post-graduate course in Astrographic Interpretation under Freddie's father, and he was going to fail Richard Brambilla in Celestial Mechanics Four. With his new consciousness of the power to make decisions, he wasn't afraid of Brambilla. There *were* things more significant than salary or position.