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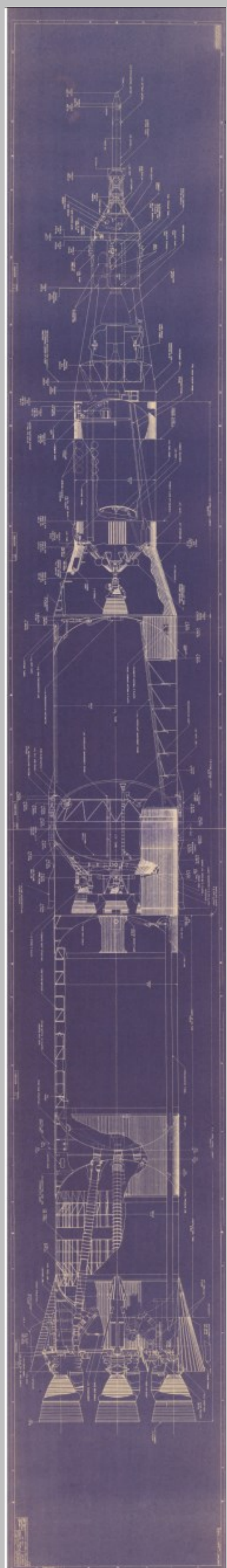

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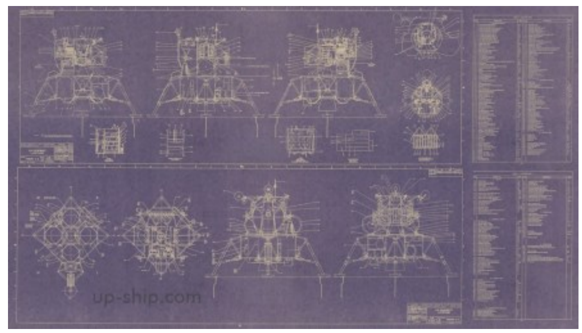

Dreams of Space

Books & Ephemera

Non-Fiction Children's Books
about Space Flight from 1945 to 1975
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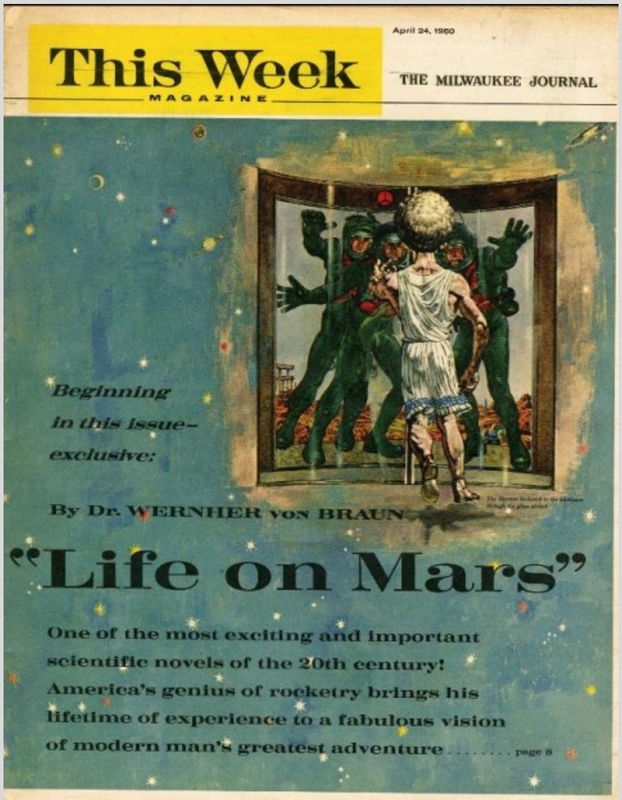
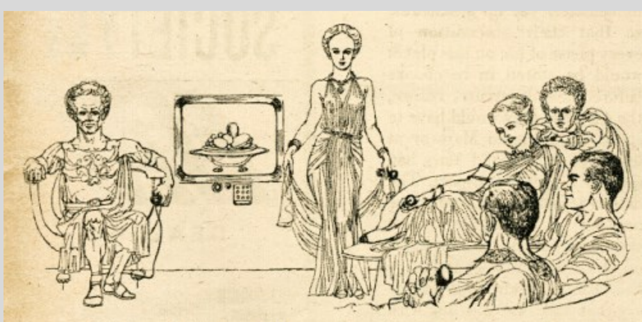
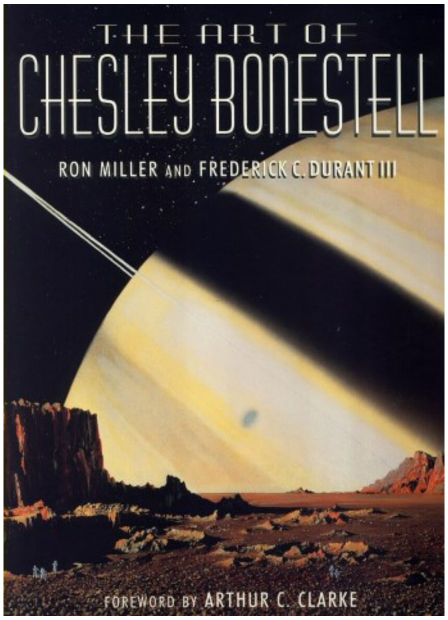




TV showed the menu. Minutes later the food was delivered

Cables secured the return rocket



Award winner Ron Miller & Black Cat Studios

Ron Miller, winner of the 2002 Hugo Award (World Science Fiction Society) for Best Related Work: The Art of Chesley Bonestell

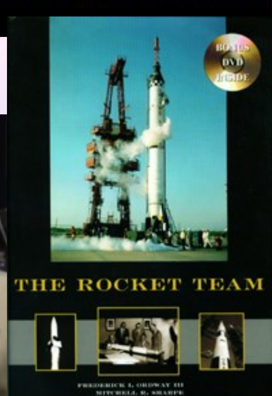
The Chesley Bonestell Archives of Melvin H. Schuetz

www.bonestell.com

A former satellite controller in the U.S. Air Force and private industry, Melvin H. Schuetz has researched and collected publications from around the world containing Bonestell's art for more than four decades. His book, A Chesley Bonestell Space Art Chronology, is a unique reference bibliography containing detailed listings of over 750 publications which have included examples of Bonestell's space art.

Space scientist and well-known author of visionary books on spaceflight. Ordway was in charge of space systems information at the Marshall Space Flight Center from 1960 to 1963 and before that performed a similar function for the Army Ballistic Missile Agency. For many years he was a professor at the University of Alabama's School of Graduate Studies and Research. However, his greatest contribution has been to the popularization of space travel through dozens of books that he has authored or coauthored. He was also technical consultant to the film 2001: A Space Odyssey and owns a large collection of original paintings depicting astronautical themes. Ordway was educated at Harvard and completed several years of graduate study at the University of Paris and other universities in Europe.

www.cgpublishing.com



Frederick Ira Ordway III

Co-Author with Mitchell R. Sharpe of The Rocket Team

Dreams of Space, Books & Ephemera

Non-Fiction Children's Books about Space Flight from 1945 to 1975

http://dreamsofspace.blogspot.fr

Classics Illustrated were comic books intended to educate as well as entertain. They often were fictional "classic" books in comic book form such as Moby Dick. They also had a special series called "The World around Us." These were non-fiction comic books about topics of interest.

Classics Illustrated. Illustrated by Gerald McCann, Sam Glanzman and John Tartaglione. The Illustrated Story of Space (80 pages), 26 cm, softcover.

Contains illustrated stories on training for space, the first rocket to the Moon, the history and use of the rocket, the launch of Vanguard 1 and the construction of a space station. "The World Around Us" (#5) January 1959.

Man's Survival

We can build the rocket ships, but success depends on

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ILLUSTRATED BY CHESLEY BONESTELL, FRED FREEMAN AND ROLF KLEP

in Space

Edited by CORNELIUS RYAN

the most complicated mechanism of all: the human body

WHO will fly tomorrow's rocket ships? Must the crews be limited to expert mathematicians, astronomers and physicists or can we use the caliber of men who fly today's jet planes? Will space travelers be tall, short, fat or thin?

We have the answers to these questions. Scientists, physicists and aero-medical doctors can specify the type of person suited for the job of conquering space and how the crews will be selected and trained. There's a good reason why our scientists can confidently make these estimates: they are hard at work at this moment to put man into space. So are certain branches of the Navy and Air Force.

While the government has not officially announced a space program, a score of the nation's colleges have quietly received U.S. contracts to investigate specific space flight problems. Some aircraft manufacturers are busily engaged in top-secret space research. One has the prototype of a space station on its drawing boards.

The Air Force and Navy are also vitally concerned with what kind of man we'll need for space flight. Today's jet fighters, bombers and experimental rocket-powered craft are flying faster and higher than ever before. They are speeding along the very borders of the upper atmosphere and, at these great altitudes and high speeds, crews are meeting virtually the same environmental hazards which exist in the void of space. In short, modern aviation is rapidly growing into space flight. We have been preparing for the inevitable.

Just as we protect man in atmospheric flight, so will we safeguard man in space. In the last few years, Air Force and Navy scientists and doctors, working together, have developed pressure suits which can be used in upper-altitude flight. We can use the Navy's version in space. The time has come to start thinking how we want the rocket ships built.

In the prejet age, airplanes were built with only performance in mind. Little thought was given to the men who had to fly them. Pilots and crews were expected to adjust automatically to the finished machines. Modern aviation medicine, as it becomes space medicine, has one rule of thumb concerning upper-altitude or space flight: man—human needs—must be considered before a single blueprint for an aircraft or rocket ship leaves the drawing board. Says Major General H. G. Armstrong, Air Force Surgeon General: "Physics and its allied sciences identify the specific physical hazards . . . Medicine determines the human reactions to these hazards . . . Engineering and its allied sciences design and develop the necessary protective equipment."

We must construct our rocket ships around the men who must fly them.

But who are they?

The story of the selection and training of the crews who will operate tomorrow's rocket ships begins on the following pages, as the first of a three-part series. So many branches of science are involved in discussing the human factor of space flight that Collier's asked a distinguished panel of aero-medical scientists, physicists, radiologists and engineers to contribute to the series. Because their fields of study interlock and overlap, their papers have been combined into one continuous narrative.

It is an important narrative. The success of any program to reach space depends on the machines, it is true. But even more largely it depends on the most delicate, most indispensable of all instruments—man himself.


von BRAUN


MULLER


FLICKINGER


LEY


STRUGHOLD


HENRY

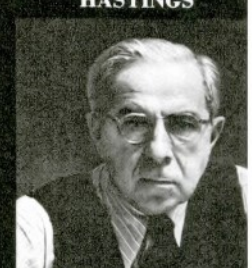

H. HABER


F. HABER


VAN ALLEN


HASTINGS


SULLIVAN


BONESTELL


FREEMAN


KLEP

Picking the Men

Can ordinary, healthy people visit space? They can—the Navy's new space suit points the way—but we'll look for special qualities in the pioneers. The physical and psychiatric examinations will be so tough that of every 1,000 trainees who can meet the strict entrance requirements only five will make the grade. Here's how we'll choose

WE COULD send man into space right now, this year. And he *would* survive. Without any particular discomfort, either. He'd face hazards—from blood-draining acceleration to blood-boiling low pressure, from cosmic rays to extreme temperatures—but these are hazards we know we can beat.

Most, in fact, have been overcome by a single development, never before publicly disclosed: the completion of the Navy's new pressure suit, tailored for space travel. The Navy space suit, pictured on this week's cover and on the opposite page, carries its own atmosphere—oxygen, pressure, air conditioning. It can be worn for long periods, and permits complete freedom of movement. It was developed with space problems in mind.

You could wear it to the moon tomorrow.

We know that we can build the rocket ships to take us into space (Collier's, March 22, October 18 and 25, 1952), and we know we can protect their crews. All we have to do is find the right men—and women—to make the trip.

It would be foolish to solve all the mechanical problems and then run a risk of human error. So we must choose space crew members carefully—so carefully that Colonel Don Flickinger, the doctor who is one of the top Air Force experts on what the body must endure in flight, makes this rough estimate:

Of every 1,000 persons who can meet the initial rigid educational, physical and age requirements for space training, only five will ever enter space—just enough for one rocket-ship crew.

What are the standards those 1,000 must measure up to? And what are the problems that will wash out 995 of them?

An applicant for space training must be old enough to have mature judgment; whizzing through the blackness of space at speeds up to 18,000 miles an hour, facing situations men have never known before, he must make decisions fast—and right. But he must not be so old that he can't stand the rigors of space travel: catapultlike acceleration which may increase his weight ninefold, followed within minutes by complete weightlessness; tremendous demands on his endurance; the need for near-perfect reflexes and co-ordination.

Of the 11 scientists taking part in Collier's three-installment symposium, six contributed to the article Picking the Men: Drs. Heinz Haber, Donald W. Hastings, Hermann Muller and James A. Van Allen; Air Force Col. Don Flickinger and Navy Capt. James E. Sullivan

He must be well-educated, so he can absorb the fairly advanced scientific instruction that will equip him for rocket travel and life in space. As part of his training, he will receive a thorough grounding in both practical and theoretical engineering, medicine, astronomy and navigation.

He can't be too tall or too short and stout. Such people often have poor control of their blood circulation, which makes them more subject to fainting, and more susceptible to variations in temperature and other hazards of space.

The best prospective crew members will be between twenty-eight and thirty-five years old, and of medium build: five feet five to five feet eleven inches tall, and weighing perhaps 10 per cent less than the average for their height. And they will have college degrees, or the equivalent as measured by examination.

How about women? Chances are, they'll be sought after for some space crew jobs. Not as pilots, perhaps, but as radio and radar operators—jobs requiring a high degree of concentration under difficult circumstances. In industry, women have indicated that they can perform monotonous and tedious tasks hour after hour without undue loss of efficiency. We need people like that in space travel. The physical and educational qualifications will be about the same for women as for men, except that the women may be shorter and lighter.

Those are the applicants. Now they must be culled; the unfit must be ruthlessly eliminated to minimize the risk of personnel failure.

The first and most severe test will be a medical-psychiatric examination which will cut the original 1,000 down drastically. The physical exams, which will be in two parts, are expected to weed out no less than 880 of the starters, and the psychiatric test 60 more.

Why so tough? Because even minor organic or emotional defects will be tremendous handicaps; what we're looking for are people with specific physical attributes and unusually stable personalities.

The space crew members will not be supermen. But they will be well-adjusted individuals in excellent health, with a few special aptitudes to equip them for the special problems of space. Those special aptitudes are important; they explain why even men as carefully picked and well-trained as jet pilots probably wouldn't all make the grade as space pilots.

At altitudes above four miles, there's virtually no air; an unprotected man would swiftly suffocate. From eight to 12 miles up, the region of extreme low pressure starts; from that level on into infinity, the body fluids would boil if not protected (first the saliva bubbles, then the skin balloons in places, under the pressure of water vapor rising beneath it, and finally the blood starts to churn).

Then there's the temperature problem. A man speeding spaceward passes within moments through wild temperature variations—from moderate temperatures on the ground to 67 degrees below zero F. at an altitude of eight miles and then into a region where temperature as we know it no longer exists: a man exposed to the full blast of the sun's ultraviolet rays would roast in an instant, while objects hidden from the sun would lose heat until—if in the shadow long enough—their temperature would drop close to absolute zero.

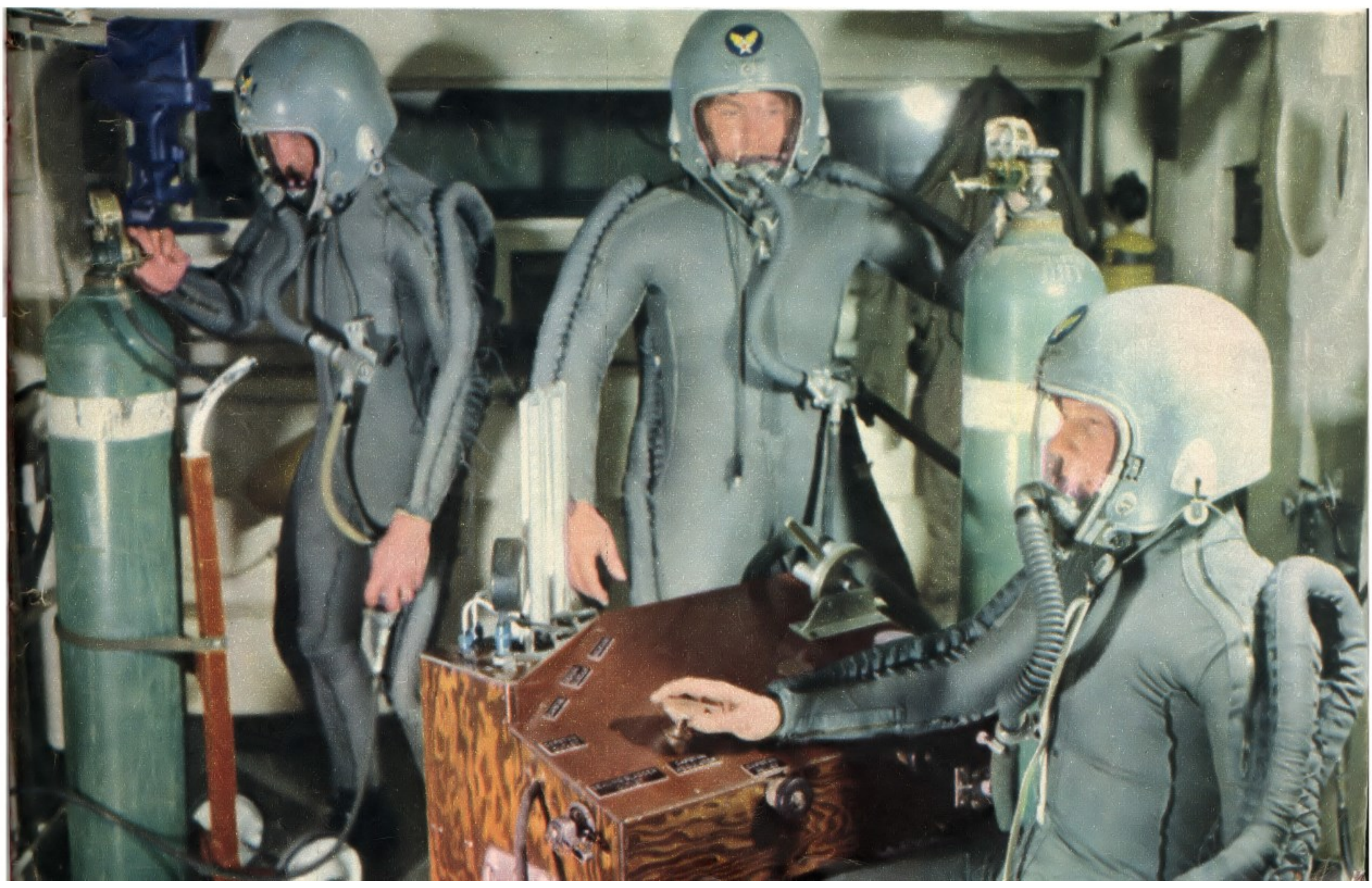
In a region so unlike the environment we've always known, there's only one way to protect life: bring our environment with us. From the moment he enters space until the time he leaves it, man will

Like Navy, the Air Force has been thinking of space problems. This is Air Force emergency pressure suit, developed by Dr. James Henry, shown undergoing pressure-chamber test. Suit inflates automatically as cabin pressure drops, does not protect hands or feet. Main contractors were David Clark Co., Bendix Aviation Corp., and International Latex Corp.

PHOTOGRAPHS BY RALPH ROYLE

New Navy space suit is a one-piece affair, with helmet hinged to the shoulders. It has been tested to altitudes of 63,000 feet and still higher tests are under way. Many details of the suit are top secret

Suit permits great freedom of movement. It was designed by Carroll P. Krupp, of Findlay, O., 35-year-old self-taught Goodrich engineer, under the direction of U.S. Navy's technicians. It would work on the moon



A typical space crewman: not too tall, short or stout—and emotionally stable. For some

live inside a protective envelope of his own making, a high-pressure chamber, either within the sealed cabin of his rocket ship or living quarters, or within the sealed casing of his space suit. The new Navy suit—developed under the direction of Captain James Sullivan of the Navy Bureau of Aeronautics—will do the trick.

The Navy space uniform, which is being used experimentally under heavy guard at the National Air Matériel Center, Philadelphia, actually does more than solve the major problems which occur at extreme low pressure. It solves many of the bothersome minor problems, too.

How does a man move around when he's encased in a high-pressure balloon (which is what a space suit is)?

The natural tendency of a pressure-filled suit is to become rigid and unyielding; how can the wearer bend his arms and legs? How can he use his fingers? Turn his head?

The rubber Navy suit permits almost complete mobility by means of a variety of devices, most of them still top secret. Semirigid accordion pleats allow movement of the important body joints: shoulders, elbows, knees. Ingenious wrist joints permit rotation of the hands. Man in space will find that his fingers wriggle almost as freely as they might in a conventional thick glove—and with a sensitivity of touch that's almost completely lacking in normally gloved hands. The helmet is attached at the shoulders, and is so built that a man's head can move comfortably within it. The suit has special slide fasteners which seal the suit as they close.

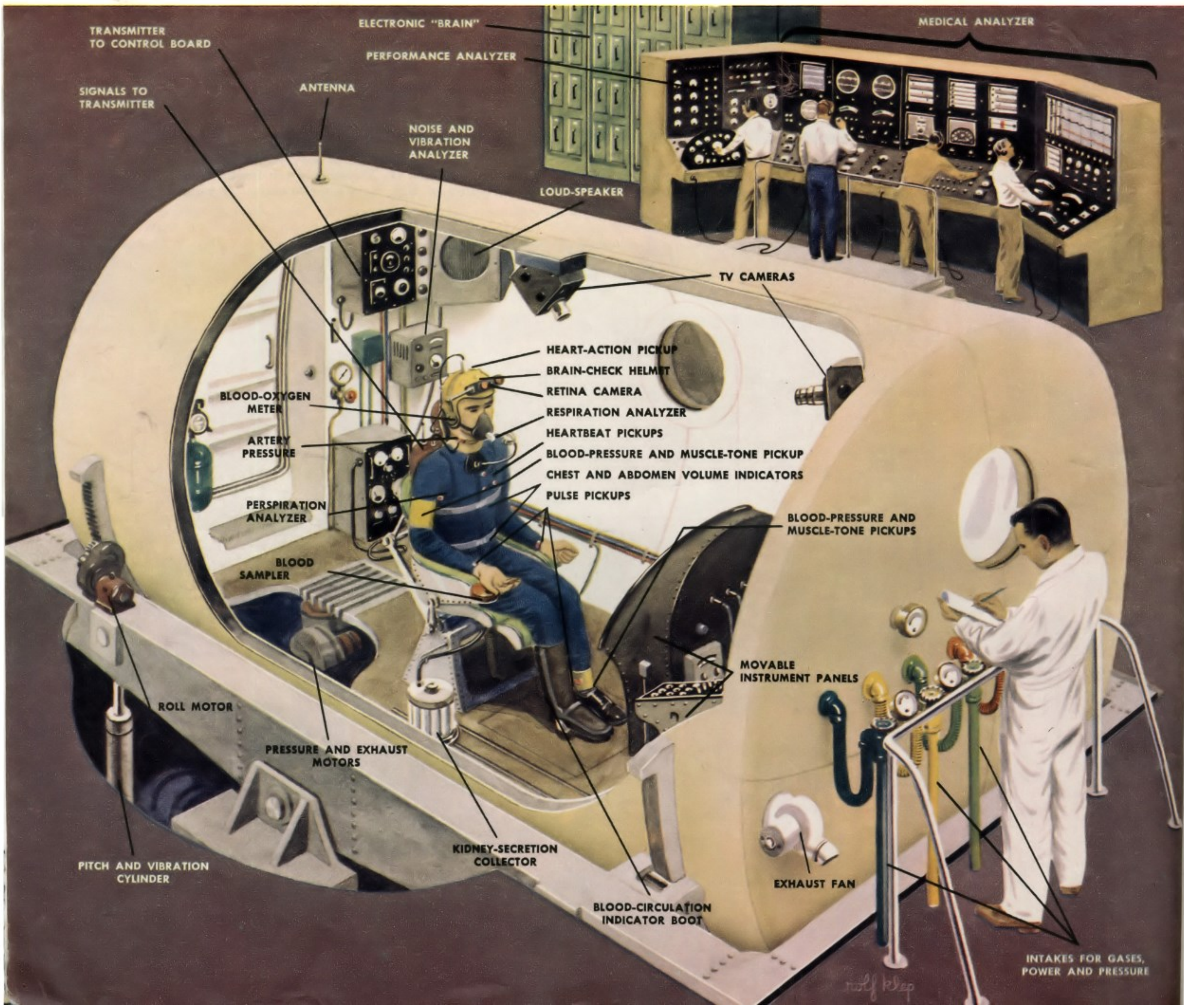
Refinements such as these explain, in part, why the suit cost about $225,000 to develop. (It was made by the B. F. Goodrich Company, using fabricating techniques developed by the David Clark Company and hardware by the Firewel Company and Bendix Aviation Corporation. In production—it will be made in three sizes—its price will drop to about $2,000 per suit.) But the real significance of the uniform is the near-perfect protection that it gives against the big hazards: lack of oxygen, blood-boiling low pressure and temperature variation.

If the crew member gets all that protection, why worry about special aptitudes? Couldn't any individual live comfortably in an artificial atmosphere almost identical to the earth's?

The answer is no. Some people simply can't endure man-made atmosphere. Scientists aren't sure why, although it seems certain that the reasons are largely psychological. Pressure-chamber and pressure-suit tests show that a certain percentage of any group will fold up under conditions which other people don't mind at all. And a few can take low pressures that would knock out almost anyone else.

Those are the few we want.

Suppose a rocket-ship cabin develops a leak. It's possible; no equipment is perfect. The crew members will be so well-versed in emergency procedures that the leak probably will be plugged in a few moments—but for those few moments all personnel aboard the ship will have to cope with an environ-



ment far different from the earth's. It's then that our extreme care in the selection of crew members will pay off.

Obviously, we'll want to test all applicants in pressure chambers. We've been doing that for years with aircraft crews and trainees. But more than that, we'll check our 1,000 for certain physical properties. A person whose circulatory system is under excellent control will be far better equipped to exist for long periods on relatively little oxygen, and in the cramped quarters of a rocket ship, than one with unpredictable variations in blood pressure.

A crew member whose nervous and circulatory systems react swiftly and efficiently to outside temperature changes will be affected only slightly by variations which might incapacitate someone else.

Problems of a Space Vehicle's Crew

Before a space vehicle even leaves the 120-mile-high atmosphere which surrounds the earth, its crew members will have confronted all the problems of low pressure, plus a couple of others: cosmic radiation and ultraviolet radiation.

Ultraviolet radiation doesn't trouble us; it could be dangerous to an unprotected man, but our crew member will never lack the protection of cabin walls, space suit fabric and tinted glass.

Cosmic rays, the minute, ultrahigh-speed, radioactive particles which whiz constantly through the upper atmosphere and space, have been an object of dread for many years—principally because most people know so little about them.

Scientists know enough, however, to be pretty certain of two facts:

First, they aren't as bad as they've been described, not bad enough to constitute a real danger.

Second, their relative harmlessness is a source of vast satisfaction to space scientists, because there's no practical way of protecting space travelers from them. The reasons will be discussed later in this article.

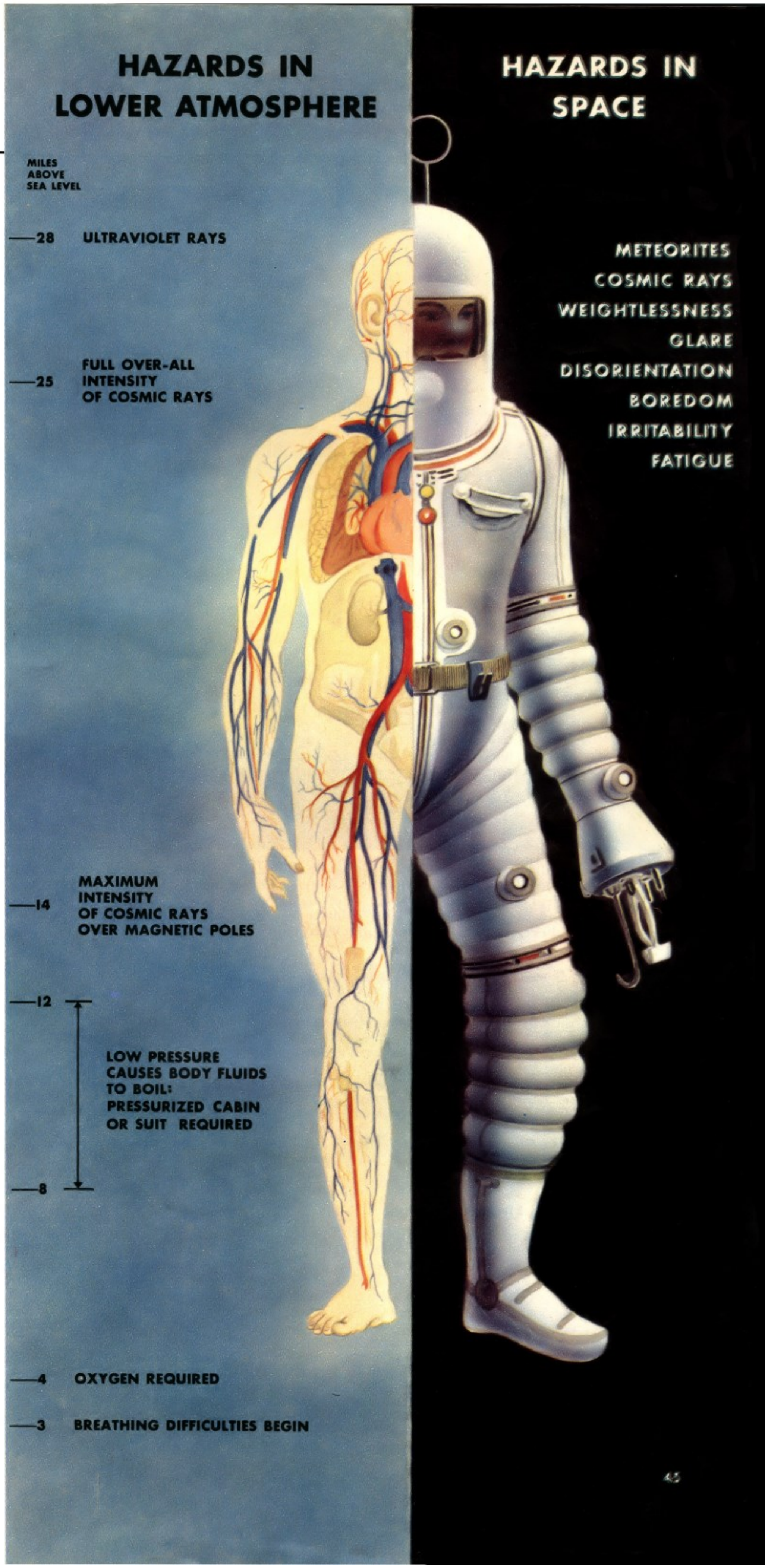
Above the atmosphere, only one more physical hazard confronts the space traveler: meteorites. There again, there is no built-in safeguard in the human body. Medical men are counting on the engineers to provide sufficient protection. But there are other problems we must meet.

In aviation training, the greatest number of men are eliminated because of faulty reactions or poor judgment under actual flight conditions. It isn't easy to provide flight conditions in rocket-ship training; obviously, we can't send potential crew members into space in a multimillion-dollar space vehicle as part of our selection process. Yet it's much more important to weed out the unfit in a

This device will test candidate's ability to take stresses of space. Roll motor and pitch cylinder will rock and shake chamber; noise will be piped in; pressure and composition of atmosphere will be varied. Prospective crew member will be required to solve problems set into instrument panels by remote control. As he works, electrodes, cardiographs and other instruments attached to his body will record how various organs function under the strain. The heart, brain, eyes, perspiration, blood, muscles all will be checked separately, and technicians and surgeons will see results on analyzer panels. One TV camera will be fixed on candidate, other on the instrument boards

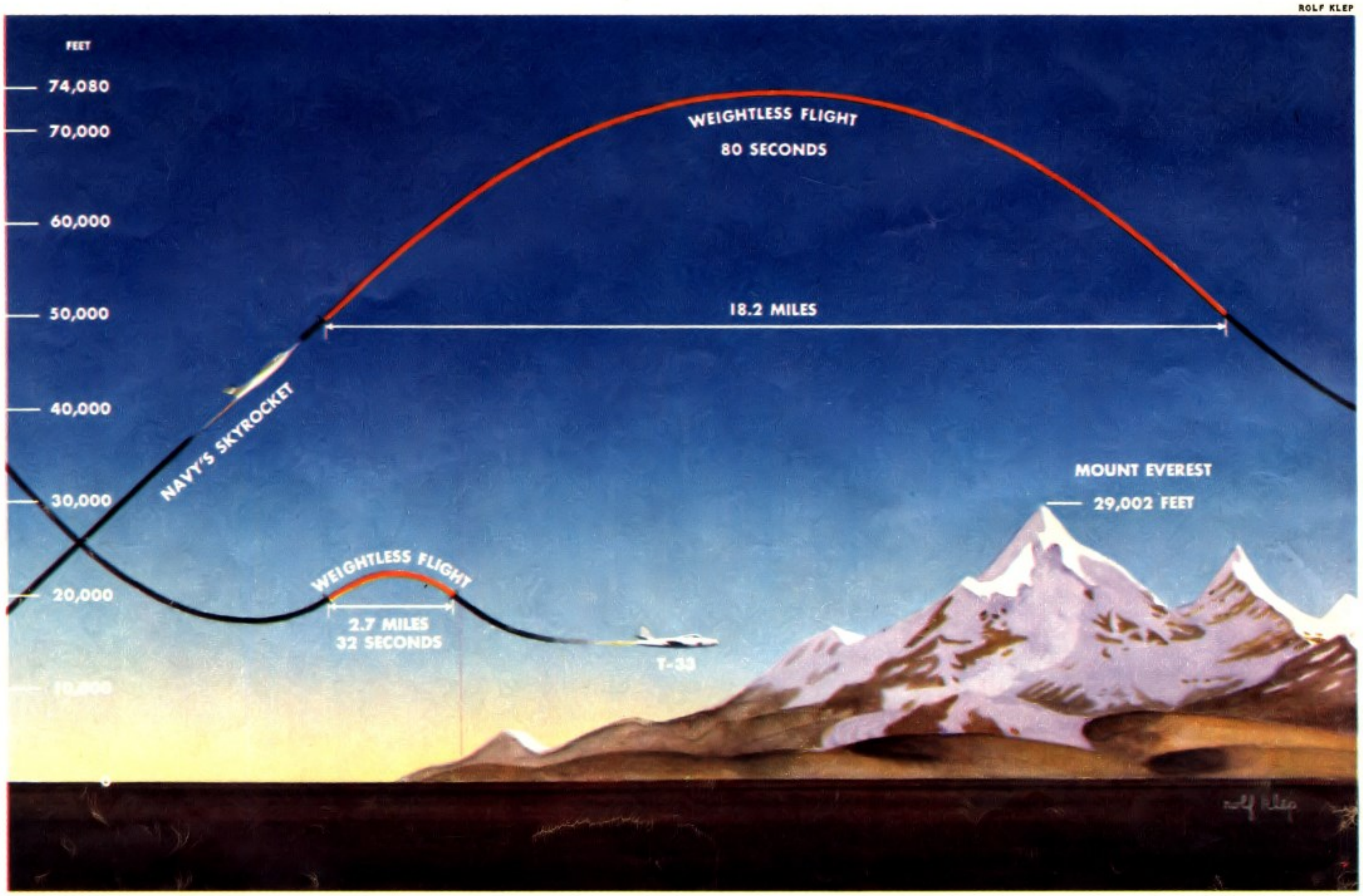
In lower atmosphere, the hazards at left menace unprotected man. Even crewman in space wearing pressure suit will be subject to dangers noted on right. But none is a serious obstacle to an assault on space today

DRAWINGS BY ROLF KLEP



Science is breaking down the barriers. The Navy suit licks the low-pressure hazard;

ROLF KLEP



This shows the method devised by Dr. Heinz Haber for achieving weightless flight in a modern high-velocity airplane. Plane dives to pick up speed, then pulls up and flies in humplike arc. Pilot is weightless while in arc. Bottom diagram shows flight path of T-33 jet trainer which made the first such flight, with crack Air Force test pilot Maj. Charles Yeager at the controls. Upper line indicates how our fastest rocket plane, the Douglas Skyrocket, flying above 10-mile altitude, can lengthen arc, almost triple period of weightlessness

space program than in aviation training. What can we do?

We can copy the stresses of rocket flight on the ground. In fact, we can do better: right now we can make the tests far more concrete than those used in aviation, which depend largely on personal observation and opinion.

The trainee will be seated within a small, elaborately instrumented, boilerlike chamber. The inside pressure can be lowered; the chemical composition of the atmosphere varied; the temperature adjusted. The testing flight surgeon can vibrate the whole contraption violently, pipe noises into it—or conduct any of the tests in combination.

Candidate Given Electronic Checkup

The candidate will, in effect, be wired for sound and radar. His suit will be the center of a network of wires. Television and X-ray cameras will hover over him. Electrodes, cardiographs and other electronic devices will check his pulse, blood pressure, breathing rate, skin temperature, internal temperature, perspiration and the oxygen content of his blood. Every section of his heart and brain will send out its own signals to a control board outside the chamber—so the surgeons will be able to check not only for malfunctioning of specific organs, but for the co-ordination of the physical machinery as a whole.

The air intake of the candidate's lungs and the chemical composition of the exhaled air will be analyzed to see how efficiently his lungs work at various pressures. The movement of blood through his body will be followed as a check on the contraction and relaxation of his blood vessels.

Outside the chamber, the watching doctors will see a picture story of the candidate's life processes in action. They will be able to evaluate the reports transmitted from the chamber, to see if some organs are working too hard, to see if integration between the brain, heart, lungs and circulation is all it should be.

By the time he steps out of the chamber, the candidate won't have a physical secret left; of the original 1,000 only 120 men and women will remain. And the chamber tests may disclose a few psychological secrets, too.

Psychology is an extremely important consideration in weighing a candidate's ability to cope with life in space. An individual living in the confinement of a rocket ship or space station experiences many emotional strains: the confusing absence of familiar guidepoints, like the horizon, to show him what position he's in (there's no vertical or horizontal in space); the tremendous monotony of empty scenery and cramped quarters; the irritating presence of the same few people over long periods; mental fatigue caused by the need for constant, unrelenting alertness to the problems of a completely new environment.

Can harassed modern man endure the additional mental stresses of space life?

He can, according to Dr. Donald W. Hastings,

U.S.A.F.

Maj. "Chuck" Yeager, first man to be weightless, found experience confusing

a new method lets us experience weightlessness. Cosmic radiation? Nothing to fear

the top Air Force consultant on psychiatric problems. Some men will do better than others, though, and we'll want the best of the lot. We'll get them by putting each candidate through an exhaustive psychiatric check, probing into his subconscious (possibly with the aid of harmless drugs and hypnosis), and testing him for such characteristics as ingenuity, intelligence, judgment and courage.

When our psychiatrists and psychologists finish with the candidates, the 120 survivors of the physical tests will have been whittled down to 60.

Even so, no test psychologists can devise will measure adequately an individual's ability to adjust to the one remaining problem of space: weightlessness.

A space vehicle or space platform traveling around the earth at a certain distance and speed (1,075 miles and 15,840 miles an hour, for example) will exactly counterbalance the effect of the earth's gravity. Occupants of such craft will float in space. It's likely to be a disturbing experience; until crew members get used to it, they may suffer from dizziness and nausea.

Some people might never get used to it. How can we comb them out? We certainly can't simulate weightlessness on earth, can we?

No, but we can simulate at least one *effect* of weightlessness, and, using jet planes, at certain speeds we can achieve brief periods of weightlessness in the air.

Cosmic rays, X rays act alike. Normal flies like one above, heavily X-rayed, had freakish descendants below: tiny-eyed, yellow, short-winged, wingless, mottle-eyed or dark-bodied. But men won't find such heavy dosage in space

Zoologists know that when small iron filings replace the sand grains which are normally in the inner ear, or balancing organ, of a crayfish, and a magnet is held above the filings, the crayfish shows about the same kind of confusion humans can expect from weightlessness. His organ of equilibrium responds to the impulse of the magnetized filings with a wrong guess: up becomes down, and the crayfish flips onto its back. A similar experiment, both harmless and painless, might be tried on larger animals. We might learn a lot about weightlessness in humans from such research.

An Experiment in Defying Gravity

But obviously, the most effective way to judge the effect of weightlessness is to watch someone who's experiencing weightlessness. We're now able to do that, using a method devised by Dr. Heinz Haber, astronomer and physicist, who was formerly with the Air Force Department of Space Medicine. A number of men have already tried Haber's method, and have defied gravity for periods of up to 30 seconds. Here's how it's done:

A cannon shell is weightless from the moment it leaves the muzzle until the instant it strikes the target. Haber proposed imitating the arc of a shell with an airplane.

Air Force Major Charles Yeager tried it. Yeager, the first man to fly faster than sound, went up in a jet trainer and put it into a long dive, to pick up speed. Then he pulled up and pushed over into a roller-coaster arc, to simulate a shell's flight. From the moment he started the arcing trajectory, he was weightless. A pencil lying on the jet's instrument panel rose majestically into the air and hovered there, providing Yeager with a course indicator. (When the freely floating pencil rose too high, Yeager adjusted his flight to keep the pencil stationary; in that way, he was able to stay within the weightless arc.)

How did it feel?

Strange, Yeager reported. First there was a falling sensation, but that didn't bother him much, since he was securely fastened to his seat. But then his head began to "grow thick," and he had trouble orienting himself. A few seconds later, he had the impression that he was spinning around slowly; he couldn't say in what direction. It was, he said, like sitting on a big ball which was slowly rotating in all directions at once. After 15 seconds, thoroughly confused, he pulled out of the arc.

Several other men have tried the Haber method since Yeager's attempt. Some have been weightless for half a minute—and none have reported the effects that disturbed Yeager. Their solution: by staring at a fixed point on the plane's instrument panel, they keep a sense of balance and perspective. Additional flights, under controlled conditions, should supply more answers to the problem of weightlessness—especially if they're made in one of the latest experimental rocket models. If the Navy's rocket-propelled Douglas Skyrocket, our fastest plane, were used for such an experiment, weightlessness could be achieved for almost a minute and a half.

There's just one more possible psychological hazard to space travel: an unreasoning fear of cosmic radiation. The simplest answer is to give our space candidates a complete course in cosmic rays, to prove that they need not be afraid.

Theoretically, cosmic rays are capable of doing the same kind of delayed damage to humans as that done by X rays or radium or atomic-bomb rays: a person who absorbed too great a dosage might produce strange physical changes—or mutations—in his descendants.

But the damage is insignificant unless we absorb an overdose. About 25 years ago, massive doses of X rays were administered to a species of fruit fly which breeds so rapidly an entire generation can be produced in a few weeks. Within a short time, weird freaks turned up among certain of the descendants—some without eyes, others with strangely shaped wings and legs, or with legs where their feelers should be, or with unusual coloration. These mutations were passed on to later generations, proving that the damage had been permanent.

The fruit-fly tests were dramatic and, to many people, fearsome. They should not have been. It wasn't easy to produce the freakish insects. Of hundreds of flies subjected to massive X-ray doses, only a relative few passed on marked changes to their offspring, and it sometimes took generations of breeding to turn out a real monster. Even






PHOTOGRAPHS BY INDIANA UNIVERSITY

ROLF KLEP

One expert checked cosmic-ray intensity 53 miles up

genes which sustain a near-killing dose of radiation seldom produce outlandish abnormalities. Changes, yes; freaks, rarely. Dr. Hermann J. Muller, one of the world's outstanding authorities on the subject, puts it this way: If a human were exposed to all the radiation his system could stand, enormous numbers of his descendants would have to be closely examined before a single really abnormal person turned up.

How much cosmic radiation would a man absorb in space?

The Air Force is conducting experiments to help answer that question, sending fruit flies aloft in balloons to altitudes between 50,000 and 100,000 feet. But even now we know the answer in general terms. Last year, Dr. James A. Van Allen led an expedition to the waters off Greenland for the Office of Naval Research to measure the intensity of cosmic radiation over the polar area, where the earth's magnetism attracts an especially high concentration of the electrically charged particles. Small plastic balloons were sent aloft from the Coast Guard cutter Eastwind with slender rockets suspended beneath them. After 55 minutes, timing devices launched the rockets, and Geiger counters on each rocket measured cosmic intensity all the way up to 53 miles.

The greatest concentration—about 170 particles per second striking an area the size of a man's hand—was found at altitudes between 14 and 25 miles. There are sure to be more particles than that at a great distance from the earth, because the earth itself shielded Van Allen's Geiger counter from particles which might otherwise have struck from below. Van Allen estimates, on the basis of his findings, that a three-inch square 1,000 miles above the earth might be struck by about 700 cosmic particles a second.

Is that a dangerous intensity? Far from it. A man could absorb such a concentration for as long as six years in a row without appreciable harm. The X-ray doses used on the fruit flies were equivalent to millions of particles, administered all at once.

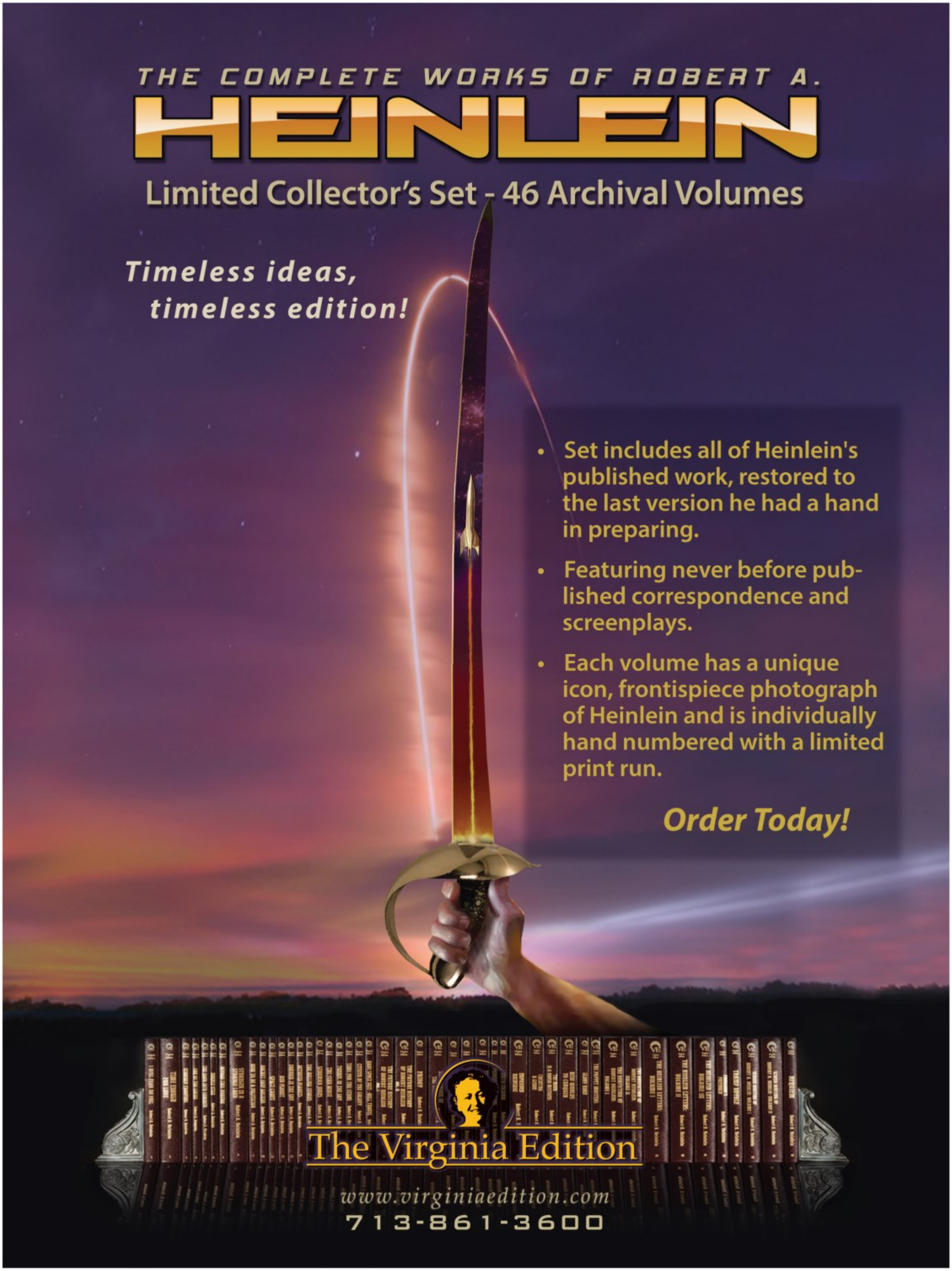
So, the 60 candidates now left of the original 1,000, armed with the facts on cosmic radiation, will know they have little to fear on that score.

But some tests lie ahead. The 60 are ready for training now—training in methods of withstanding acceleration shocks, training in group procedures within a sealed cabin, in navigation, and in personal locomotion in space. By the time the candidates have finished that instruction, there will be only five left.

U.S. NAVY PHOTO

Left: high-altitude cosmic-ray tests were carried on from Coast Guard cutter Eastwind by launching balloons which set off rockets aloft. Above: preparing rocket-firing mechanism

Next Week **In a big hangar, a cage whirls around like a bucket on the end of a string; inside sits a man, his face sagging, his body under heavy pressure—but his mind working swiftly. In the next room, a space-suited figure is seated atop a slender pole with a gunlike instrument in his hand; as he pulls the trigger, he cartwheels, spins, gyrates crazily. What are they doing? They're training for the toughest assignments of their lives: the harsh, complicated, exacting duties of rocket crewmen preparing to conquer space**



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