Horizons

Volume 39
Issue 2

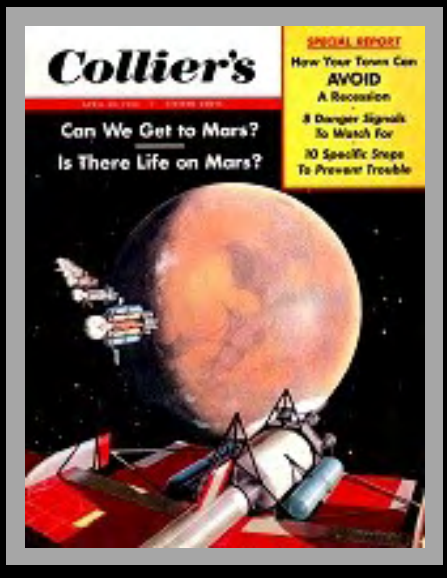
The Newsletter of AIAA Houston Section
The American Institute of Aeronautics and Astronautics

September / October 2013
www.aiaahouston.org

100 Year Starship Public Symposium

Pathway to the Stars, Footprints on Earth

Hyatt Regency Houston
September 19-22, 2013



Also, Continuing in this Issue! Part 8 of 8:
Man Will Conquer Space Soon!
(Collier's 1952-54)

Collier's 1952-54

Man Will Conquer Space Soon! (1952-54)

DOUGLAS YAZELL, EDITOR

The Horizons Collier's Team

Douglas Yazell, Editor
Scott Lowther, Aerospace Projects Review (APR)
Dr. Albert A. Jackson IV
Ron Miller, Black Cat Studios
Melvin Schuetz, bonestell.com
Frederick Ira Ordway III
John Sisson, Dreams of Space
Arthur M. Dula
Shirazi Jaleel-Khan

Quite a few more people make these articles possible, including the Horizons team listed on page 2. Thanks to all involved!

Thanks to a great team of volunteers, this issue of Horizons presents the last of the eight installments in this famous Collier's series of space articles from 1952 to 1954, *Man Will Conquer Space Soon!* This issue of Horizons is the eighth consecutive bimonthly issue used for this project. It was a big job, but we get more out of this volunteer work than we put into it.

Since Horizons is archived on two websites, these page-by-page, high-resolution reprints will always be available. The AIAA Houston Section website is www.aiaahouston.org/newslettter. Horizons is free for anyone to download at this

(Continued on page 31)

	"Man Will Conquer Space Soon!" in 8 Issues of the Weekly Magazine Collier's 1952-54	Cover Image	Page Count
1	March 22, 1952: Man Will Conquer Space Soon! What are we Waiting For? pp. 22-23, The Editors Crossing the Last Frontier, pp. 24-29, 72, 74, Dr. Wernher von Braun A Station in Space, pp. 30-31, Willy Ley The Heavens Open, pp. 32-33, Dr. Fred L. Whipple This Side of Infinity, pg. 34, Dr. Joseph Kaplan Can We Survive In Space? Pp. 35, 65-67, Dr. Heinz Haber Who Owns the Universe? Pp. 36, 70-71, Oscar Schachter Space Quiz Around the Editor's Desk, pp. 38-39	Yes	25
2	October 18, 1952: Man on the Moon Man on the Moon, p. 51, The Editors The Journey, pp. 52-58, 60, Dr. Wernher von Braun Inside the Moon Ship, pg. 56, Willy Ley	Yes	11
3	October 25, 1952: More About Man on the Moon The Exploration, pp. 38-40, 44-48, Dr. Fred Whipple & Dr. Wernher von Braun Inside the Lunar Base, pg. 46, Willy Ley	No	10
4	February 28, 1953: World's First Space Suit Man's Survival in Space, 10 Contributors & 3 Artists, edited by Cornelius Ryan pp. 40-41 Picking the Men, pp. 42-48	Yes	10
5	March 7, 1953: More About (Continuing) Man's Survival in Space Testing the Men, pp. 56-63	No	8
6	March 14, 1953: How Man Will Meet Emergency in Space Travel Concluding Man's Survival in Space: Emergency! pp. 38-44	Yes	9
7	June 27, 1953: The Baby Space Station: First Step in the Conquest of Space Baby Space Station, pp. 33-35, 40, Dr. Wernher von Braun with Cornelius Ryan	Yes	6
8	April 30, 1954: Can We Get to Mars? / Is There Life on Mars? Is There Life on Mars? pg. 21, Dr. Fred L. Whipple Can We Get to Mars? pp. 22-29, Dr. Wernher von Braun with Cornelius Ryan	Yes	10

This issue

Above: Man Will Conquer Space Soon!, a series of articles from 1952 to 1954, from the weekly magazine Collier's.
Source for most of the table: Wikipedia, Man Will Conquer Space Soon!, an article first written by John Sisson.

(Continued from page 30)

address. The AIAA national website for a Horizons archive is specified in the Editor's column on page four of every recent issue of Horizons. A username and password are probably required.

Wernher von Braun was a great American whose talents were on display as he led this Collier's team of writers, artists and editors. John Sisson (creator of the *Dreams of Space* blog) showed us that advertisement for this Collier's series, an advertisement saying that if we build that Earth-orbiting space station, "*We can guarantee peace—forever!*" I doubt that von Braun wrote that. It was probably written by an employee of the weekly magazine Collier's.

AIAA Houston Section member Dr. Albert A. Jackson IV wrote about this Collier's series in Horizons in 1992 for the 50th anniversary and in 2002 for the 60th anniversary. For the 70th anniversary, he was part of this Horizons Collier's team. Al is also a Fellow of the British Interplanetary Society and an AIAA Associate Fellow.

Horizons started this Collier's reprint series in our July / August 2012 issue. The NASA human space program suffered a cancellation of its Moon-centric *Moon, Mars and Beyond* Constellation program in February of 2010, though the Orion crew capsule was revived in April of 2010. A NASA manager speaking at an AIAA Houston Section event explained about some troubles with Orion, including the units system to be used, English or metric. He explained that commercial companies were willing to change from English to metric units as long as NASA was willing to pay for the cost of that change. DARPA and NASA/Ames created the 100 Year Starship (100YSS) program, and its first public symposium took place in Orlando, Florida, in September and October of 2011. The winning team is led by space shuttle astronaut Mae Jemison. The monetary award for 100YSS is a one-time sum which probably could not last for one year, much less 100 years, but 100YSS is doing very well so far.

Collier's 1952-54

There are many visions available now for our world's human space programs. NASA is proposing exciting missions for its human space program, such as the current Asteroid Retrieval Mission (ARM).

The Collier's series serves as an unforgettable example of *dreams of space* with one's feet firmly planted in reality.

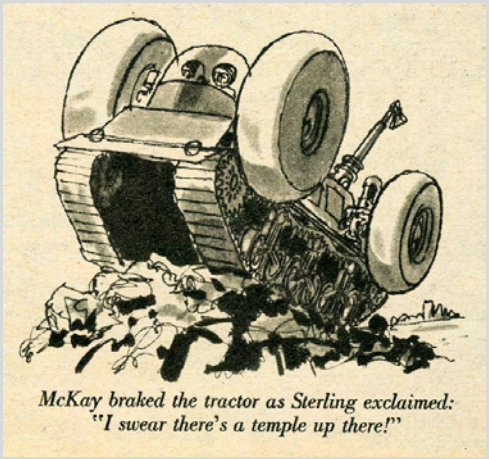
Issue 3 of 8:
The cover image
is not related to
Man Will Conquer
Space Soon!

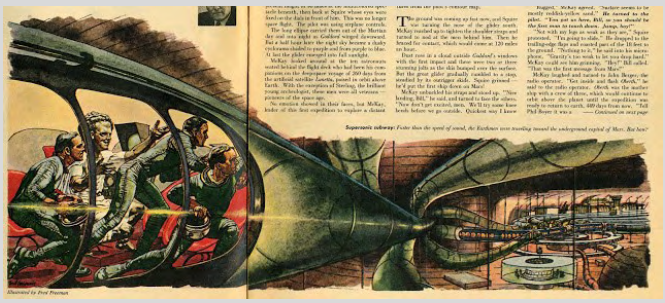
Issue 5 of 8:
The cover image
is not related to
Man Will Conquer
Space Soon!

Above: Image credits: Scott Lowther, with help from other Horizons Collier's team members.

Dreams of Space
Books & Ephemera

Non-Fiction Children's Books
about Space Flight from 1945 to 1975
http://dreamsofspace.blogspot.com/





Collier's

APRIL 30, 1954 • FIFTEEN CENTS

Can We Get to Mars?

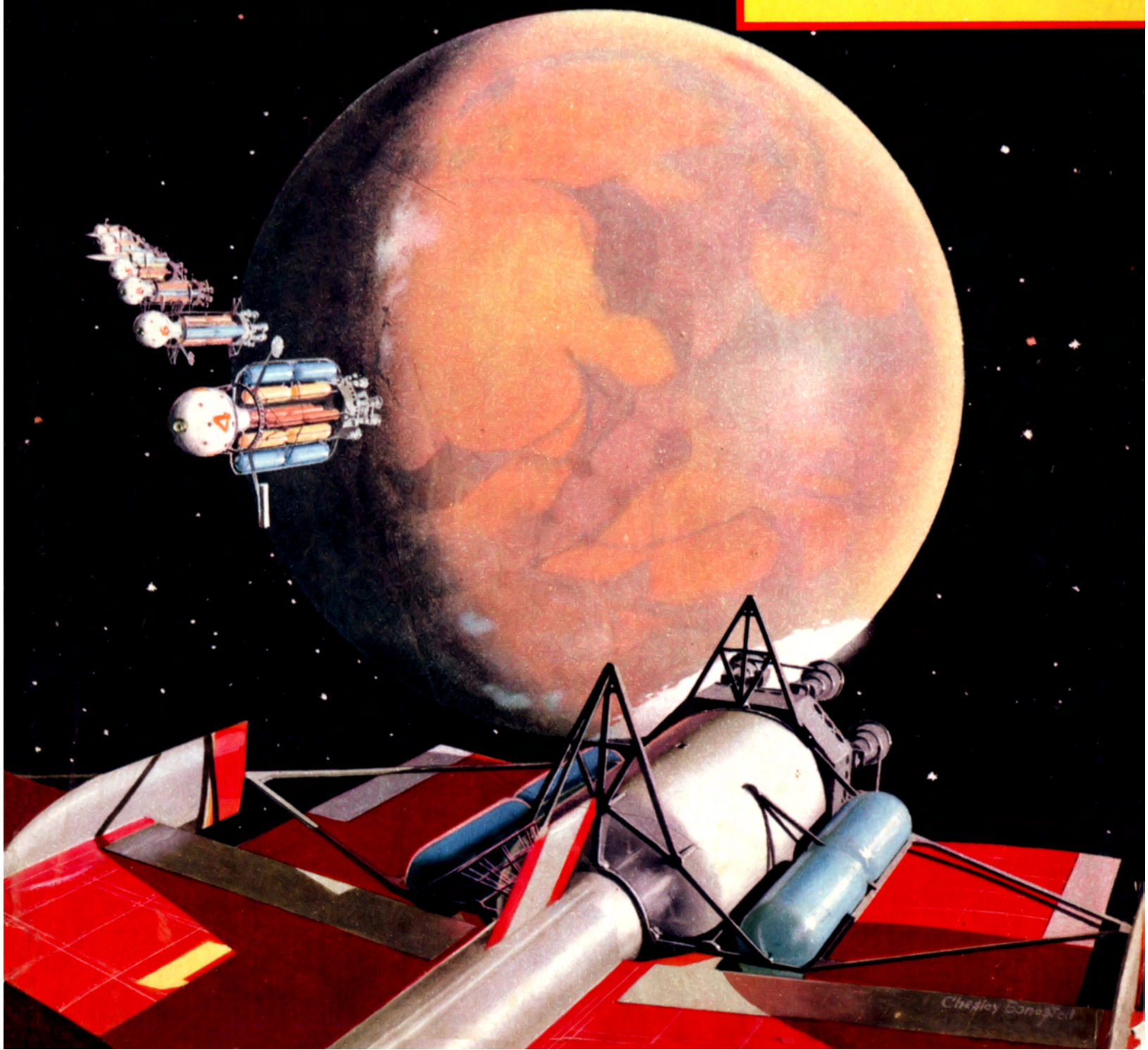
Is There Life on Mars?

SPECIAL REPORT

How Your Town Can AVOID A Recession

8 Danger Signals To Watch For

10 Specific Steps To Prevent Trouble



Collier's

APRIL 30, 1954

PUBLISHED BY THE CROWELL-COLLIER PUBLISHING CO.

CLARENCE E. STOUCH
Chairman of the Board

PAUL C. SMITH
President

ARTICLES

SPECIAL

SHORT STORIES

SERIAL

FEATURES

THE COVER . . Chesley Bonestell

From an orbit around Mars, the first visitors from the earth prepare to land on the most intriguing of our neighbor planets. The winged rocket in the foreground is preparing for the descent; the ships that remain, all cargo carriers, will stay in the orbit. When will this visit occur—and what will it uncover? Leading scientists give the answers in a special nine-page report, starting on page 21

The characters in all stories and serials in this magazine are purely imaginary. No reference or allusion to any living person is intended.

SUBSCRIPTION DEPARTMENT
204 West High Street, Springfield, Ohio

EDITORIAL and EXECUTIVE OFFICES
640 Fifth Avenue, New York 19, N.Y.

COLLIER'S, Vol. 133, No. 9.

PUBLISHED every other week by The Crowell-Collier Publishing Company, Springfield, Ohio, U.S.A., Publishers of Collier's, Woman's Home Companion, The American Magazine. Executive and Editorial Offices, 640 Fifth Avenue, New York 19, N.Y. Clarence E. Stouch, Chairman of the Board; Paul C. Smith, President; T. L. Brantly, Peter J. Dennerlein, Edward Anthony, E. P. Seymour, John W. McPherrin, Wm. A. Sittig, William A. H. Birnie, Shepard Spink, C. F. Norsworthy, Vice-Presidents; Denis O'Sullivan, Secretary; E. J. McCaffrey, Treasurer.

TITLE "COLLIER'S" Reg. U.S. Pat. Off.

SUBSCRIPTION PRICES: United States and Possessions, also Canada, 1 year (26 issues) $3.50; 2 years (52 issues) $6.00; 3 years (78 issues) $8.00; 4 years (104 issues) $10.00. All other countries, 1 year $7.00. Payments from foreign countries, except Canada, must be in United States funds.

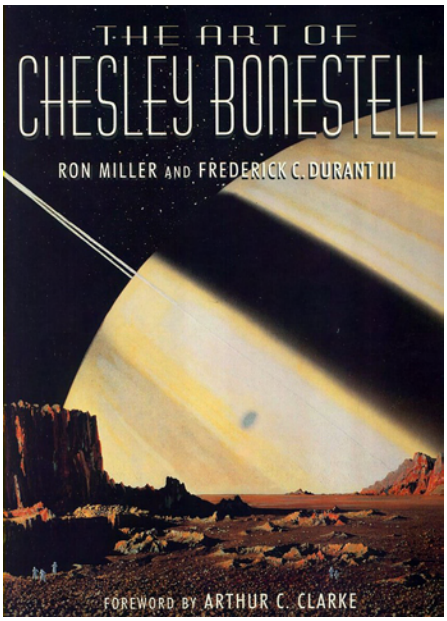
ADDRESS all subscriptions and correspondence to The Crowell-Collier Publishing Company, Springfield, Ohio.

ENTERED as second-class matter at the Post Office, Springfield, Ohio, under Act of March 3, 1879. Authorized as second-class mail. Post Office Department, Ottawa, Canada.

MANUSCRIPTS or art submitted to Collier's should be accompanied by addressed envelopes and return postage. The Publisher assumes no responsibility for return of unsolicited manuscripts or art.

CHANGE OF ADDRESS should reach us five weeks in advance of the next issue date. Give both the old and new addresses.

THE CROWELL-COLLIER PUBLISHING COMPANY
Publishers of COLLIER'S, THE AMERICAN MAGAZINE, WOMAN'S HOME COMPANION



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

A Chesley Bonestell Space Art Chronology

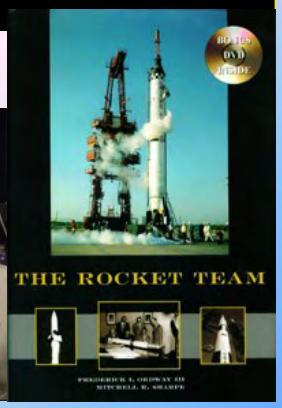
Melvin H. Schuetz

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

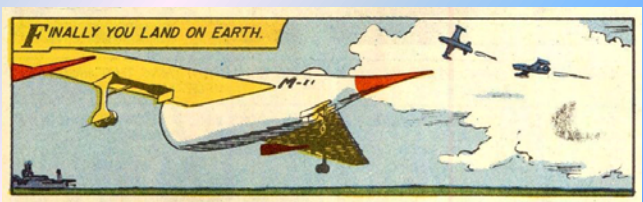
Non-Fiction Children's Books about Space Flight from 1945 to 1975

http://dreamsofspace.blogspot.com/

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.



Afterword about the Collier's Spaceflight Series

By Dr. A. A. Jackson, October 30, 2013

Before the 1952-1954 Collier's series was finished, there appeared the book, *Across the Space Frontier*, Ryan, Cornelius, (Ed.); Kaplan, Joseph; von Braun, Wernher; Ley, Willy; Whipple, Fred L.; Haber, Heinz; Schacter, Oscar, illustrated by Chesley Bonestell, Fred Freeman, Rolf Klep, published by The Viking Press, 1952. And the book, *Conquest of the Moon*, Wernher von Braun, Willey Ley, Fred Whipple, illustrated by Chesley Bonestell, Fred Freeman, Rolf Klep, publisher: Viking Press, 1953.

These books were dynamite to my 13-year-old mind. I still have my copies of the first printings.

Only many years later (like 50 years later) did it occur to me that the Viking Press series was quite subpar. The books are of fair to middling manufacture. Especially in that the paintings and illustrations are all on plain paper. Bonestell art demands enameled paper. The books are interesting because they contain some expansion and elaboration of the prose material in the Collier's series.

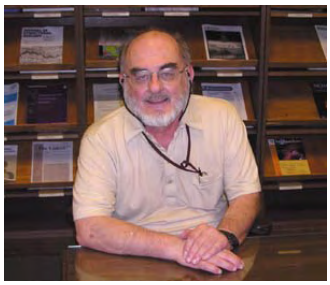
Then came, *The Exploration of Mars*, Ley, Willy; Wernher Von Braun, published by Viking, 1956 (a much better-manufactured book).

But! I wondered what became of *Can We Get to Mars? / Is There Life on Mars?* Collier's (1954). *The Mars Project* by von Braun was written in 1948. A shortened version was published in German in 1952 and in English in 1953 and was the motivation for Cornelius Ryan's Collier's series. The 1954 Collier's issue, which was first popular realization of the 1948 manuscript, never appeared as a book. In 2005 *The Mars Project* version that contained von Braun's novel did appear, alas without von Braun's excellent popularization in the 1954 issue of Collier's. With the Walt Disney television series in 1955, von Braun had changed his mind about the Mars Expedition and scaled it back.

With my complete collection (eight issues of the magazine from that two-year period) of the Collier's spaceflight series, I thought, for about 20 years, why?! Why didn't anyone ever publish the whole Collier's series? So much is missing is missing from the Viking Press books… some of Bonestell's paintings, a bunch of Fred Freeman's illustrations and paintings. Also never reprinted in book form: most of the exposition in the issues about spacesuits, simulation instruction and emergency training using the escape capsules and space medicine.

Books covering the rest of the material were never produced. Here we have, thanks to Douglas Yazell and his efforts, we have the complete series, reprinted page by page using high resolution. *[Thanks also go to our volunteers in Houston, around the USA, and around the world.]* Special thanks go to Scott Lowther for his work, including supplying most the original magazine issues, and Art Dula for work relating to the copyright status of the Collier's series.

The Collier's spaceflight series was unique and influential, and now, finally, accessible on the Web.



Dr. A. A. Jackson, Visiting Scientist at the Lunar and Planetary Institute (LPI). Image credit: LPI.

COLLIER'S CREDITS..

GILLOON AGENCY

Wernher von Braun, Ryan

THE name Dr. Hubertus Strughold will ring a bell with readers who recall our symposium on Man's Survival in Space (Collier's, February 28, 1953), of which the doctor, head of the Department of Space Medicine at Randolph Field, Texas, was a member. We Credit him now because Dr. Wernher von Braun and staffer Cornelius Ryan found much relevant information in Dr. Strughold's book, The Green and Red Planet (University of New Mexico Press), when our writing team tackled the discussion of a 355,000,-000-mile journey to Mars.

Dr. Strughold's thesis is perhaps more easily assimilated than Dr. Wernher von Braun's authoritative volume, The Mars Project (University of Illinois Press), because it does not contain such formulas as Dr. von Braun's

$$\dot{v} = \frac{F_1 + A_{a,1}(p_{a,1} - p_a) - c_D \cdot A_1 v^2 \gamma / 2 g_0}{1/g_0 \, (W_{a,1} - W_1 \cdot t)} - g_0 \cos \vartheta \quad (4.1)$$

for "the ascent track" of a space ship. But friend Wernher's scientific books are not particularly intended for your library or ours, and anyway that's where "Connie" Ryan comes in—to give you the facts in nontechnical verbiage.

The Mars story begins on page 21 and will comprise part of the third book on space travel that Cornelius Ryan has edited since Collier's began to explore the subject two years ago.

★ ★ ★

EFFORTS to improve American schooling long ago became a permanent agendum on our editorial calendar, which is why, when we were casting about for a quick and comparatively inexpensive answer to the current shortage of schoolroom facilities, we consulted The Architects Collaborative, of Cambridge, Massachusetts. This eight-member partnership is inspired by seventy-year-old Walter Gropius, whose architectural achievements cover every kind of service and design man can dream about. Well equipped by experience and imagination, the Collaboratives co-operated with Collier's in detailing the plans for the modern school plant we sponsor in this issue.

Credits to the hard-working team (identified below)—and a special one for Mr. Gropius for having recently received in Brazil the Grand Prix International d'Architecture (Premio São Paulo) from the hands of President Getulio Vargas in the presence of the diplomatic corps.

★ ★ ★

SPEAKING of schools, we have proud and selfish reasons for mentioning a Creditable new magazine called Omnibus. Vol. 1, No. 1 of this fat (53-page) periodical, jammed with articles, stories, drawings and advertisements, was produced on a duplicating machine by sixth-grade students in Oceanlake, Oregon. Preliminary work on the project included a thorough study of seven leading magazines by the editors, who finally "decided to use Collier's as a model because it has so many different kinds of features." The youthful staff regretted the lack of a Letters department, but explained logically that it was their first issue and no mail was at hand. Typical Omnibus cartoon: on the sidewalk one flea asks another, "Shall we walk or take a dog?" The last (editorial) page Omnibusly warned: "Let Collier's look to their laurels . . . There's only room at the top for one and we won't quit until we are there!" Respectful note to the Omnibus staff: Confronted by this spirit of competition, we shall indeed do as you advise. P.S. Perhaps this item will find a place in your indubitably now flourishing Letters column.

—GURNEY WILLIAMS

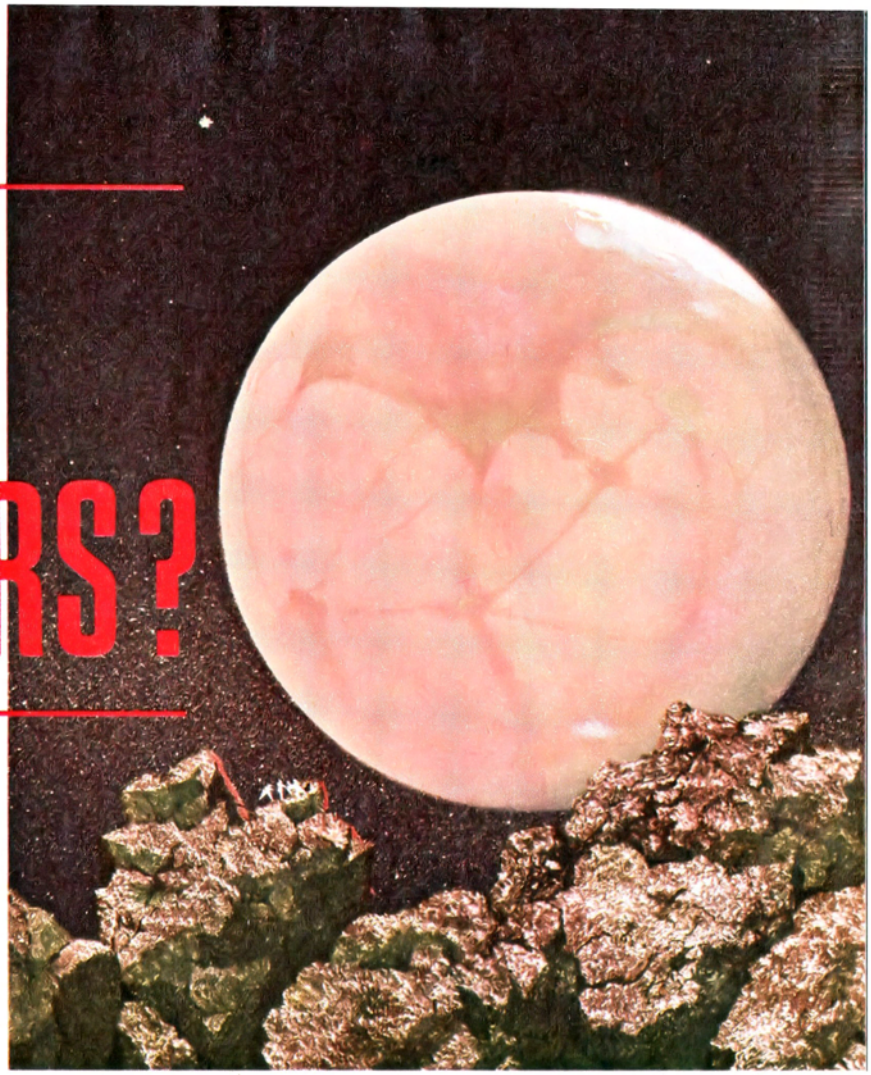
SAMUEL ROSENBERG

The designers of the Collier's school included this architectural team: Benjamin Thompson, Sarah Harkness, Norman Fletcher, Chester Nagel, Walter Gropius, Jean B. Fletcher, John C. Harkness, Louis A. McMillen

Collier's for April 30, 1954

Collier's, April 30, 1954

IS THERE LIFE ON MARS?



By DR. FRED L. WHIPPLE

Chairman, Department of Astronomy, Harvard University

Astronomers—planning to give the great red planet its closest scrutiny in history this summer—are nearer than ever before to answering the most fascinating question of all

ON JULY 2d, the planet Mars, swinging through its lopsided orbit around the sun, will be closer to the earth than at any time since 1941. All over the world, scientists will train batteries of telescopes and cameras on the big red sphere in history's greatest effort to unravel some of the mystery surrounding this most intriguing of the planets.

Next to Venus, Mars is our closest planetary neighbor. Even so, it will be 40,000,000 miles away as it passes by this summer (compared to 250,000,000 miles at its farthest point from the earth); on the most powerful of telescopes it will look no larger than a coffee saucer. Still, it will be close enough to provide astronomers important facts about its size, atmosphere and surface conditions—and the possibility that some kind of life exists there.

We already know a great deal.

Mars's diameter is roughly half the size of the earth. The Martian day is 24 hours, 37 minutes long, but its year is nearly twice as long as ours—670 Martian days. During daylight hours, the temperature on Mars shoots into the eighties, but at night a numbing cold grips the planet: the temperature drops suddenly to 95 below zero, Fahrenheit.

There is no evidence of oxygen in Mars's thin blue atmosphere. Moreover, its atmospheric pressure is so low that an earth man couldn't survive without a pressurized suit. If life of any kind does exist on Mars it must be extremely rugged.

Through the telescope, astronomers can clearly see Mars's great reddish deserts, blue-tinted cloud formations and—especially conspicuous—its distinctive polar caps.

The Martian polar caps cover about 4,000,000 square miles in the wintertime—an area roughly half the size of the North American continent. But as they melt in spring, strange blue-green areas develop near their retreating edges. Some months later these color patches, now covering great areas of the planet's surface, turn brownish. Finally in the deep of Martian winter they're a dark chocolate color. Do these seasonal color variations indicate some sort of plant or vegetable life? That's one of the riddles we'd like to solve.

There's another big question mark: Mars's so-called canals. Although most modern astronomers have long since discounted the once popular theory that the faint tracings seen by some on Mars are actually a network of waterways (and, therefore, perhaps constructed by intelligent beings), we still don't know what they are—or if they exist at all.

The "canals" have had a controversial history. They were first reported in 1877 by an Italian astronomer named Giovanni Schiaparelli who said he had seen delicate lines tracing a gridlike pattern over vast areas of the planet. He called them *canali*—"canals" or "channels."

Since Schiaparelli, many astronomers (especially Dr. Percival Lowell, who established an observatory for the primary purpose of studying Mars) have reported observing the delicate veinlike lines. Others, just as keen-sighted, have spent years studying the Martian face without once seeing the disputed markings.

This year we may get an opportunity to clear up the canal confusion once and for all. An American team, sponsored jointly by the National Geographic Society and Lowell Observatory, will photograph Mars from Bloemfontein, South Africa, where Mars will appear almost directly overhead nightly during early July. The U.S. team, using new photographic techniques and the latest in fast film emulsions, expects to get the most detailed photographs of the planet yet obtained.

But great as the 1954 Mars observation program promises to be, it's only the curtain raiser for 1956, when Mars will approach to within 35,000,000 miles of the earth. Not for another 15 years, in 1971, will it be so close again.

When all the findings have been evaluated we may be able to make some intelligent guesses as to the possibility of life on Mars. Chances are that bacteria are the only type of animal life which could exist in the planet's oxygenless atmosphere. There also may be some sort of tough, primitive plant life—perhaps lichens or mosses which produce their own oxygen and water. Such plants might explain the changing colors of the Martian seasons.

There's one other possibility.

How can we say with absolute certainty that there isn't a *different* form of life existing on Mars—a kind of life that we know nothing about? We can't. There's only one way to find out for sure what is on Mars—and that's to go there. ▲▲▲

Rocket expert Dr. Wernher von Braun discusses the problems of a trip to Mars on the pages that follow

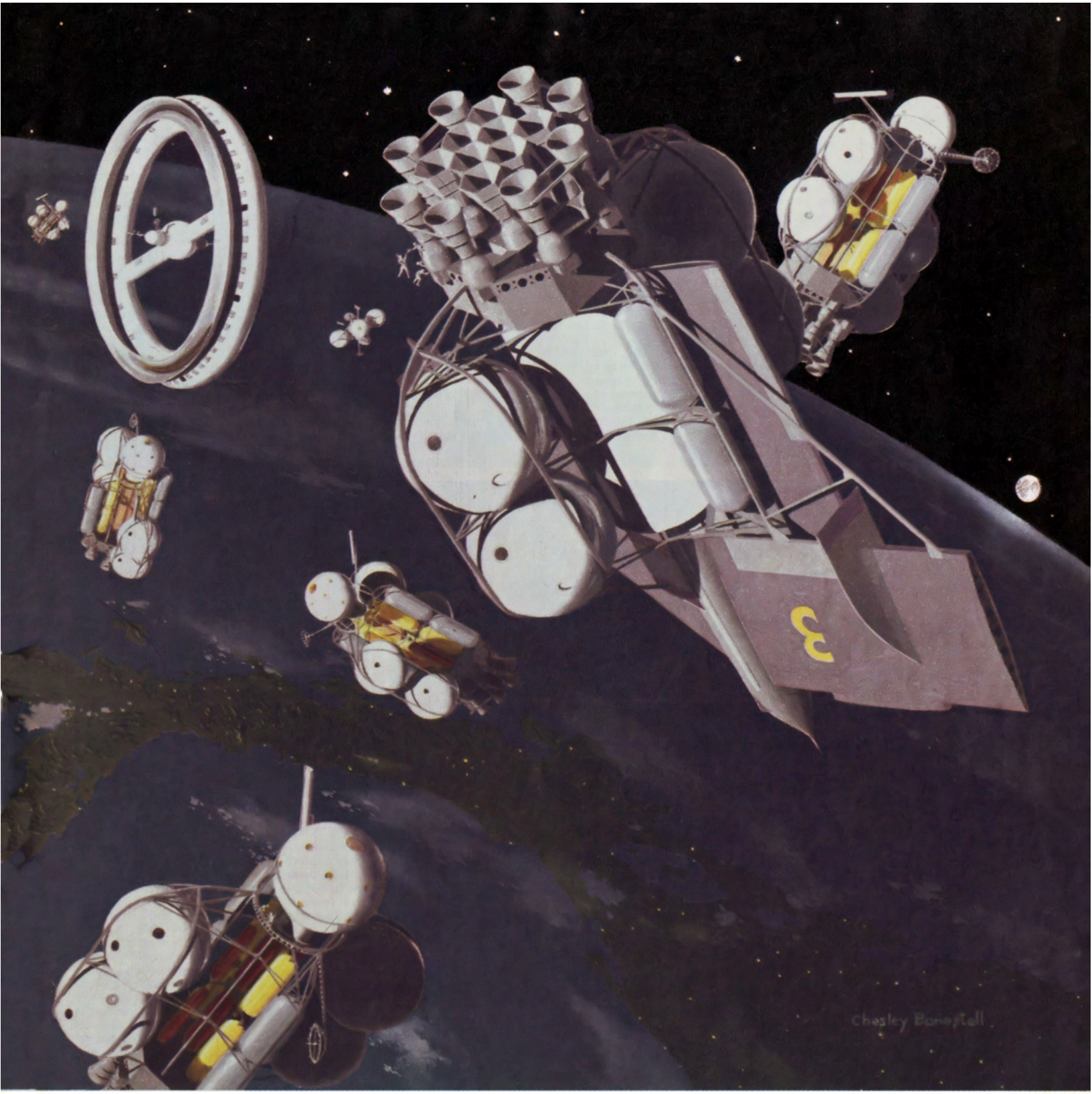
Near wheel-shaped space station 1,000 miles from the earth, built especially for assembly of the Mars expedition, weightless workers put together

Can We Get to MARS?

By DR. WERNHER von BRAUN with CORNELIUS RYAN

Chief, Guided Missile Development Division, Redstone Arsenal, Huntsville, Alabama

Man's trail-blazing journey to Mars will be a breath-taking experience—with problems to match



CHESLEY BONESTELL

the 10 rocket ships required for the flight. Three of the huge space craft have torpedo noses which convert to planes for landing on the planet

THE first men who set out for Mars had better make sure they leave everything at home in apple-pie order. They won't get back to earth for more than two and a half years.

The difficulties of a trip to Mars are formidable. The outbound journey, following a huge arc 355,000,000 miles long, will take eight months—even with rocket ships that travel many thousands of miles an hour. For more than a year, the explorers will have to live on the great red planet, waiting for it to swing into a favorable position for the return trip. Another eight months will pass before the 70 members of the pioneer expedition set foot on earth again. All during that time, they will be exposed to a multitude of dangers and strains, some of them impossible to foresee on the basis of today's knowledge.

Will man ever go to Mars? I am sure he will—but it will be a century or more before he's ready. In that time scientists and engineers will learn more about the physical and mental rigors of interplanetary flight—and about the unknown dangers of life on another planet. Some of that information may become available within the next 25 years or so, through the erection of a space station above the earth (where telescope viewings will not be blurred by the earth's atmosphere) and through the subsequent exploration of the moon, as described in previous issues of Collier's.

Even now science can detail the technical requirements for a Mars expedition down to the last ton of fuel. Our knowledge of the laws governing the solar system—so accurate that astronomers can predict an eclipse of the sun to within a fraction of a second—enables scientists to determine exactly the speed a space ship must have to reach Mars, the course that will intercept the planet's orbit at exactly the right moment; the methods to be used for the landing, take-off and other maneu-

vering. We know, from these calculations, that we already have chemical rocket fuels adequate for the trip.

Better propellants are almost certain to emerge during the next 100 years. In fact, scientific advances will undoubtedly make obsolete many of the engineering concepts on which this article, and the accompanying illustrations, are based. Nevertheless, it's possible to discuss the problems of a flight to Mars in terms of what is known today. We can assume, for example, that such an expedition will involve about 70 scientists and crew members. A force that size would require a flotilla of 10 massive space ships, each weighing more than 4,000 tons—not only because there's safety in numbers, but because of the tons of fuel, scientific equipment, rations, oxygen, water and the like necessary for the trip and for a stay of about 31 months away from earth.

All that information can be computed scientifically. But science can't apply a slide rule to man; he's the unknown quantity, the weak spot that makes a Mars expedition a project for the far distant, rather than the immediate, future. The 70 explorers will endure hazards and stresses the like of which no men before them have ever known. Some of these hardships must be eased—or at least better understood—before the long voyage becomes practical.

For months at a time, during the actual period of travel, the expedition members will be weightless. Can the human body stand prolonged weightlessness? The crews of rocket ships plying between the ground and the earth's space station about 1,000 miles away will soon grow accustomed to the absence of gravity—but they will experience this odd sensation for no more than a few hours at a time. Prolonged weightlessness will be a different story.

Over a period of months in outer space, muscles accustomed to fighting the pull of gravity could shrink from disuse—just as do the muscles of people who are bedridden or encased in plaster casts for a long time. The members of a Mars expedition might be seriously handicapped by such a disability. Faced with a rigorous work schedule on the unexplored planet, they will have to be strong and fit upon arrival.

The problem will have to be solved aboard the space vehicles. Some sort of elaborate spring exercisers may be the answer. Or perhaps synthetic gravity could be produced aboard the rocket ships by designing them to rotate as they coast through space, creating enough centrifugal force to act as a substitute for gravity.

Far worse than the risk of atrophied muscles is the hazard of cosmic rays. An overdose of these deep-penetrating atomic particles, which act like the invisible radiation of an atomic-bomb burst, can cause blindness, cell damage and possibly cancer.

Scientists have measured the intensity of cosmic radiation close to the earth. They have learned that the rays dissipate harmlessly in our atmosphere. They also have deduced that man can safely venture as far as the moon without risking an overdose of radiation. But that's a comparatively brief trip. What will happen to men who are exposed to the rays for months on end? There is no material that offers practical protection against cosmic rays—practical, that is, for space travel. Space engineers could provide a barrier by making the cabin walls of lead several feet thick—but that would add hundreds of tons to the weight of the space vehicle. A more realistic plan might be to surround the cabin with the fuel tanks, thus providing the added safeguard of a two- or three-foot thickness of liquid.

The best bet would seem to be a reliance on man's ingenuity: by the time an expedition from the earth is ready to take off for Mars, perhaps in the mid-2000s, it is quite likely that researchers will have perfected a drug which will enable men to endure radiation for comparatively long periods. Unmanned rockets, equipped with instruments which send information back to earth, probably will blaze the first trail to our sister planet, helping to clear up many mysteries of the journey.

FRED FREEMAN

Small Meteors Could Do Little Damage

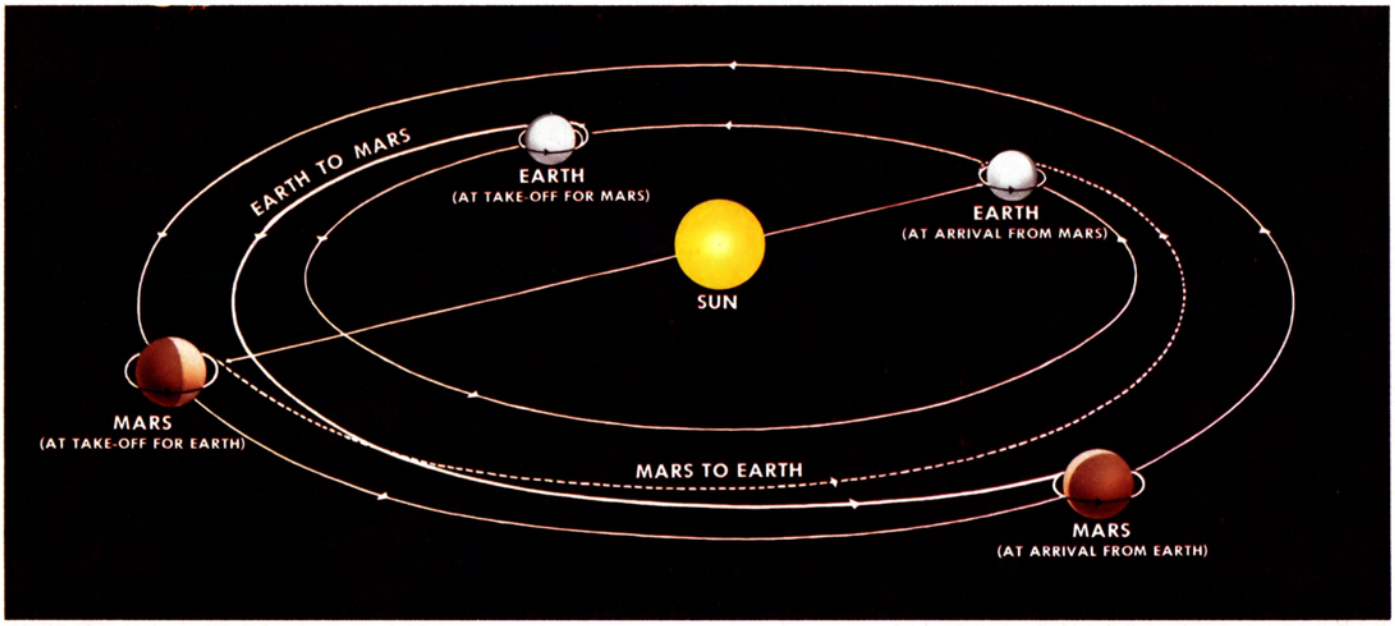
Meteors, for example. Many billions of these tiny bullets, most of them about the size of a grain of sand, speed wildly through space at speeds of more than 150,000 miles an hour. For short trips, we can protect space ships from these lightning-fast pellets by covering all vital areas—fuel tanks, rocket motors, cargo bins, cabins and the like—with light metal outer shields called meteor bumpers. The tiny meteors will explode against this outer shell, leaving the inner skin of the ship—and the occupants—unharmed.

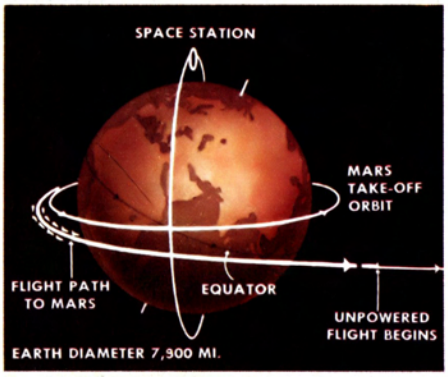
But in the 16 months of space travel required for a visit to Mars, much larger projectiles might be encountered. Scientists know that the density of large meteors is greater near the red planet than it is around the earth. If, by some chance, a rock the size of a baseball should plow through the thin shell of one of the rocket ships it could do terrible damage—especially if it struck a large, solid object inside. A meteor that size, traveling at terrific speed, could explode with the force of 100 pounds of TNT. In the cabin of a space vehicle, such an explosion would cause tremendous destruction.

Fortunately, meteors that size will be extremely rare, even near Mars.

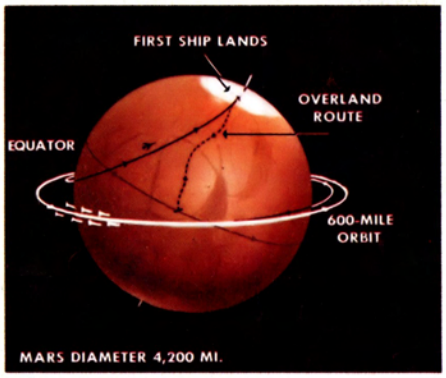
Dime-sized chunks are more likely to be encountered. They will be a danger, too, although not so bad as the larger rocks. They'll rip through the bumper and skin like machine-gun bullets. If they strike anything solid, they'll explode with some force. If not, they'll leave through the other side of the ship—but even then they may cause trouble. Holes will have to be plugged to maintain cabin pressure. The shock wave created by the meteors' extreme speed may hurt the ship's occupants: there will be a deafening report and a blinding flash; the friction created by their passage through the cabin atmosphere will create enough heat to singe the

Illustration shows how the landing planes are assembled in 600-mile Martian orbit. Pointed noses are removed from three of 10 ships that made trip from earth; wings and landing gear are fitted to them. Cutaway of plane in the foreground shows personnel, tractors in ship





Top diagram shows positions of earth and Mars at times of arrival and departure, and routes followed in both directions. Drawing at left depicts take-off maneuver from an orbit 1,000 miles above earth's equator (note polar orbit of original earth space station, which might be built within next 15 or 20 years). Mars vehicles cut power 5,700 miles from the earth and coast rest of the way through space. At right, fleet of 10 rocket ships approaches to within about 600 miles of Mars, establishes itself in orbit and launches first of three landing planes toward Martian polar area for snow landing. After landing, advance party abandons plane and travels on tractors 4,000 miles to equator, where it prepares a landing strip for expedition members in other planes



ROLF KLEP

eyebrows of a man standing close by. And, of course, a person in the direct path of a pebble-sized meteor could be severely injured. A fragile piece of machinery could be destroyed, and it's even possible that the entire rocket ship would have to be abandoned after sustaining one or more hits by space projectiles that size (astronomers estimate that one out of 10 ships on a 16-month voyage might be damaged badly, although even that is unlikely).

If one of the Mars-bound vehicles does suffer serious damage, the incident needn't be disastrous. In a pinch, a disabled space vehicle can be abandoned easily. All of the ships will carry small self-propelled craft—space taxis—which are easily built and easily maneuvered. They will be fully pressurized, and will be used for routine trips between the ships of the convoy, as well as for emergencies. If for some reason the space taxis aren't available to the occupants of a damaged ship, they will be able to don pressurized suits and step calmly out into space. Individual rocket guns, manually operated, will enable each of them to make his way to the nearest space ship in the convoy. Space-suited explorers will have no difficulty traveling between ships. There's no air to impede motion, no gravitational pull and no sense of speed. When they leave their ship the men will have to overcome only their own inertia. They'll be traveling through the solar system at more than 70,000 miles an hour, but they will be no more aware of it than we on earth are aware that every molecule of our bodies is moving at a speed of 66,600 miles an hour around the sun.

Science ultimately will solve the problems posed by cosmic rays, meteors and the other natural phenomena of space. But man will still face one great hazard: himself.

Man must breathe. He must guard himself against a great variety of illnesses and ailments. He must be entertained. And he must be protected from many psychological hazards, some of them still obscure.

How will science provide a synthetic atmosphere within the space-ship cabins and Martian dwellings for two and a half years? When men are locked into a confined, airtight area for only a few days or weeks oxygen can be replenished, and exhaled carbon dioxide and other impurities extracted, without difficulty. Submarine engineers solved the problem long ago. But a conventional submarine surfaces after a brief submersion and blows out its stale air. High-altitude pressurized aircraft have mechanisms which automatically introduce fresh air and expel contaminated air.

There's no breathable air in space or on Mars; the men who visit the red planet will have to carry with them enough oxygen to last many months.

When Men Live Too Close Together

During that time they will live, work and perform all bodily functions within the cramped confines of a rocket-ship cabin or a pressurized—and probably mobile—Martian dwelling. (I believe the first men to visit Mars will take along inflatable, spherical cabins, perhaps 30 feet across, which can be mounted atop tractor chassis.) Even with plenty of oxygen, the atmosphere in those living quarters is sure to pose a problem.

Within the small cabins, the expedition members will wash, perform personal functions, sweat, cough, cook, create garbage. Every one of those activities will feed poisons into the synthetic air—just as they do within the earth's atmosphere.

No less than 29 toxic agents are generated during the daily routine of the average American household. Some of them are body wastes, others come from cooking. When you fry an egg, the burned fat releases a potent irritant called acrolein. Its effect is negligible on earth because the amount is so small that it's almost instantly dissipated in the air. But that microscopic quantity of acrolein in the personnel quarters of a Mars expedition could prove dangerous; unless there was some way to remove it from the atmosphere it would be circulated again and again through the air-conditioning system.

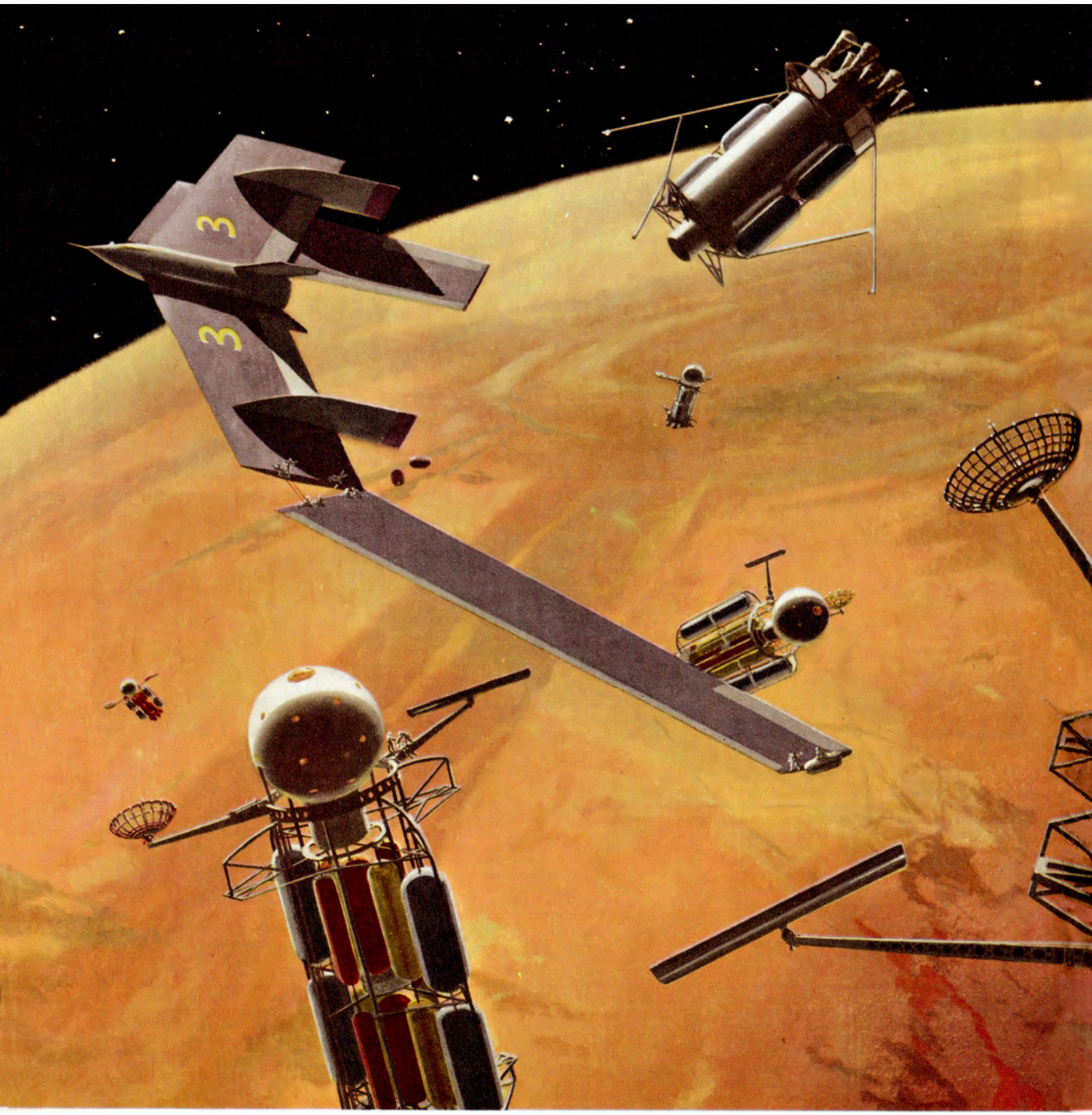
Besides the poisons resulting from cooking and the like, the engineering equipment—lubricants, hydraulic fluids, plastics, the metals in the vehicles—will give off vapors which could contaminate the atmosphere.

What can be done about this problem? No one has all the answers right now, but there's little doubt that by using chemical filters, and by cooling and washing the air as it passes through the air-conditioning apparatus, the synthetic atmosphere can be made safe to live in.

Besides removing the impurities from the man-made air, it may be necessary to add a few. Man has lived so long with the impurities in the earth's atmosphere that no one knows whether he can exist without them. By the time of the Mars expedition, the scientists may decide to add traces of dust, smoke and oil to the synthetic air—and possibly iodine and salt as well.

I am convinced that we have, or will acquire, the basic knowledge to solve all the physical problems of a flight to Mars. But how about the psychological problem? Can a man retain his sanity while cooped up with many other men in a crowded area, perhaps twice the length of your living room, for more than thirty months?

Share a small room with a dozen people completely cut off from the outside world. In a few weeks the irritations begin to pile up. At the end of



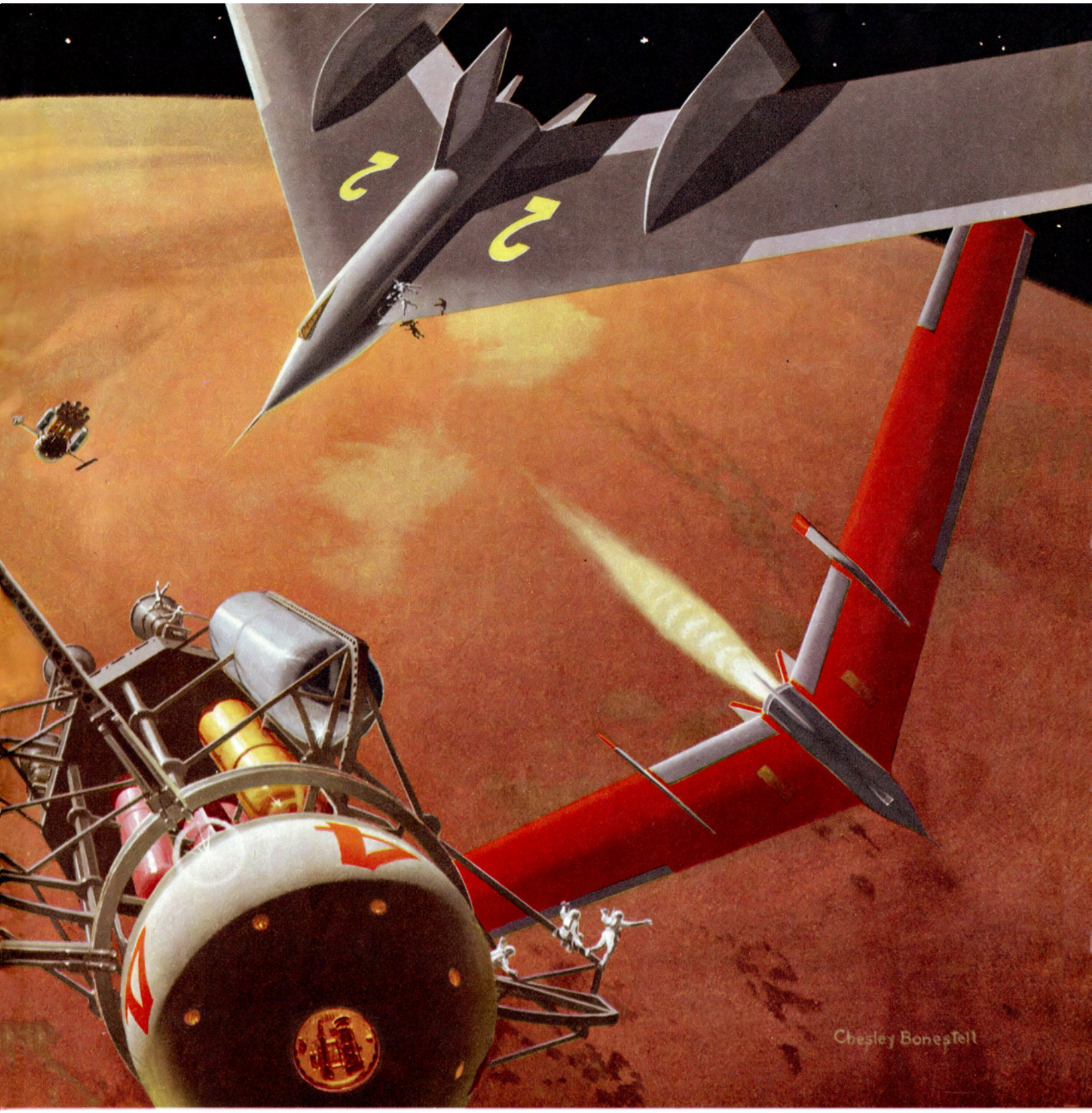
The first landing party takes off for Mars. Two other landing planes will wait until runway is prepared for them, and the remaining seven ships

a few months, particularly if the occupants of the room are chosen haphazardly, someone is likely to go berserk. Little mannerisms—the way a man cracks his knuckles, blows his nose, the way he grins, talks or gestures—create tension and hatred which could lead to murder.

Imagine yourself in a space ship millions of miles from earth. You see the same people every day. The earth, with all it means to you, is just another bright star in the heavens; you aren't sure you'll ever get back to it. Every noise about the rocket ship suggests a breakdown, every crash a meteor collision. If somebody does crack, you can't call off the expedition and return to earth. You'll have to take him with you.

The psychological problem probably will be at its worst during the two eight-month travel periods. On Mars, there will be plenty to do, plenty to see. To be sure, there will be certain problems on the planet, too. There will be considerable confinement. The scenery is likely to be grindingly monotonous. The threat of danger from some unknown source will hang over the explorers constantly. So will the knowledge that an extremely complicated process, subject to possible breakdown, will be required to get them started on their way back home. Still, Columbus' crew at sea faced much the same problems the explorers will face on Mars; the fifteenth-century sailors felt the psychological tension, but no one went mad.

But Columbus traveled only ten weeks to reach America; certainly his men would never have stood an eight-month voyage. The travelers to Mars will



CHESLEY BONESTELL

will stay in 600-mile orbit. Arms on cargo ships hold screenlike dish antennas (for communication), trough-shaped solar mirrors (for power)

have to, and psychologists undoubtedly will make careful plans to keep up the morale of the voyagers.

The fleet will be in constant radio communication with the earth (there probably will be no television transmission, owing to the great distance). Radio programs will help relieve the boredom, but it's possible that the broadcasts will be censored before transmission; there's no way of telling how a man might react, say, to the news that his home town was the center of a flood disaster. Knowing would do him no good—and it might cause him to crack.

Besides radio broadcasts, each ship will be able to receive (and send) radio pictures. There also will be films which can be circulated among the space ships. Reading matter will probably be carried in the form of microfilms to save space. These activities—plus frequent intership visiting, lectures and crew rotations—will help to relieve the monotony.

There is another possibility, seemingly fantastic, but worth mentioning briefly because experimentation already has indicated it may be practical. The nonworking members of a Mars expedition may actually hibernate during part of the long voyage. French doctors have induced a kind of artificial hibernation in certain patients for short periods, in connection with operations for which they will need all their strength (Collier's, December 11, 1953—Medicine's New Offensive Against Shock, by J. D. Ratcliff). The process involves a lowering of the body temperature, and the subsequent slowing down of all the normal physical processes. On a Mars expedition, such a procedure, over a longer

period, would solve much of the psychological problem, would cut sharply into the amount of food required for the trip, and would, if successful, leave the expedition members in superb physical condition for the ordeal of exploring the planet.

Certainly if a Mars expedition were planned for the next 10 or 15 years no one would seriously consider hibernation as a solution for any of the problems of the trip. But we're talking of a voyage to be made 100 years from now; I believe that if the French experiments bear fruit, hibernation may actually be considered at that time.

Finally, there has been one engineering development which may also simplify both the psychological and physical problems of a Mars voyage. Scientists are on the track of a new fuel, useful only in the vacuum of space, which would be so economical that it would make possible far greater speeds for space journeys. It could be used to shorten the travel time, or to lighten the load of each space ship, or both. Obviously, a four- or six-month Mars flight would create far fewer psychological hazards than a trip lasting eight months.

In any case, it seems certain that the members of an expedition to Mars will have to be selected with great care. Scientists estimate that only one person in every 6,000 will be qualified, physically, mentally and emotionally, for routine space flight. But can 70 men be found who will have those qualities—and also the scientific background necessary to explore Mars? I'm sure of it.

One day a century or so from now, a fleet of rocket ships will take off for Mars. The trip could be made with 10 ships launched from an orbit, about 1,000 miles out in space, that girdles our globe at its equator. (It would take tremendous power and vast quantities of fuel to leave directly from the earth. Launching a Mars voyage from an orbit about 1,000 miles out, far from the earth's gravitational pull, will require relatively little fuel.) The Mars-bound vehicles, assembled in the orbit, will look like bulky bundles of girders, with propellant tanks hung on the outside and great passenger cabins perched on top. Three of them will have torpedo-shaped noses and massive wings—dismantled, but strapped to their sides for future use. Those bullet noses will be detached and will serve as landing craft, the only vehicles that will actually land on the neighbor planet. When the 10 ships are 5,700 miles from the earth, they will cut off their rocket motors; from there on, they will coast unpowered toward Mars.

After eight months they will swing into an orbit around Mars, about 600 miles up, and adjust speed to keep from hurtling into space again. The expedition will take this intermediate step, instead of proceeding directly to Mars, for two main reasons: first, the ships (except for the three detachable torpedo-shaped noses) will lack the streamlining required for flight in the Martian atmosphere; second, it will be more economical to avoid carrying all the fuel needed for the return to earth (which now comprises the bulk of the cargo) all the way down to Mars and then back up again.

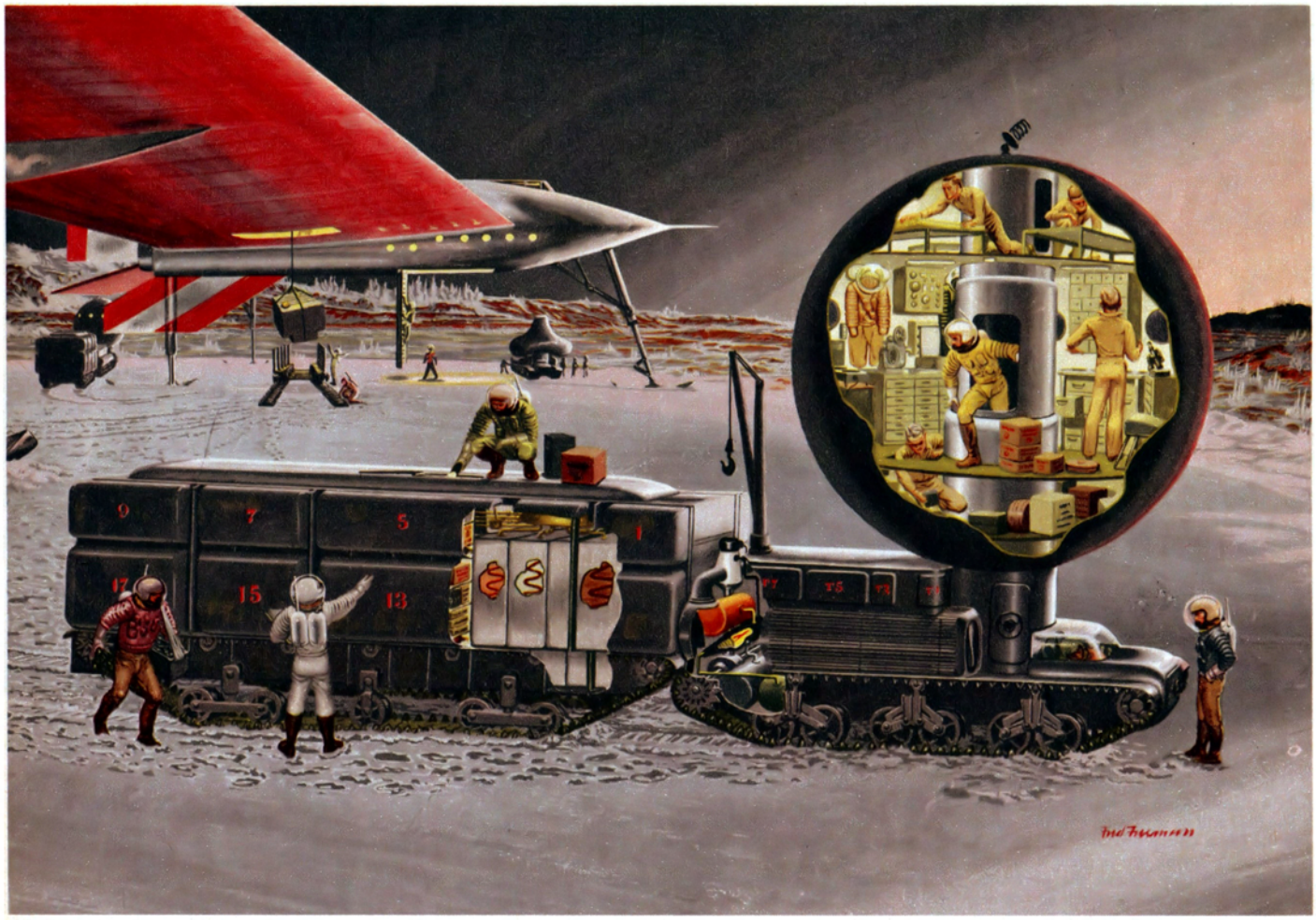
Upon reaching the 600-mile orbit—and after some exploratory probings of Mars's atmosphere with unmanned rockets—the first of the three landing craft will be assembled. The torpedo nose will be unhooked, to become the fuselage of a rocket plane. The wings and a set of landing skis will be attached, and the plane launched toward the surface of Mars.

The landing of the first plane will be made on the planet's snow-covered polar cap—the only spot where there is any reasonable certainty of finding a smooth surface. Once down, the pioneer landing party will unload its tractors and supplies, inflate its balloonlike living quarters, and start on a 4,000-mile overland journey to the Martian equator, where the expedition's main base will be set up (it is the most livable part of the planet—well within the area that scientists want most to investigate). At the equator, the advance party will construct a landing strip for the other two rocket planes. (The first landing craft will be abandoned at the pole.)

In all, the expedition will remain on the planet 15 months. That's a long time—but it still will be too short to learn all that science would like to know about Mars.

When, at last, Mars and the earth begin to swing toward each other in the heavens, and it's time to go back, the two ships that landed on the equator will be stripped of their wings and landing gear, set on their tails and, at the proper moment, rocketed back to the 600-mile orbit on the first leg of the return journey.

What curious information will these first explorers carry back from Mars? Nobody knows—and it's extremely doubtful that anyone now living will ever know. All that can be said with certainty today is this: the trip can be made, and will be made . . . someday. ▲▲▲



FRED FREEMAN

Advance party, after landing on Martian snow in ski-equipped plane, prepares for trip to equator. Men live in inflatable, pressurized spheres mounted on tractors, enter and leave through air locks in the central column. Sphere on tractor at rear center is just being blown up. Cutaway of tractor, foreground, shows closed-circuit engine, run by hydrogen peroxide, oil. Trailer cutaway shows fuel supply, cargo

After 15-month exploration, the Mars expedition prepares for return flight to earth. Two landing planes are set on tails, with wings and landing gear removed. They will rocket back to the 600-mile orbit on first leg of journey