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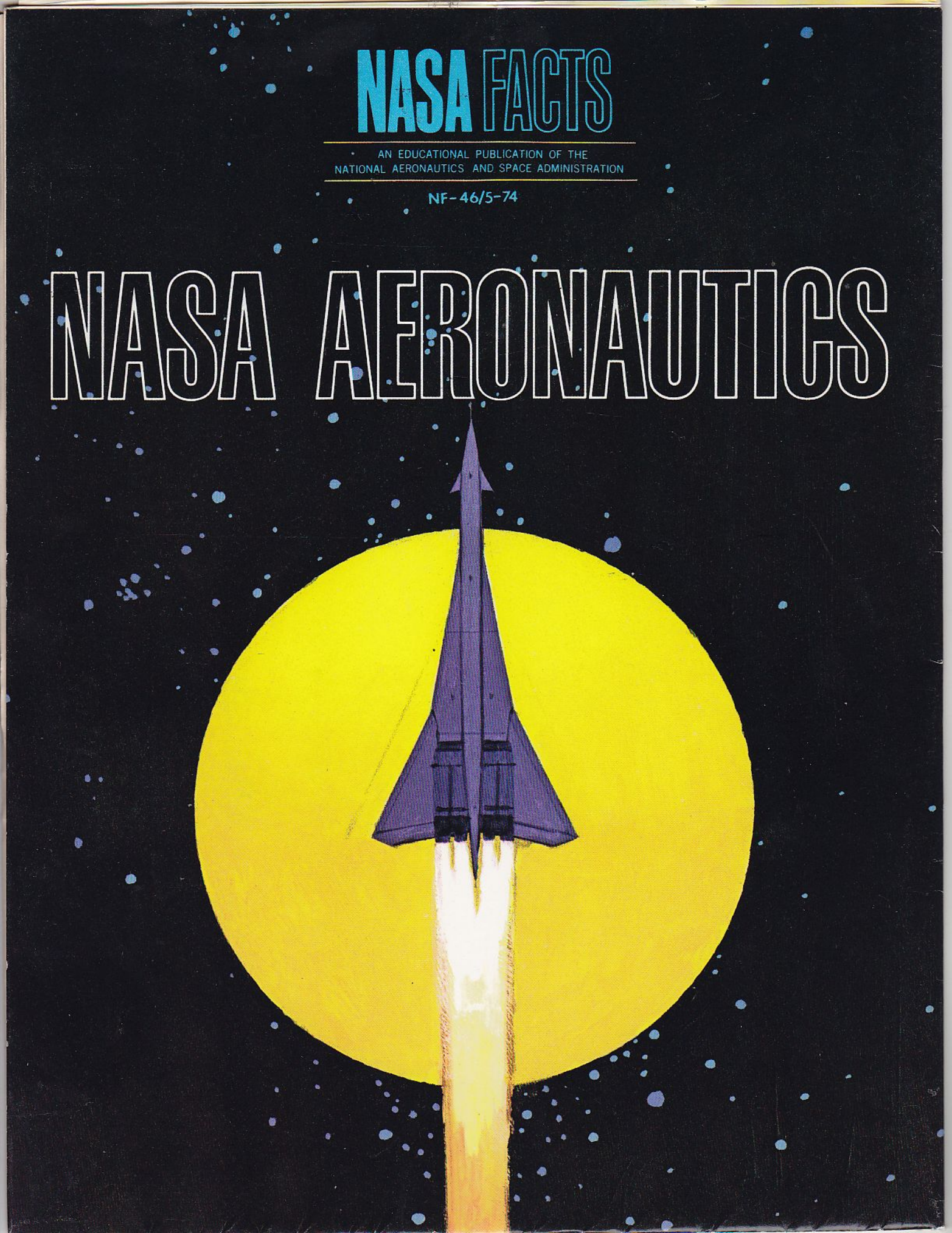

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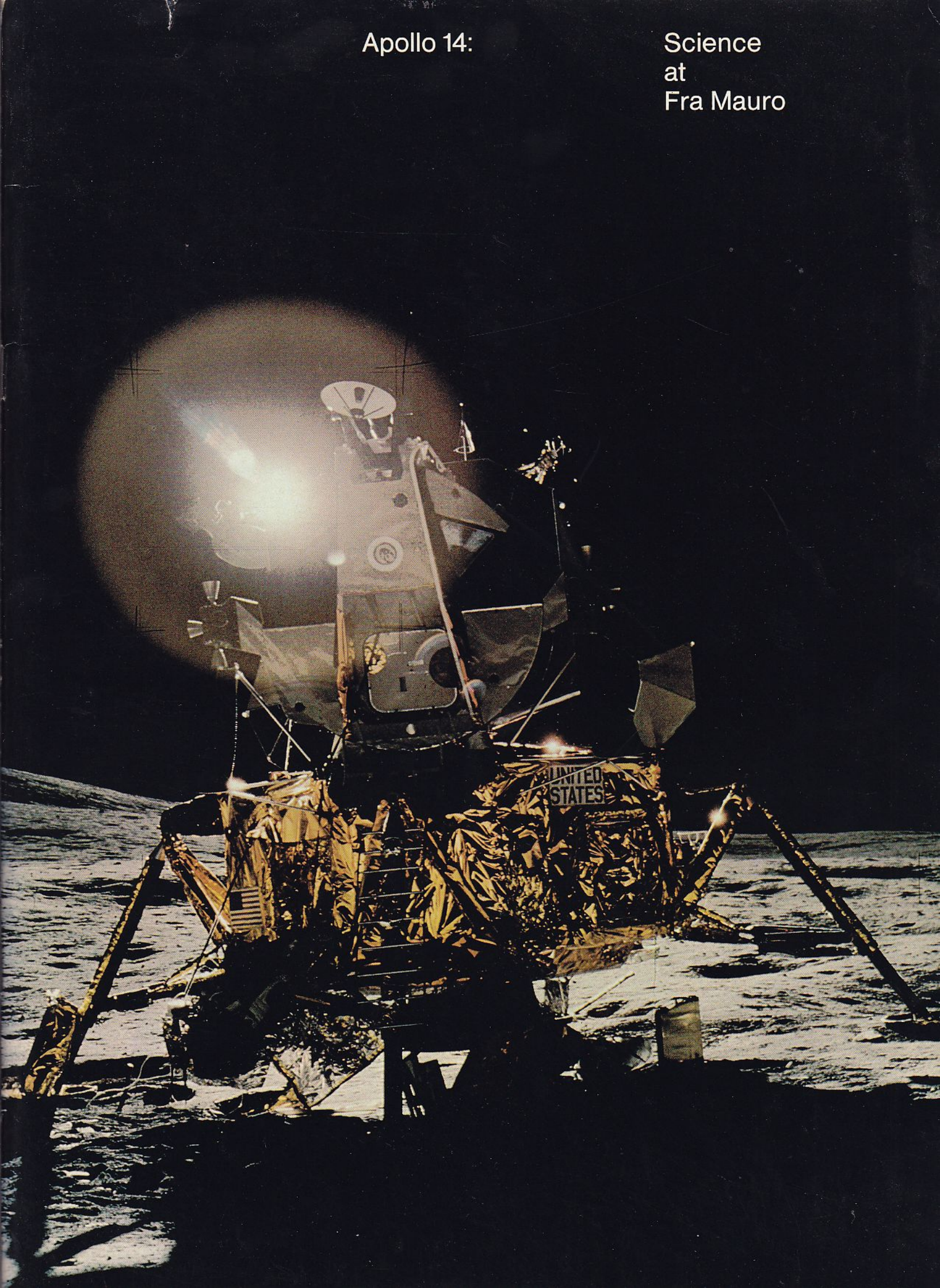

ON THE MOON WITH APOLLO 15

A Guidebook to Hadley Rille and the Apennine Mountains

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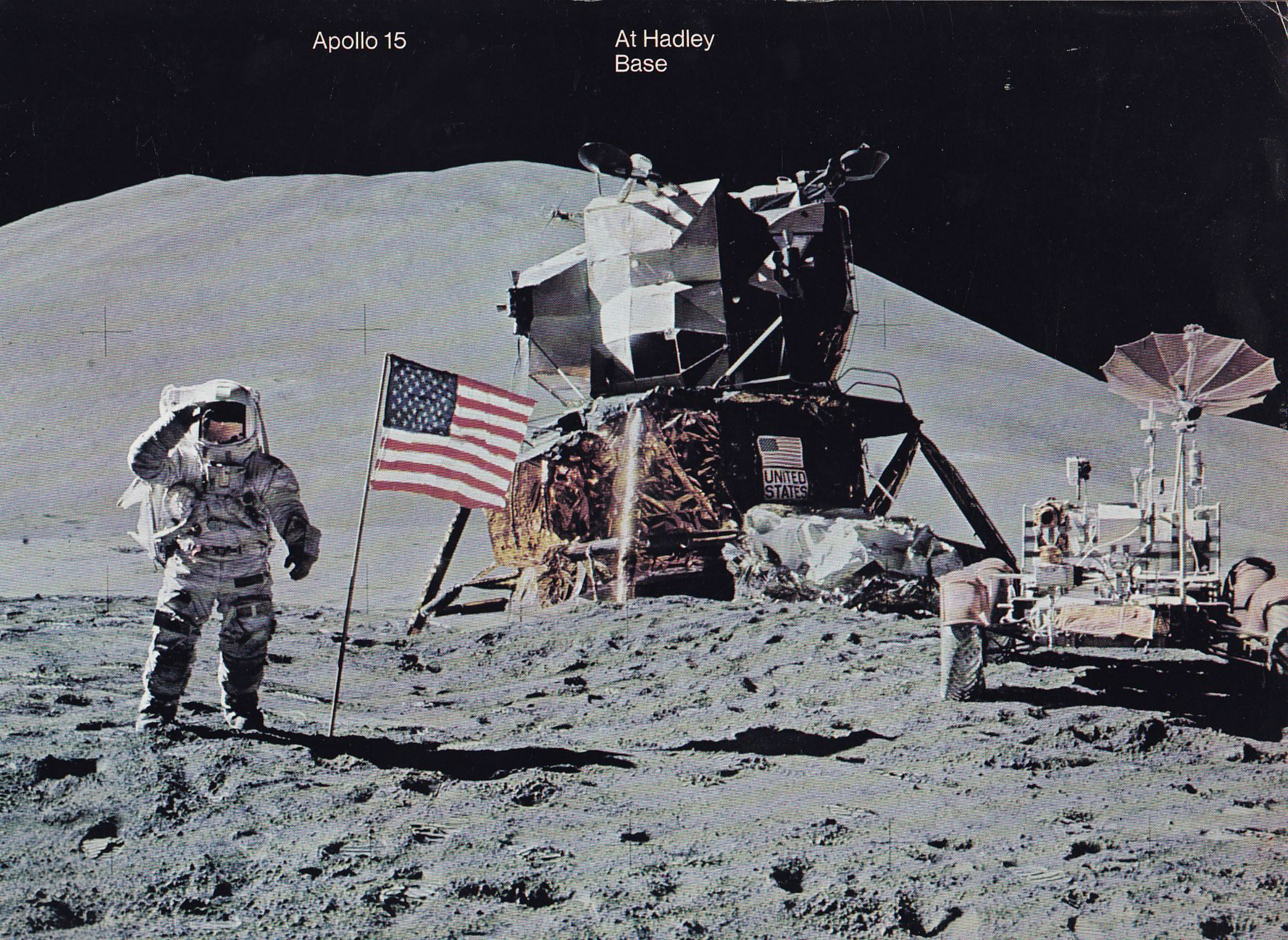
Apollo 15

At Hadley Base



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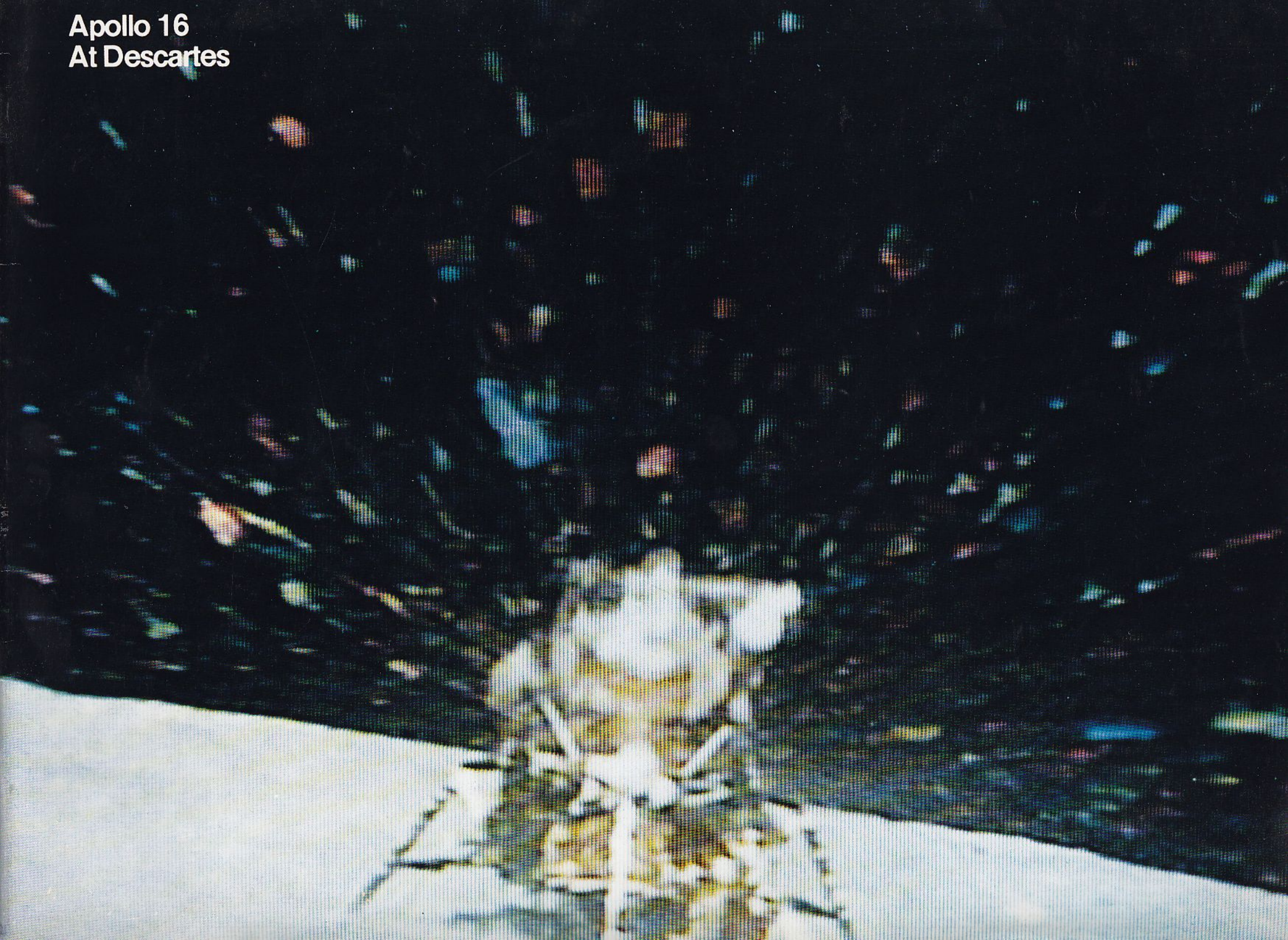

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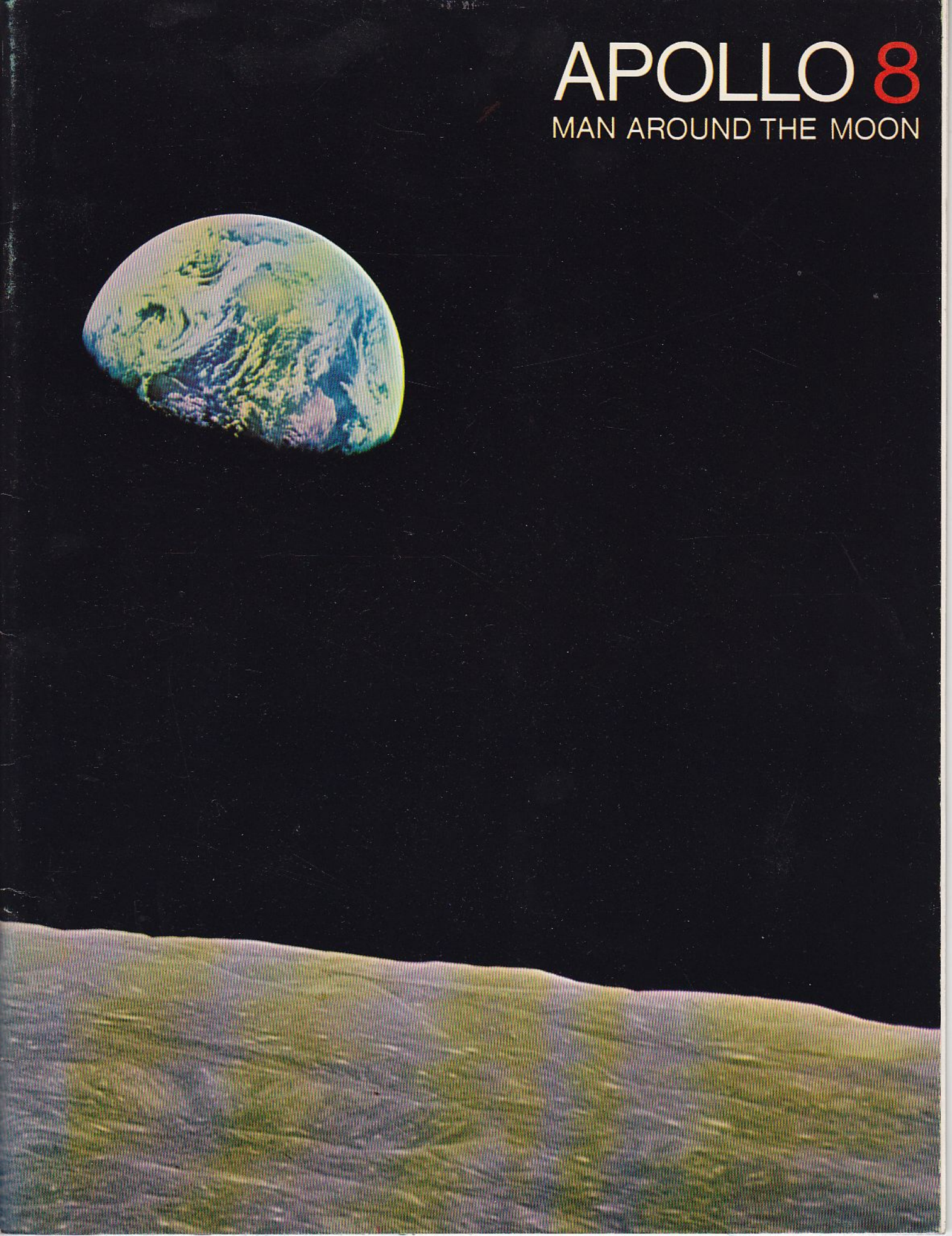
MAN AROUND THE MOON



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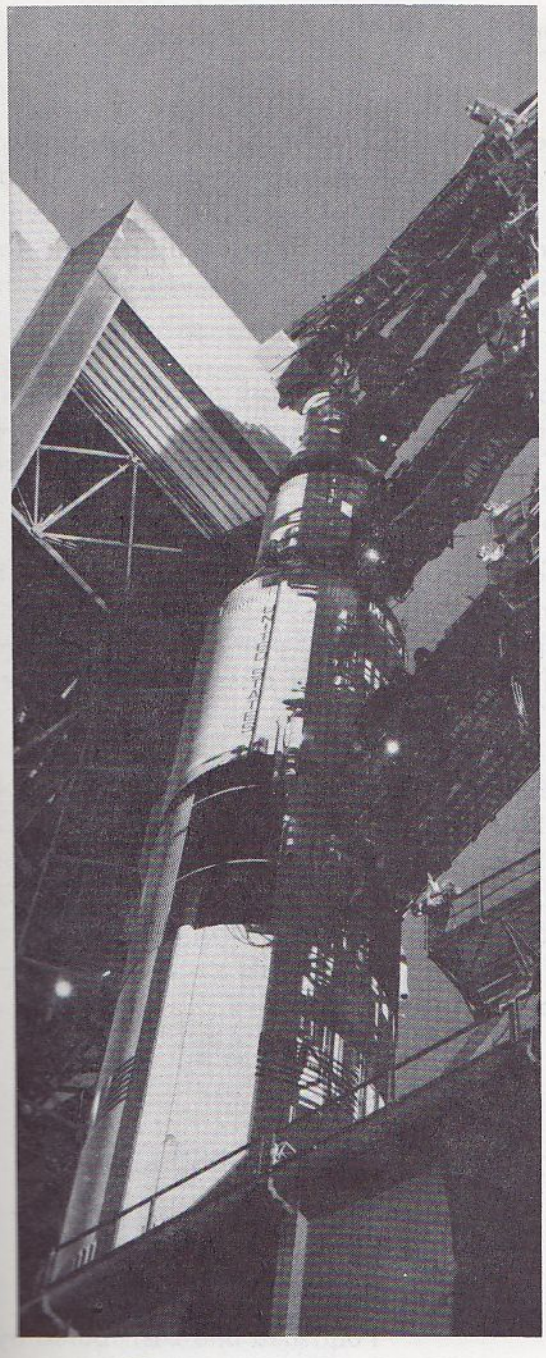

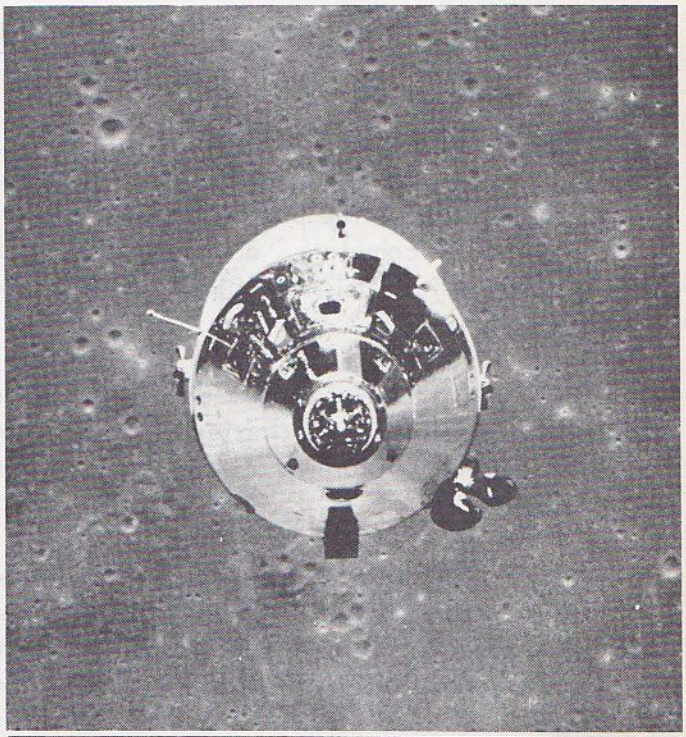

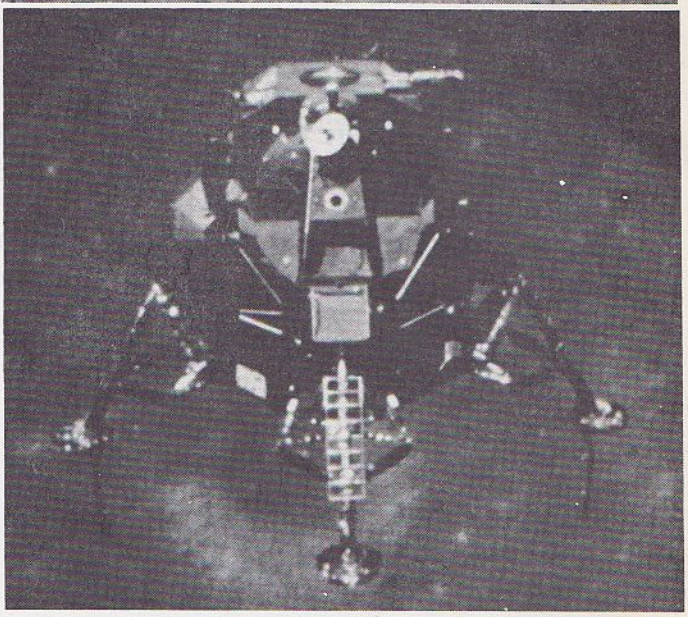

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Prepared by: Apollo Program Office - MAO

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140 pages

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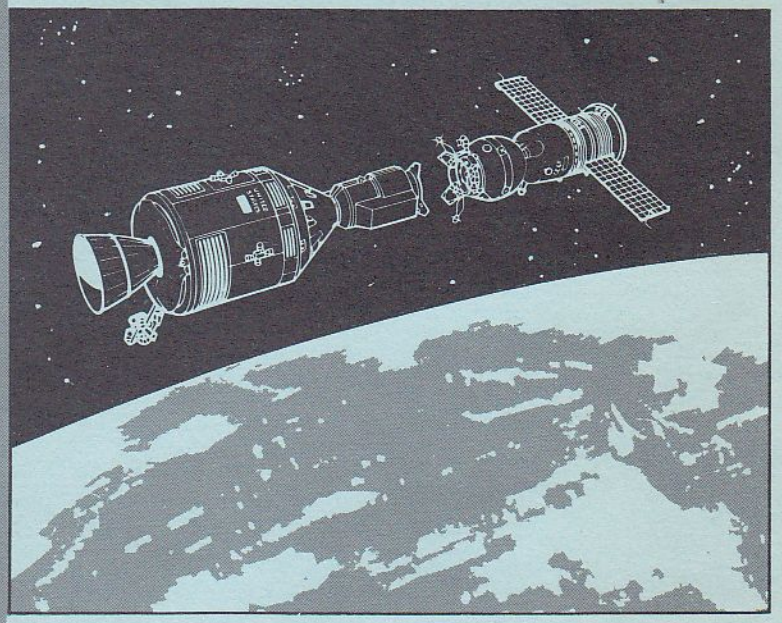

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120 pages

Atoms and Astronomy

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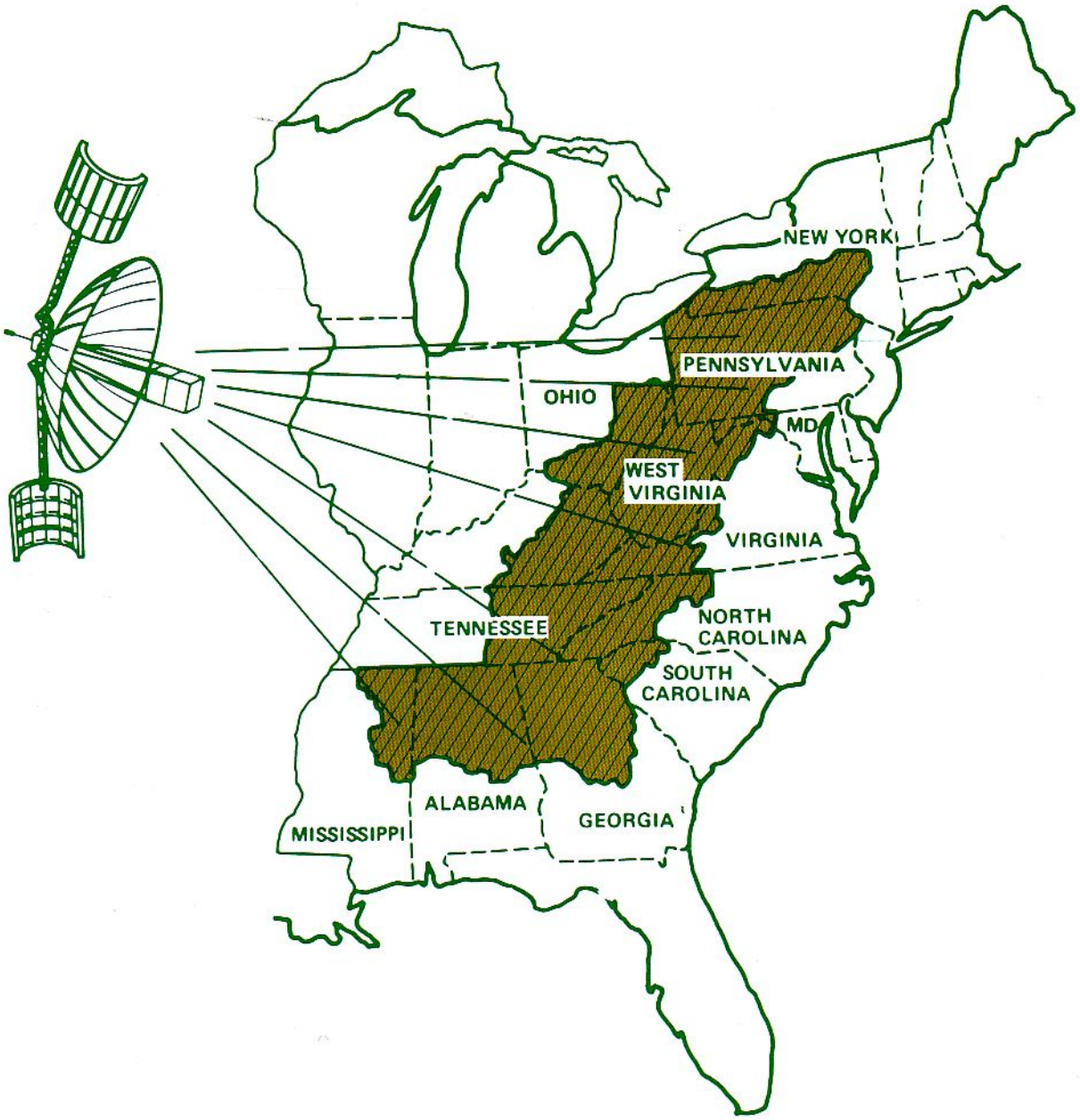

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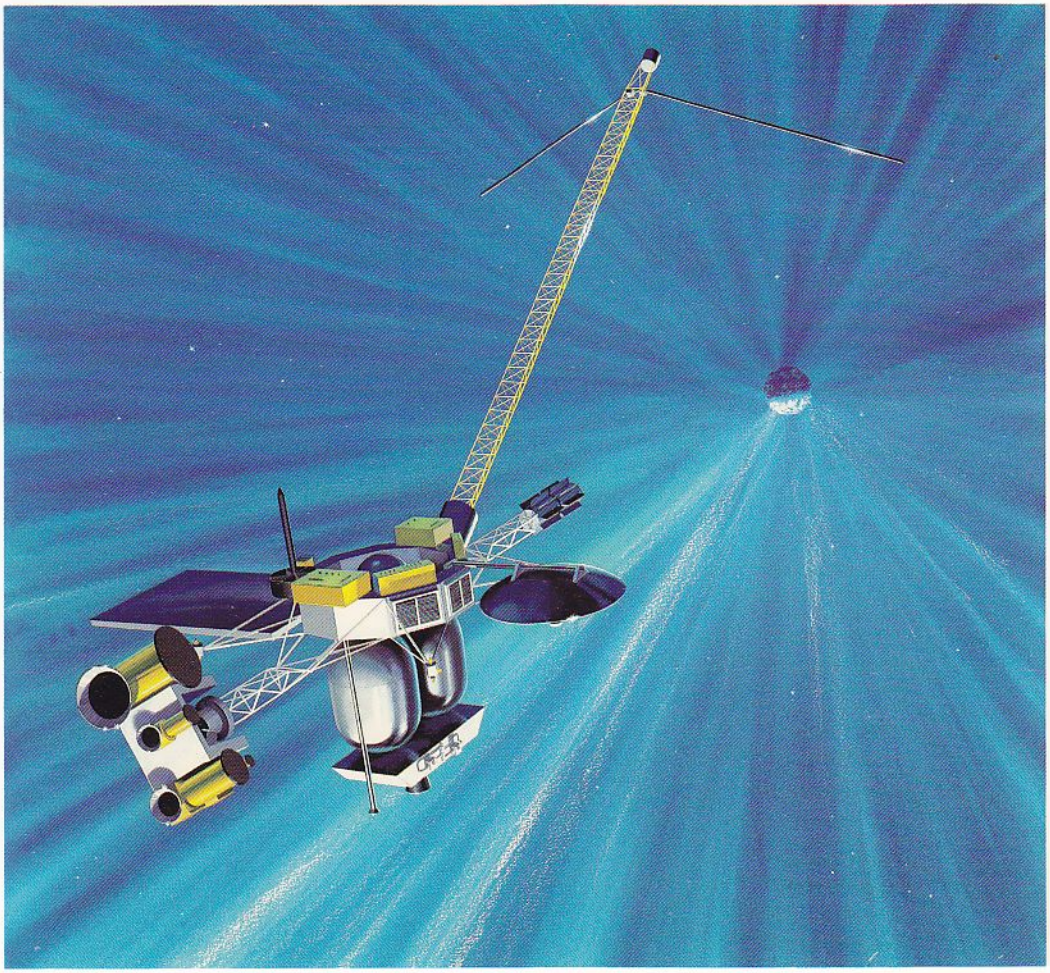

NASA SP-5967 (02)

TECHNOLOGY UTILIZATION

COMPUTER PROGRAMS: SPECIAL APPLICATIONS

A COMPILATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA
National Aeronautics and
Space Administration

Information Summaries

PMS-016(JSC)
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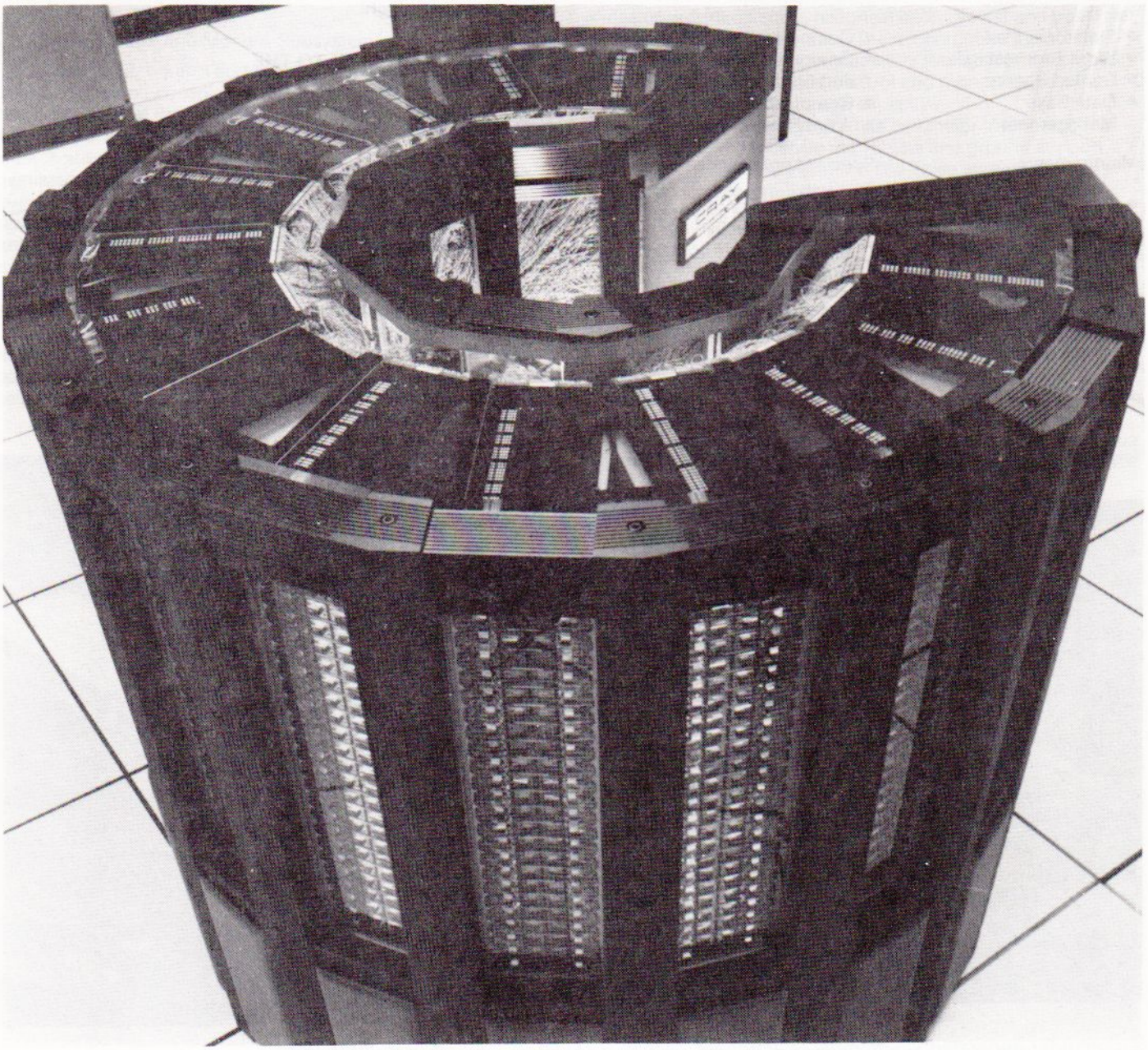
Computers



The 4-foot high, c-shaped Cray 2 supercomputer at NASA Ames Research Center does a quarter billion computations per second and has an enormous 256 million word internal memory — 16 times larger than those of previous supercomputers. The Cray 2 is part of the Numerical Aerodynamic Simulator (NAS), the most powerful supercomputer system in the world.

NASA Facts

An Educational Publication
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National Aeronautics and
Space Administration
NF-138/3-83

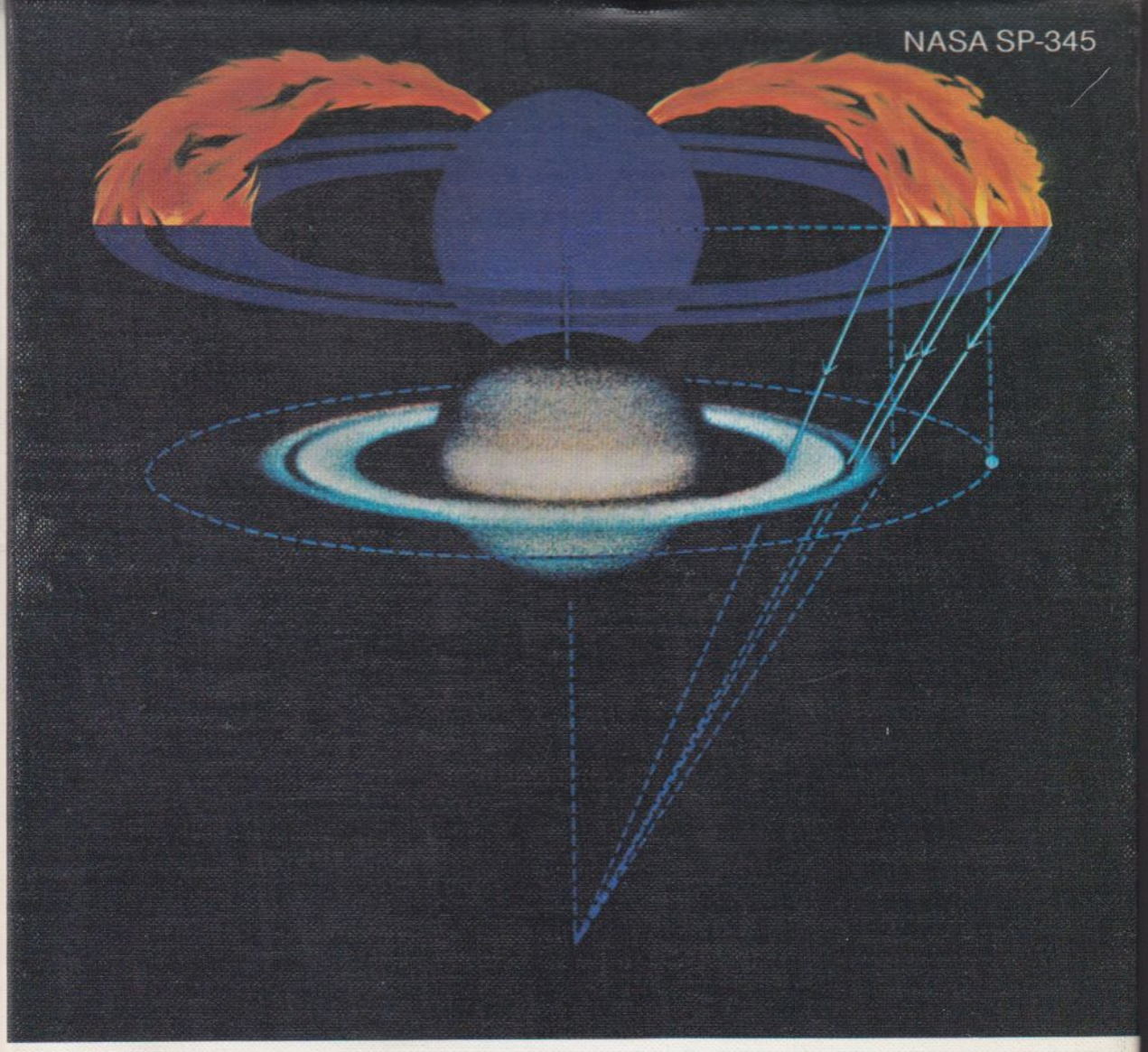
Planet Earth Through the Eyes of Landsat 4

For more than 10 years, NASA Landsat satellites have been recording pictures of the Earth's surface. Landsat 1, the first satellite in this series, was launched in 1972 and it literally changed the way we looked at our planet. Instead of returning exposed film it transmitted an astounding stream of numbers. Through its complex optical system, the Earth's surface was broken into narrow slices or scan lines. While moving roughly north to south over the sunlit side of Earth a mirror directed Earth's reflected light from the east/west sending scan lines into detectors. Before reaching the dectectors, the light was broken down into spectral bands and four were measured for brightness. Furthermore each scan line was subdivided into individual segments 79 by 79 meters in size so that the reflected light levels of acre-sized plots of land could be recorded.

Back on Earth, the streams of numbers received from Landsat 1 were assembled by a computer into black and white or colored images 185 by 185 kilometers in size. To make just one colored view, more than six million pieces of Landsat 1 data had to be assembled. Once assembled, the data could be manipulated. Unusual or unique combinations of reflected light levels could be intensified by computers to reveal features and trends on the Earth's surface not readily apparent to the human eye alone. When combined with observations made on the ground itself, Landsat 1 data could be processed into land-use classification maps. For example, a particular hardwood forest, following its identification, could be located on the Landsat scene. The light intensity levels of the various spectral bands measured of that forest by Landsat 1 could be as unique as a human fingerprint. Other areas, of the same scene, that exhibit the same reflected characteristics, could be interpreted as consisting of the same surface material—in this case, another hardwood forest. It was not necessary for the researcher to hunt for the right reflectance combinations. That job was done by a computer in just seconds.

The pictures of the Earth's surface from Landsat 1 and later from Landsats 2 and 3, launched in 1975 and 1978, gave scientists in many disciplines new opportunities to understand the complex systems of Earth. Where normally 100 aerial photographs and many months or years would be necessary to assemble and analyze a scene 185 by 185 kilometers in size, Landsat could

NASA SP-345



Evolution of the Solar System

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA SP-345

Evolution of the Solar System

Hannes Alfvén

University of California, San Diego
and
Royal Institute of Technology
Stockholm, Sweden

Gustaf Arrhenius

Scripps Institution of Oceanography
University of California, San Diego

Scientific and Technical Information Office 1976
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D.C.

Alfvén, Hannes, 1908–
Evolution of the solar system.

(NASA SP ; 345)
Includes bibliographical references and index.
1. Solar system. I. Arrhenius, Gustaf. II. Title. III. Series: United States. National Aeronautics and Space Administration. NASA SP ; 345.
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NASA SP–387

A FORECAST OF SPACE TECHNOLOGY 1980-2000

Prepared by
a Task Group consisting of participants from

Ames Research Center
Goddard Space Flight Center
Jet Propulsion Laboratory
Johnson Space Center
Langley Research Center
Lewis Research Center
Marshall Space Flight Center

NASA
National
Aeronautics and
Space
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Washington, D.C.
1976

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U.S. HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS

FIRST SESSION

JULY 22, 23, 24, 29, AND 30, 1975

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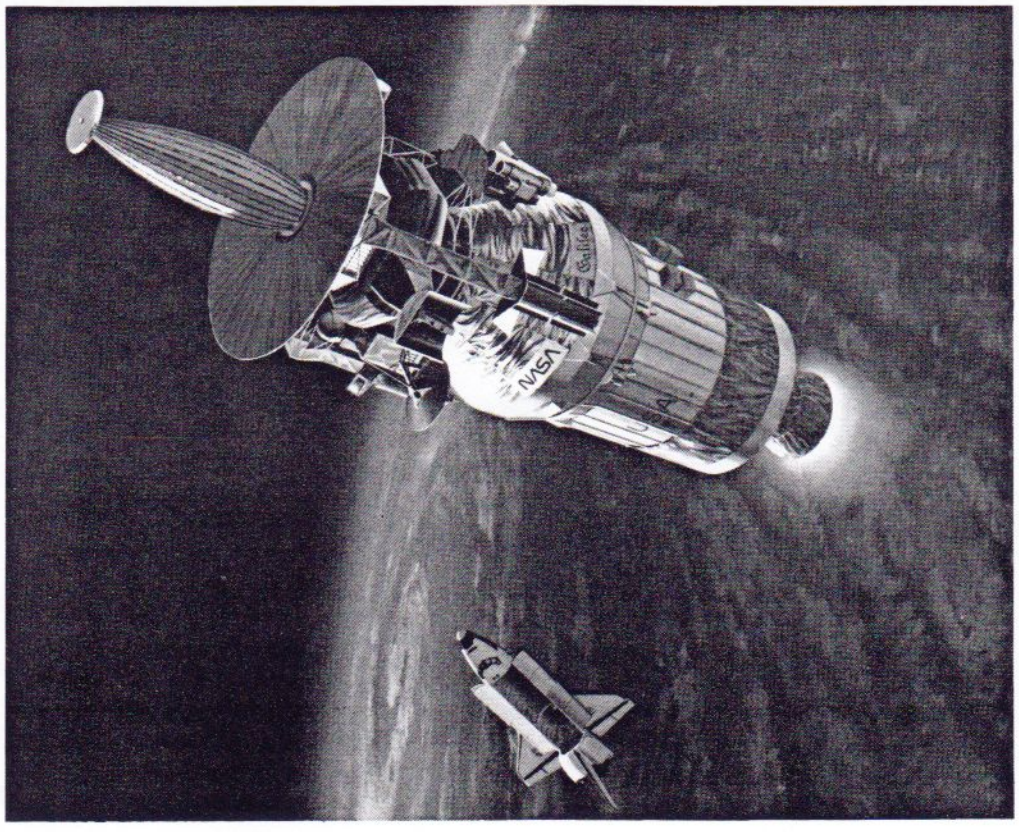

PROJECT GALILEO

NASA
Jet Propulsion Laboratory
California Institute of Technology
National Aeronautic and Space Administration
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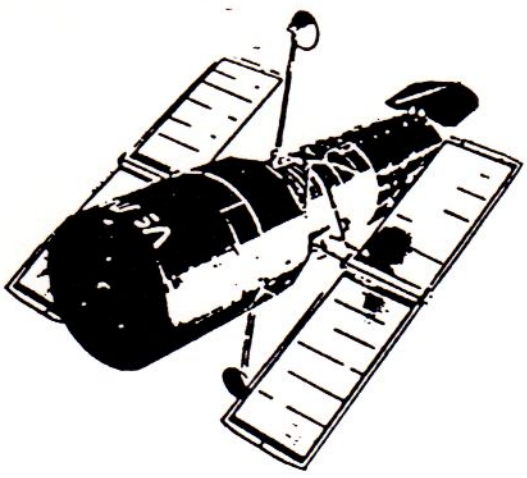
Exploring the Universe with the

Hubble Space Telescope



NASA Hubble Space Telescope Model

NASA's Hubble Space Telescope opens new vistas to the Universe. Orbiting high above the filtering effects of Earth's atmosphere, the 240-centimeter-diameter (94-inch) mirror permits astronomers to see objects many times fainter and farther away than is possible with telescopes on the ground. The Hubble Space Telescope is designed to operate many years in space with only periodic servicing by Space Shuttle crews.

Instructions:

The plans below will permit you to construct a detailed model of NASA's Hubble Space Telescope at an approximate scale of 1:70. The following is a list of materials and tools needed for the model:

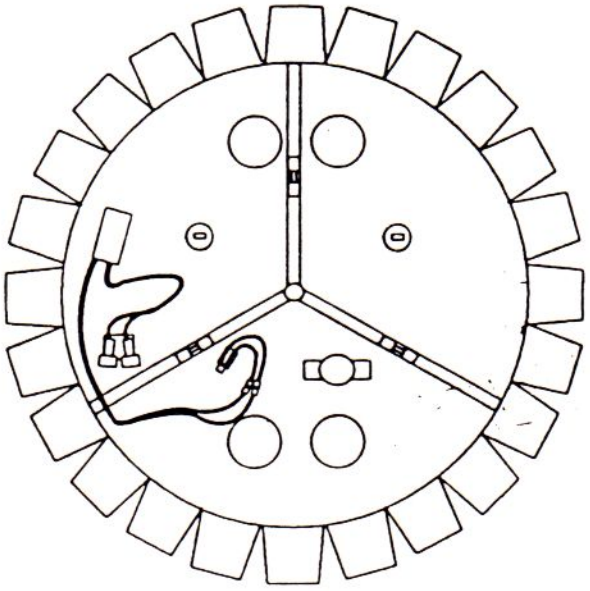
Sharp paper scissors
Razor blade
Sharp punch (such as an ice pick or nail)
Glue stick, white school paste, or contact cement
Cellophane tape
2X2 inch square piece of aluminum foil
2 7.5-inch pieces of 1/8 inch dowel rods
Colored sharp point marker pens (yellow and red)
Blue highlighter pen
Orange highlighter pen

- Before cutting out the pieces, use marker pens to color structures on the model as indicated.

#1 Assembling the AFT SHROUD

1. Carefully cut out the following pieces: AFT SHROUD cylinder, End Cap, and the INNER RING. Use the razor blade to cut small slits for insertion of the assembly tabs of the cylinder.

END CAP



2. Shape the AFT SHROUD cylinder by curling the paper around the edge of a table or desk. This will permit the paper to be easily rolled into a cylinder.
3. Curl the paper to form a tube and insert the tabs of the cylinder into the slits cut in step 1. Hold the cylinder together with a piece of tape pressed to the inside.
4. Fold the tabs of the inner ring downward. Coat each tab with glue and lay the ring upside down on a flat surface. Place the cylinder over the inner ring so that all tabs are inside. Reach in with a finger and press each tab to the inside wall of the cylinder. You will need to support the outer wall of the cylinder with another finger to achieve a good bond.
5. Fold the tabs of the end cap downward and coat each with glue. Place the end cap upside down on a flat surface and place the other end of the cylinder over it. Press the tabs in place. If you have trouble reaching the tabs, use the erasure end of a pencil in place of your finger.
6. The AFT SHROUD is completed. Set it aside.

Developed by the Aerospace Education Services Program
Oklahoma State University

earth observations, propulsion and other applications including maritime terminals and microwave remote sensing from space (d) system studies in space application programmes including onboard instrumentation and satellite control. □

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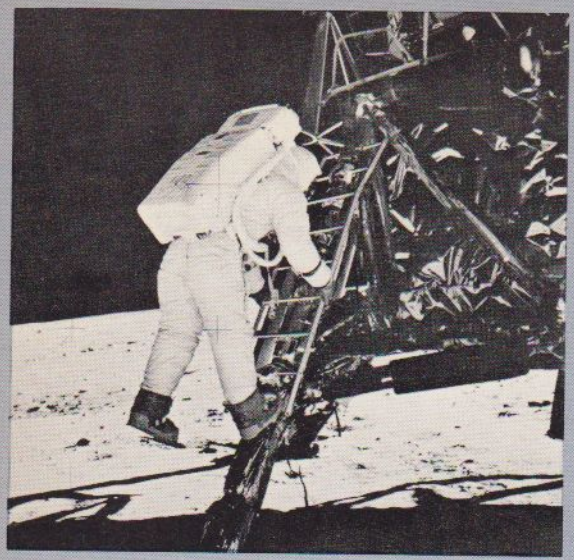
INDIAN SPACE EXHIBITION

Hannover

April 1984



THE KENNEDY SPACE CENTER STORY

THE KENNEDY SPACE CENTER STORY

This narrative relates the story of a dream that became reality November 9, 1967, when the first Apollo/Saturn V lifted slowly off Pad A of Complex 39, and carried into orbit a space vehicle weighing 129,000 kilograms (285,000 pounds), by far the heaviest mass which had ever been transported from Earth to space.

A startled world better understood the significance of this demonstrated capability on December 21, 1968, when the third Apollo/Saturn V thundered into the heavens carrying Astronauts Frank Borman, James Lovell and William Anders on man's first voyage to the Moon – an achievement that stirred the hearts of men. As he contemplated the magnificent performance of the Apollo 8 crew, Dr. Debus remarked, "Now we can explore the solar system and then the Universe."

The stage was set for the stunning climax of Project Apollo. On July 16, 1969, seven months after the Apollo 8 triumph and following closely the successes of Apollos 9 and 10, Astronauts Neil Armstrong, Edwin Aldrin and Michael Collins began mankind's greatest adventure. While millions listened in awe, at 4:15 P.M. Eastern Daylight Time, July 20, Neil Armstrong spoke the fateful words:

"Houston, Tranquility Base here. The Eagle has landed."

Earthman had found a new dimension. Apollo had achieved the goal towards which thousands of dedicated men and women labored for eight years.

Gordon L. Harris

FOOTNOTE:

Some names or titles which appear in this story were changed between their first and subsequent appearances. For example, Rockwell International is the successor to North American Rockwell; the Douglas Aircraft Company became McDonnell Douglas. Cape Kennedy, which was so designated by President Lyndon Johnson after the 1963 assassination, was formerly Cape Canaveral. The State of Florida and the U.S. Department of Interior by official actions reverted to Cape Canaveral in 1973. That title identifies a geographical entity and is not related to the official designations of the NASA Space Center, or the adjacent Air Force Station which is located on the Cape. The Manned Spacecraft Center, Houston, Texas was designated the Lyndon B. Johnson Space Center August 27, 1973 by President Nixon.

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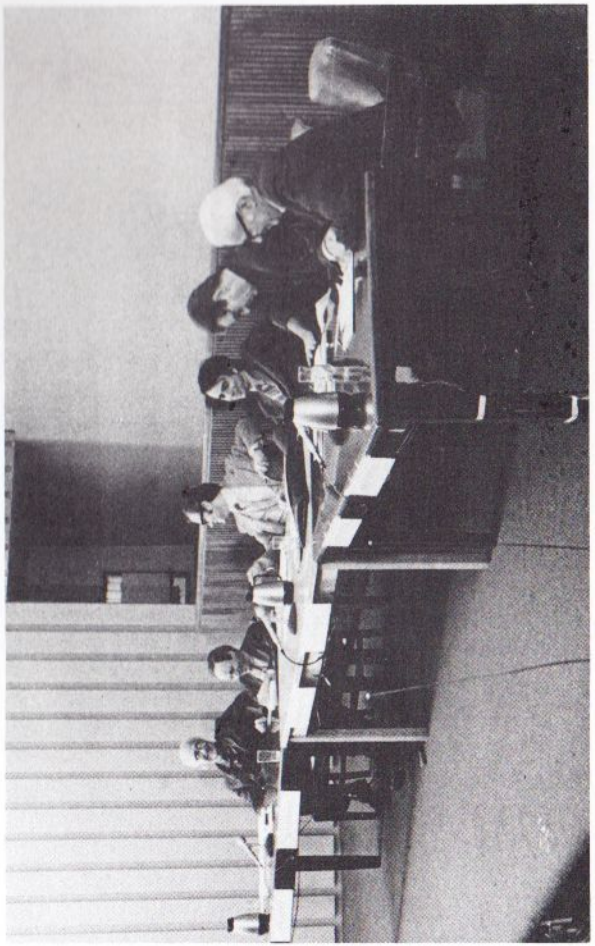

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NASA SP-328

life beyond earth & the mind of man

EDITED BY RICHARD BERENDZEN

A symposium held at Boston University
on November 20, 1972

1973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Foreword

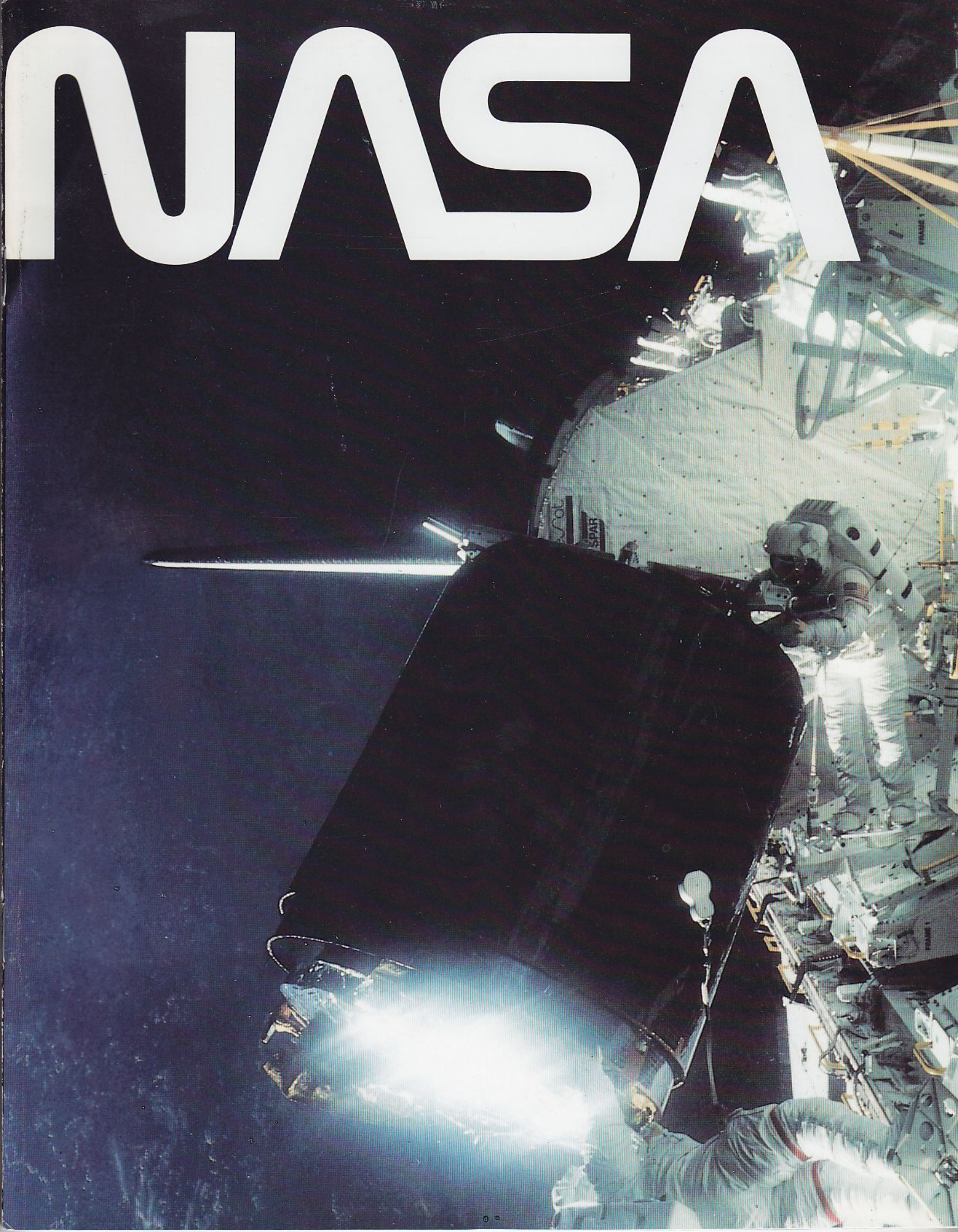
In considering the possible existence of extraterrestrial life, we have become accustomed to thinking of it chiefly in the context of our solar system. Yet in recent years information has accumulated that suggests, by some estimates of probability, that forms of life could be broadly distributed throughout the galaxy. It is within the realms of possibility, in fact, likely that technically advanced civilizations may exist on the planets of distant stars. Communications with such far-off islands of intelligence may someday be begun, with effects on man's home planet that can now be only imperfectly imagined.

A symposium to explore implications of this fascinating subject—the social, philosophic, and humanistic impact—was held in Boston last fall. Jointly sponsored by Boston University and NASA, the meeting brought out diverse viewpoints from a panel made up of two astronomers, a biologist, a

America In Space | The First Decade

MAN IN SPACE

National Aeronautics and Space Administration


NASA

NASA SP–386

OUTLOOK FOR SPACE

Report to the NASA Administrator by the Outlook for Space Study Group

Prepared by
a Task Group consisting of participants from

Ames Research Center
Goddard Space Flight Center
Jet Propulsion Laboratory
Johnson Space Center
Langley Research Center
Lewis Research Center
Marshall Space Flight Center

NASA
National
Aeronautics and
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Post Apollo Program
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Propulsion Technology
Hydrazine Technology
Electronics
Nuclear Technology
Oceanology
Protection of the Environment
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Programme Post Apollo
Systèmes de Lanceur
Lanceurs Réutilisables
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NASA SP–324

project management in NASA

the system and the men

by
Richard L. Chapman
with the assistance of
Robert H. Pontious and Lewis B. Barnes
National Academy of Public Administration

Scientific and Technical Information Office 1973
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Washington, D.C.

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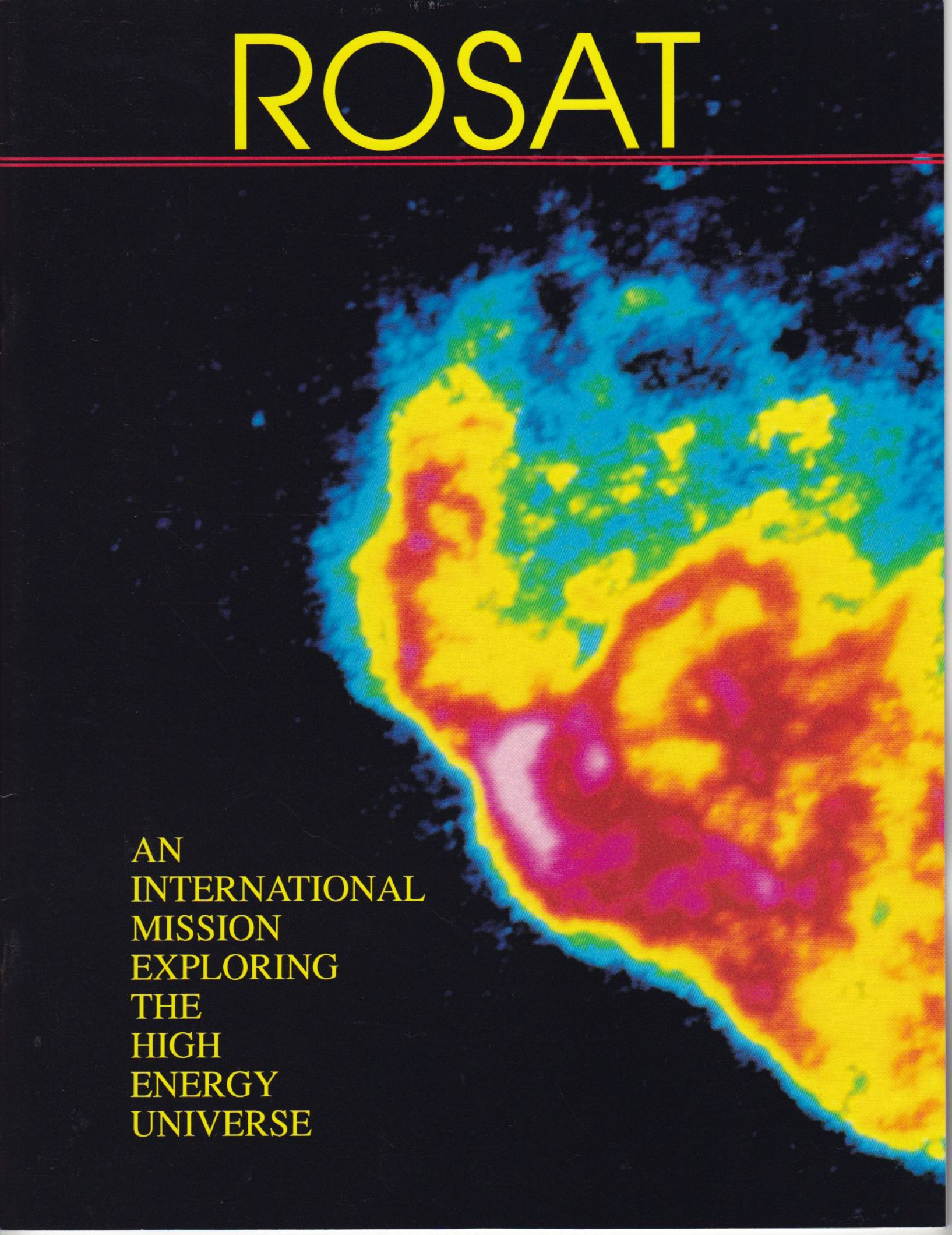

AN
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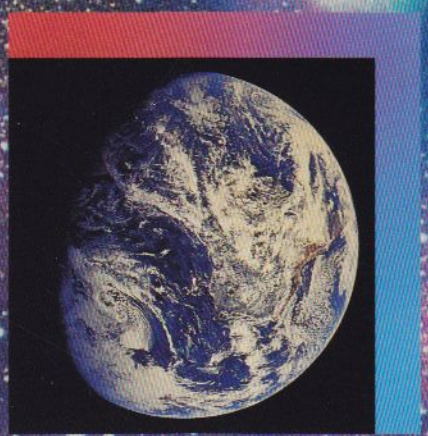
MISSION
EXPLORING
THE
HIGH
ENERGY
UNIVERSE

S.E.T.I.

Search for

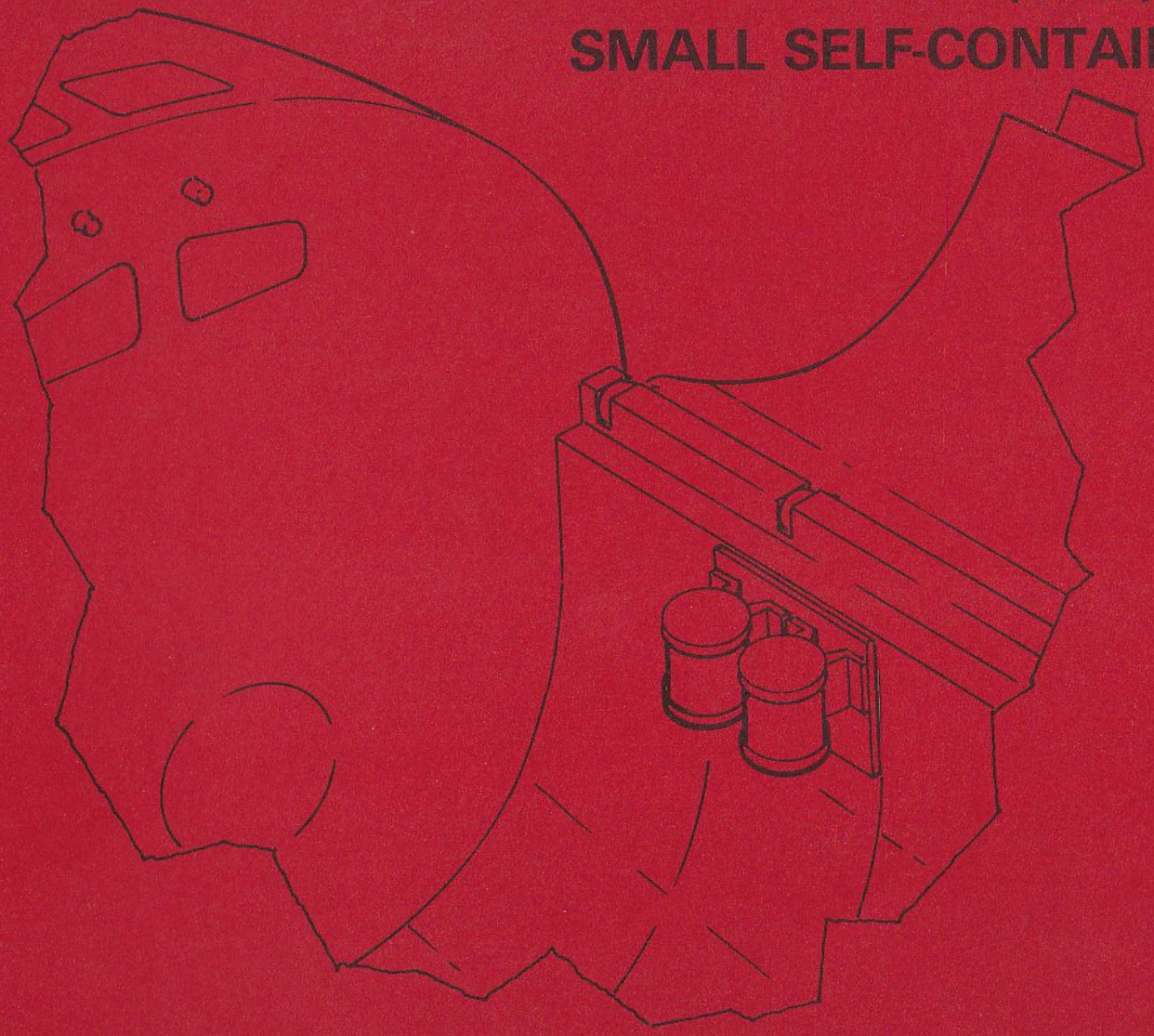
Extra-



Terrestrial

Intelligence

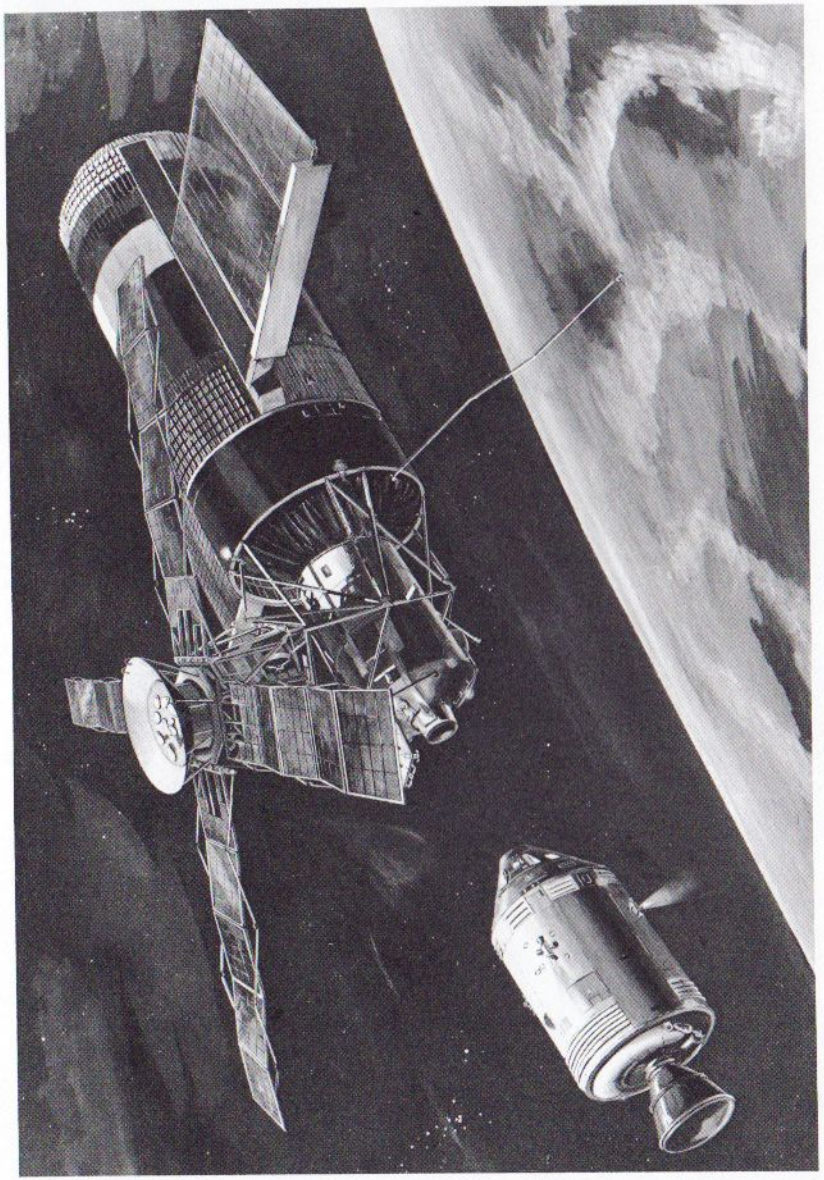
GET AWAY SPECIAL
(GAS)
SMALL SELF-CONTAINED PAYLOADS



EXPERIMENTER HANDBOOK

National Aeronautics and Space Administration
Goddard Space Flight Center
Sounding Rocket Division
October 1979

SPACE SHUTTLE



FRONTISPIECE—Skylab in orbit, being approached by the Command and Service Module for docking.

Skylab

A GUIDEBOOK

by
LELAND F. BELEW
and
ERNST STUHLINGER
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Acknowledgments

This document describes the result of the work of several thousand engineers and scientists who, over the last ten years, have conceived, designed, developed, built, and tested Skylab, the most complicated space system in the American space flight program so far. As we are completing our writing just a few months before the launching of Skylab, we extend our appreciation and gratitude to all of those who have supported us in writing this booklet. Members of many organizations at NASA Headquarters in Washington, at the Lyndon B. Johnson Space Center, the Goddard Space Flight Center, the John F. Kennedy Space Center, and the George C. Marshall Space Flight Center have provided valuable advice and help. The Life Sciences Directorate at the Lyndon B. Johnson Space Center and the Office of Life Sciences at NASA Headquarters made substantial contributions to the chapter on Life Sciences Projects. Dr. G .C. Bucher, M. I. Kent, and R. M. Nicholson of the G. C. Marshall Space Flight Center were rsponsible for organizing the material and composing most of the booklet in its present form.

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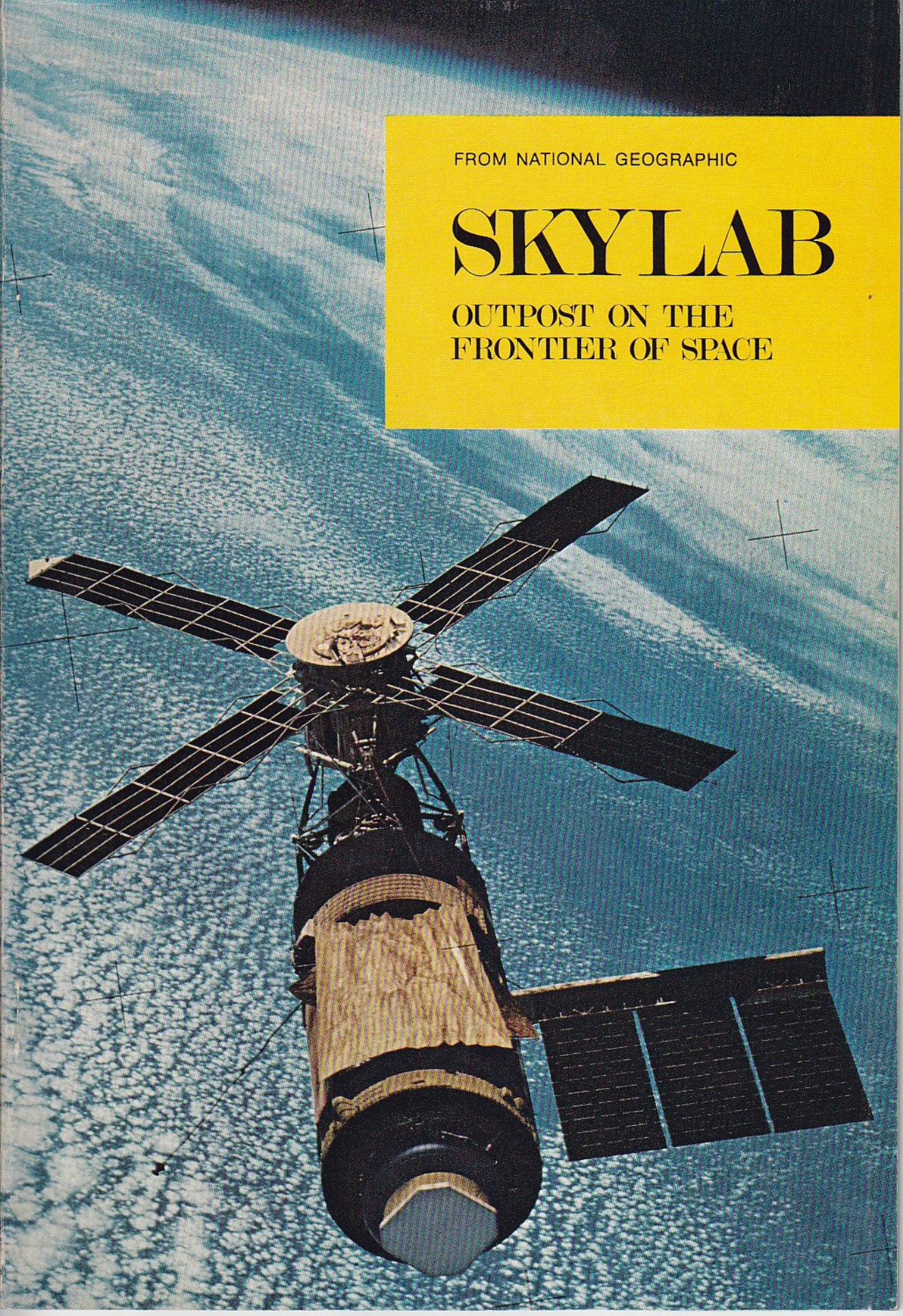
MSFC, Huntsville, AL

ERNST STUHLINGER
Associate Director for Science
MSFC, Huntsville, AL

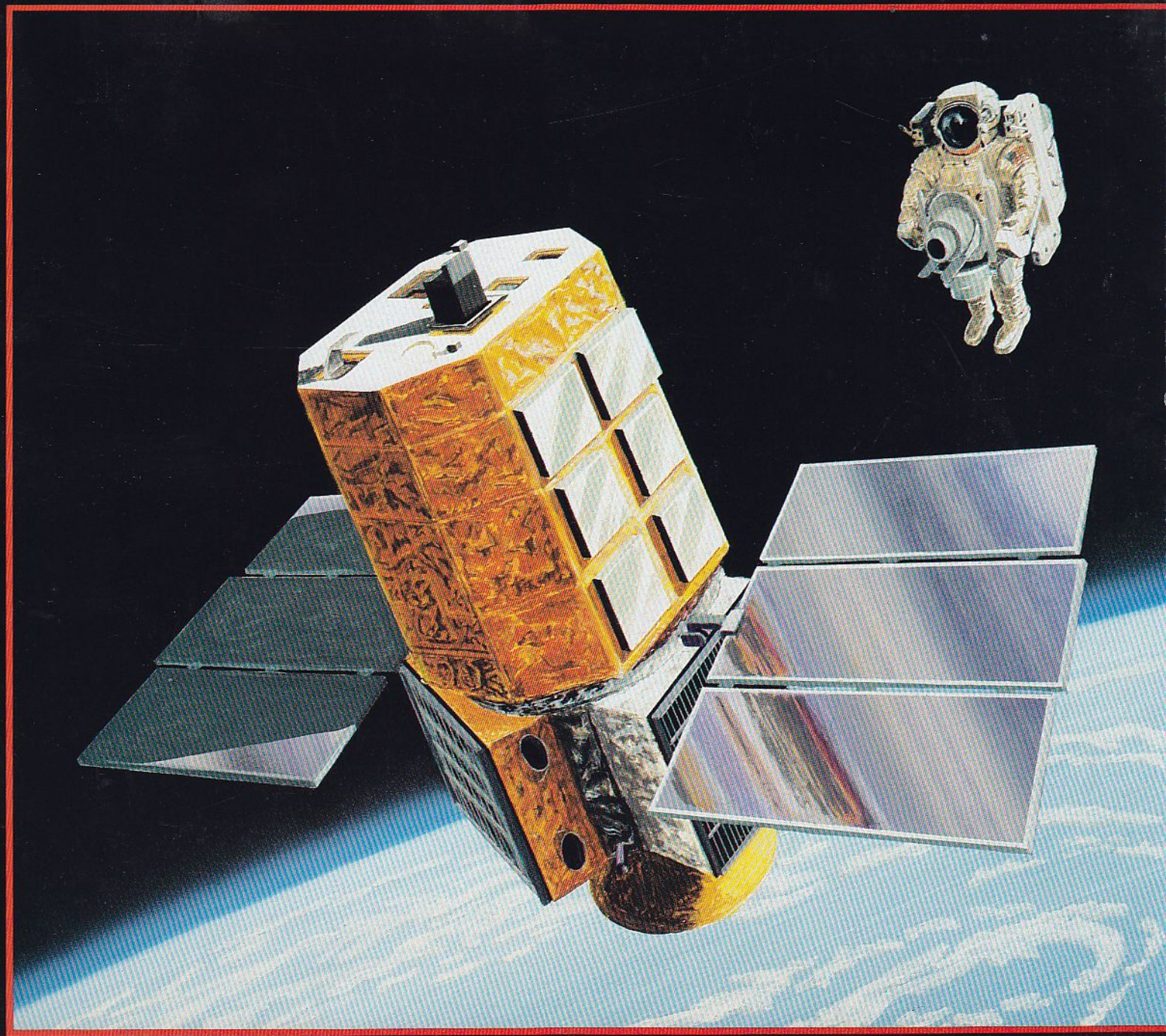
FROM NATIONAL GEOGRAPHIC

SKYLAB

OUTPOST ON THE FRONTIER OF SPACE



REPAIRING SOLAR MAX



THE SOLAR MAXIMUM REPAIR MISSION

SOLAR POWER FROM SATELLITES

HEARINGS

BEFORE THE

SUBCOMMITTEE ON AEROSPACE TECHNOLOGY AND NATIONAL NEEDS

OF THE

COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES

UNITED STATES SENATE

NINETY-FOURTH CONGRESS

SECOND SESSION

JANUARY 19 AND 21, 1976

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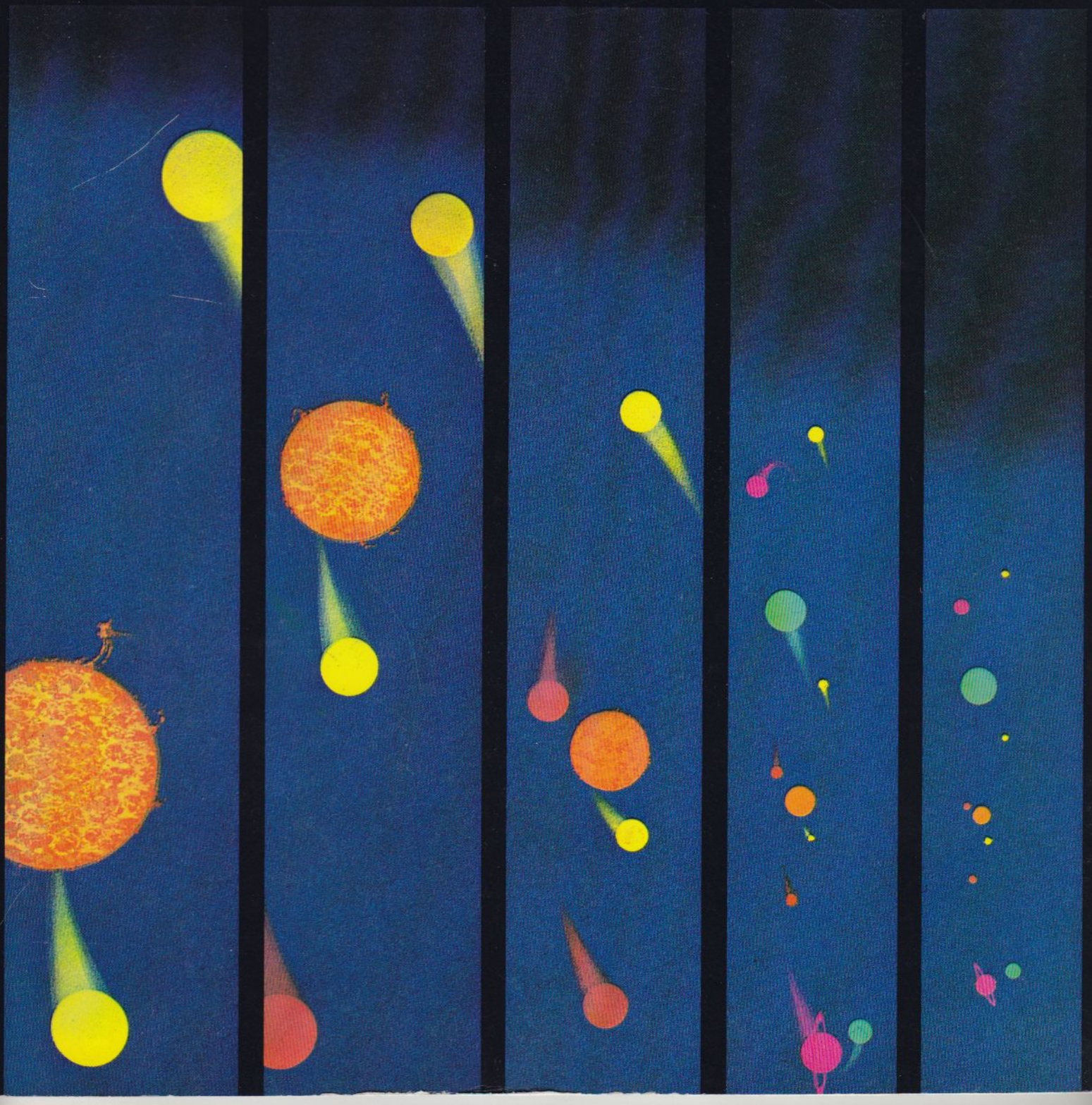

bulletin no. 71-f-5

space awareness

an adult education curriculum resource guide

This public document was promulgated at an annual cost of $3,978.01 or $3.97 per copy to serve as an instructional guide for adult educators and others interested in specific information relating to the National Aeronautics and Space Administration and to provide a source of information of the breadth and scope of space explorations including space benefits to mankind.

florida department of education
division of vocational, technical and adult education
adult and veteran education section
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tallahassee, florida

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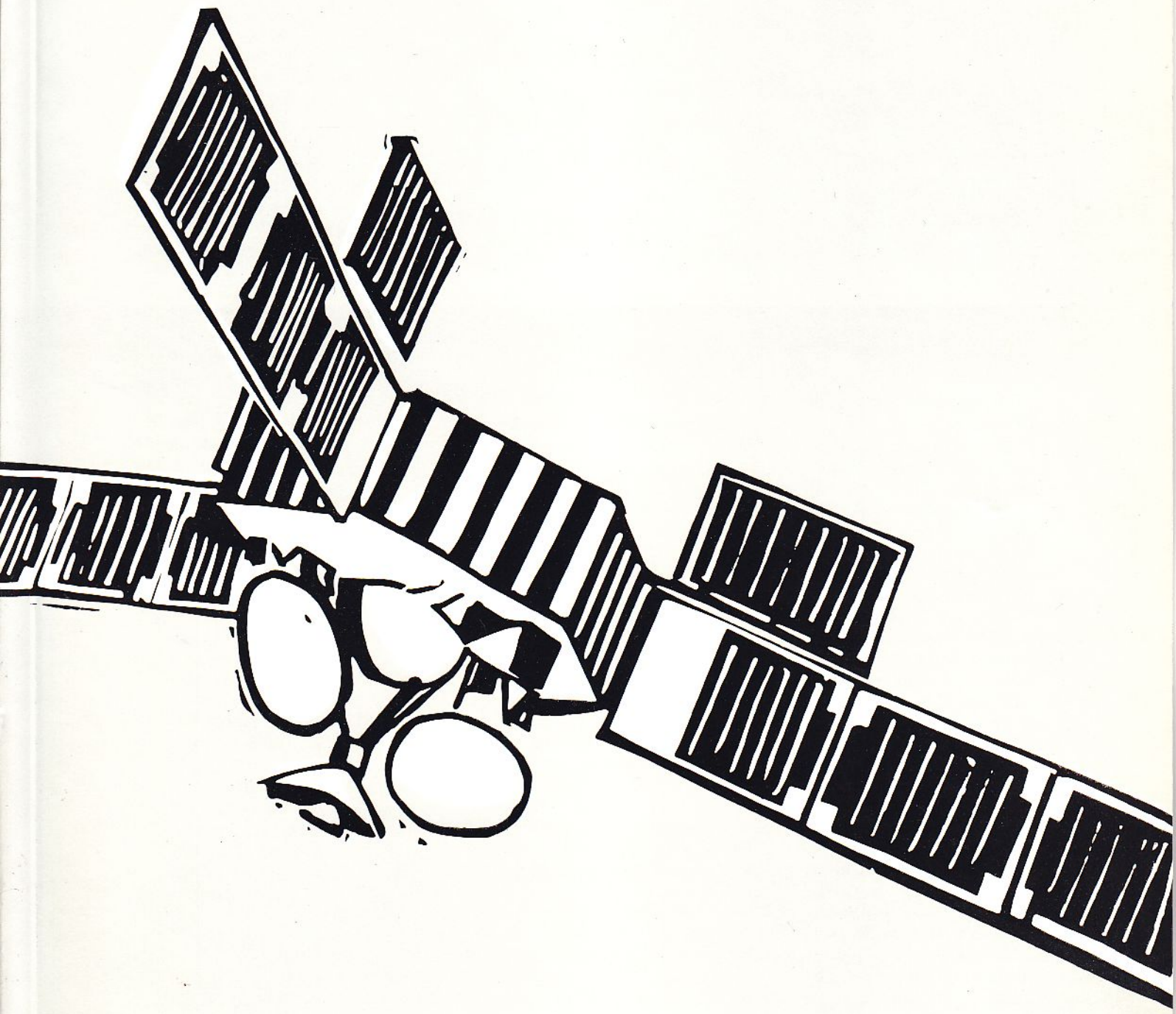

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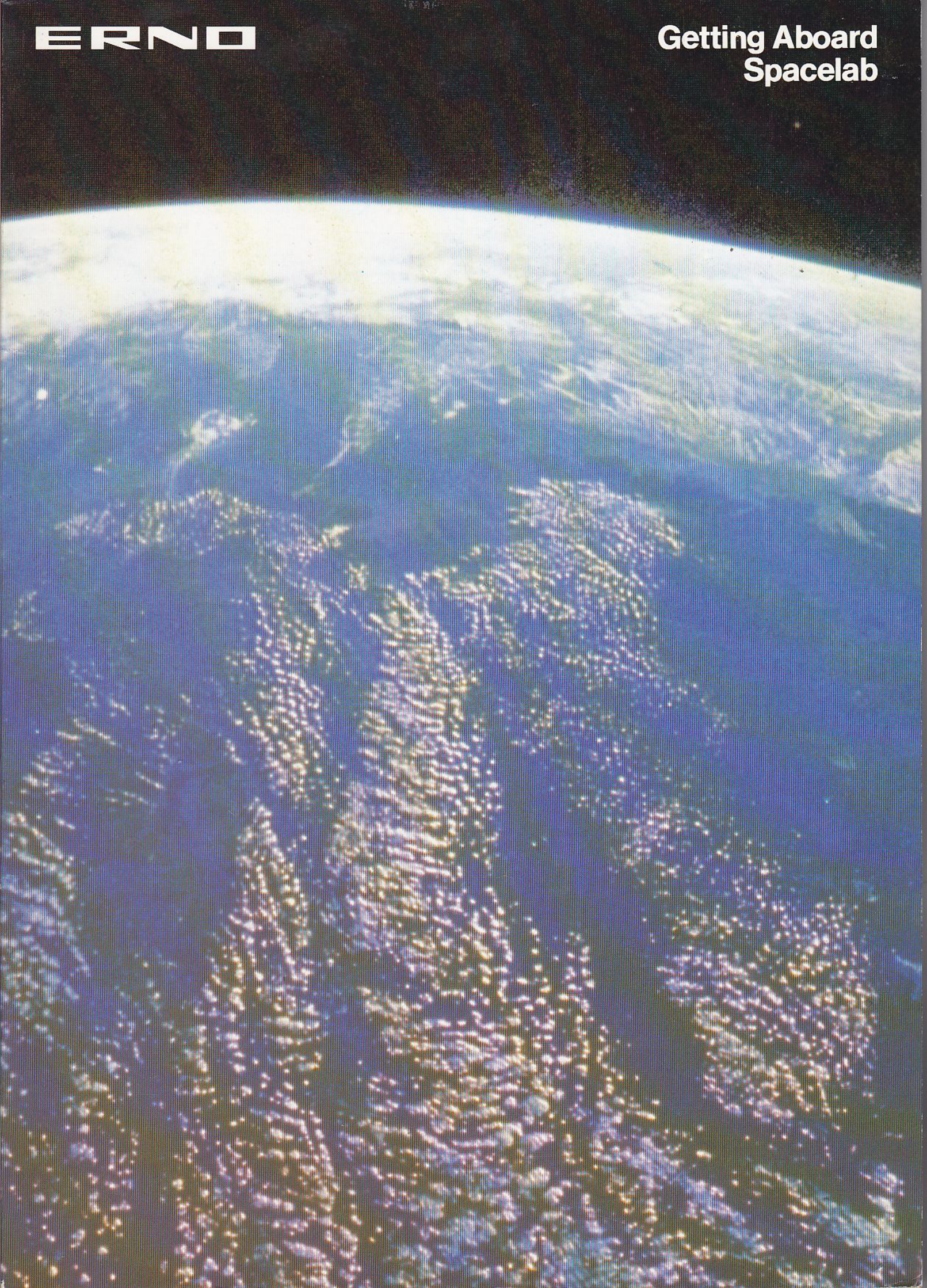
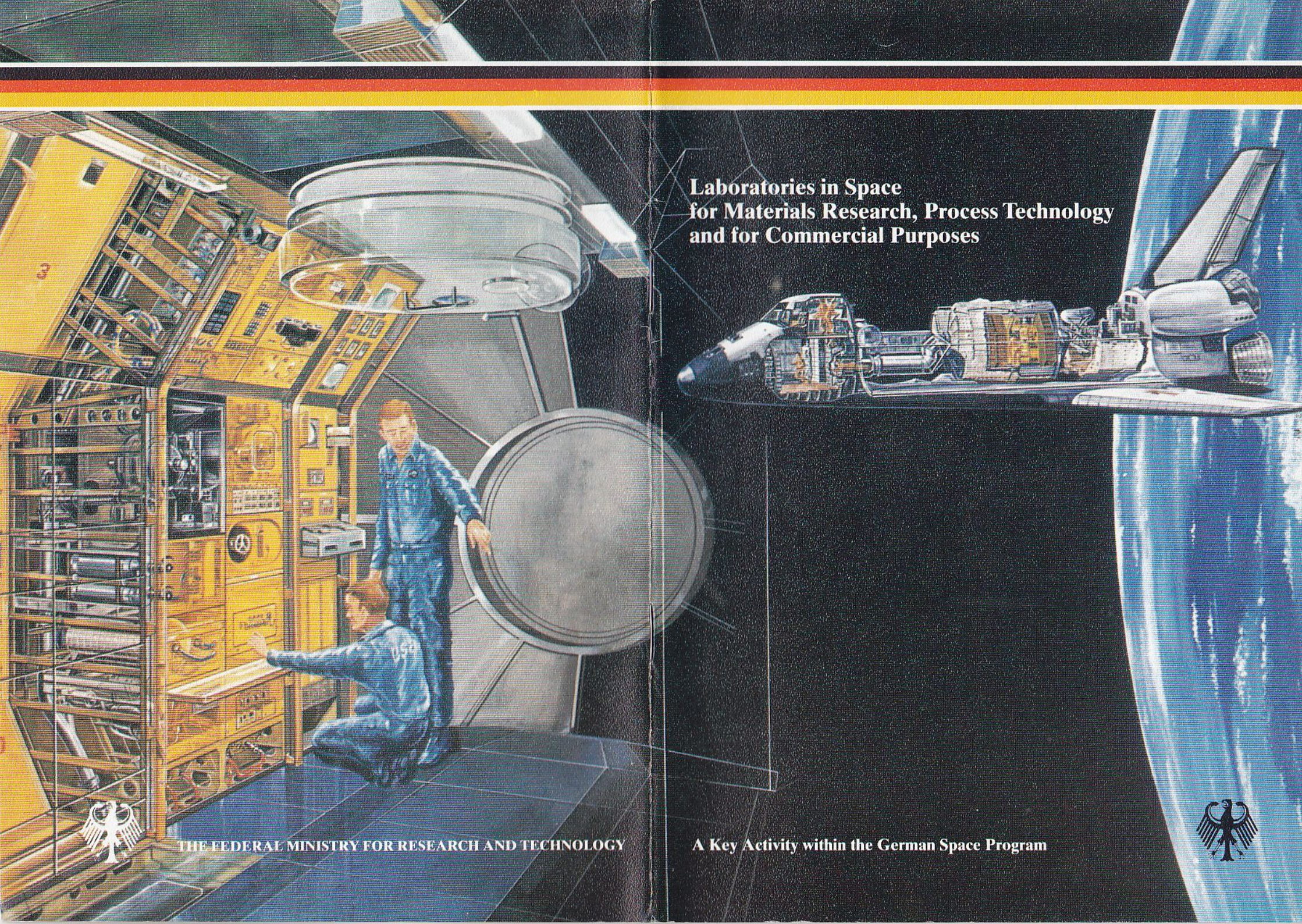
Getting Aboard Spacelab





Laboratories in Space for Materials Research, Process Technology and for Commercial Purposes

THE FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY

A Key Activity within the German Space Program

First International Microgravity Laboratory

spacelab

EUROPE's CONTRIBUTION TO THE US SPACE TRANSPORTATION SYSTEM
PRESENTED AT HANOVER 1983
BY THE INDUSTRIAL SPACELAB-CONSORTIUM
AND THE CUSTOMER ESA

Europe's space industry - a partner of NASA

Many specialist form a community

Ten European countries, twelve companies leading on the aerospace and electronic in their countries have become a unit in more than ten years, i. e. the industrial SPACELAB consortium. Their common denominator: SPACELAB, Europe's first manned and reusable laboratory. Their common target: to enable research and technology by means of this multi-mission platform to have access to manned space flight, to provide a working platform in space in order to utilize the conditions of weightlessness in space for the benefit of work on earth.

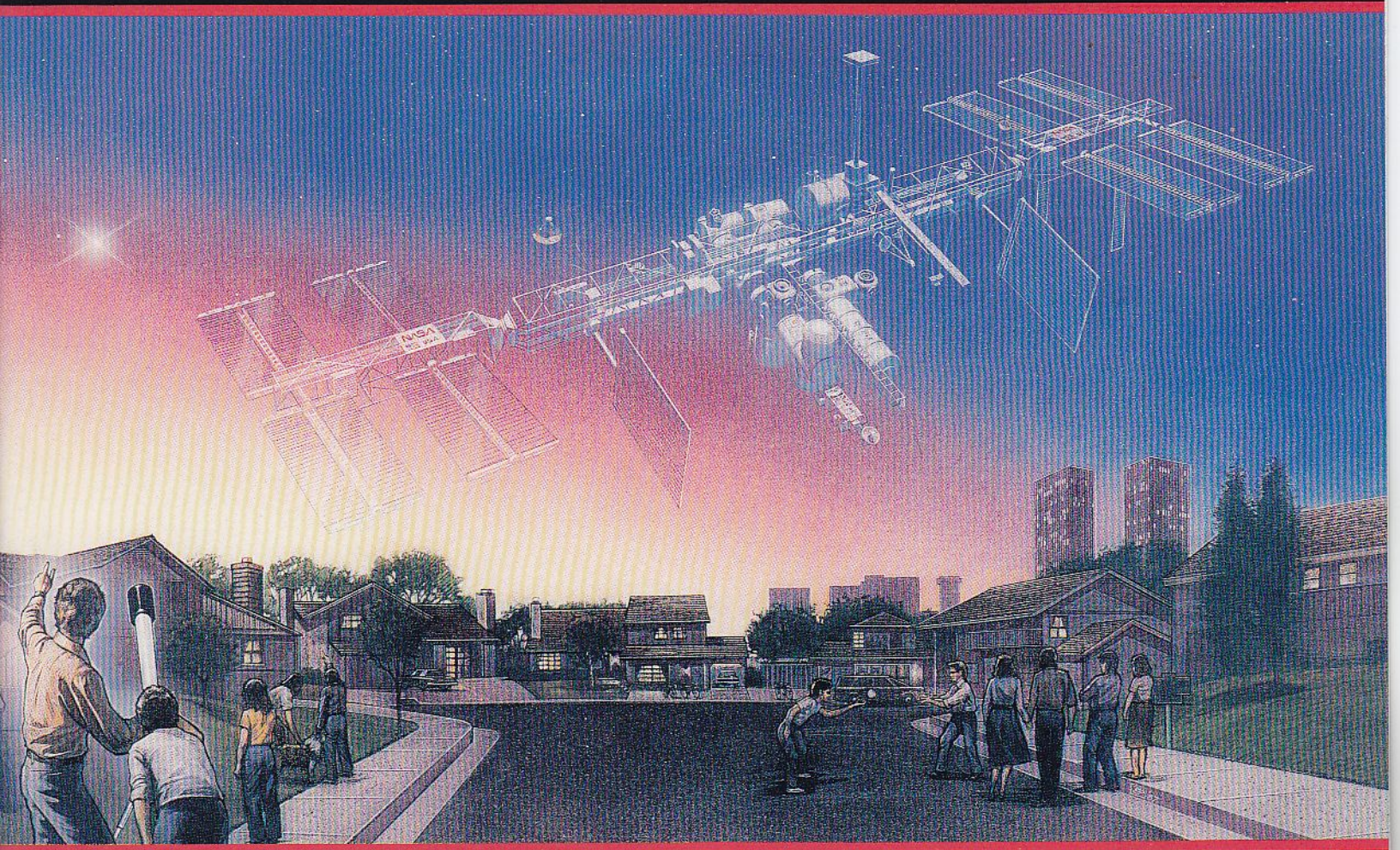
SPACELAB is more than a project, it is a trend-setting programme which offers all possibilities of paving the way for Europe's access to future space stations. The partners of the SPACELAB consortium have decided to jointly follow this course. As an acknowledged partner of the American space industry and the US space agency NASA. Transatlantic partnership has consolidated during the years of SPACELAB's development. It started in the early seventies on the basis of NASA's offer to Europe to jointly develop the new space transportation system within the framework of the Post-Apollo-Program. The European space experts who designed and built the space laboratory with MBB/ERNO as prime contractor, became a large family, their close contacts resulted in friendship with their American colleagues who built at the same time the space shuttle system. Soon all of them will witness the accomplishment of their intense efforts – the first joint flight of shuttle and SPACELAB.

THE SPACELAB CONSORTIUM: AEG-TELEFUNKEN (D), AERITALIA (I), BELL TELEPHONE MANUFACTURING (B), BRITISH AEROSPACE (GB), CIR (CH), DORNIER (D), FOKKER (NL), KAMPSAX (DK), MATRA (F), MBB/ERNO (D), SABCA (B), SENER (E).

Space Station

A Step Into The Future

By
Andrew J. Stofan



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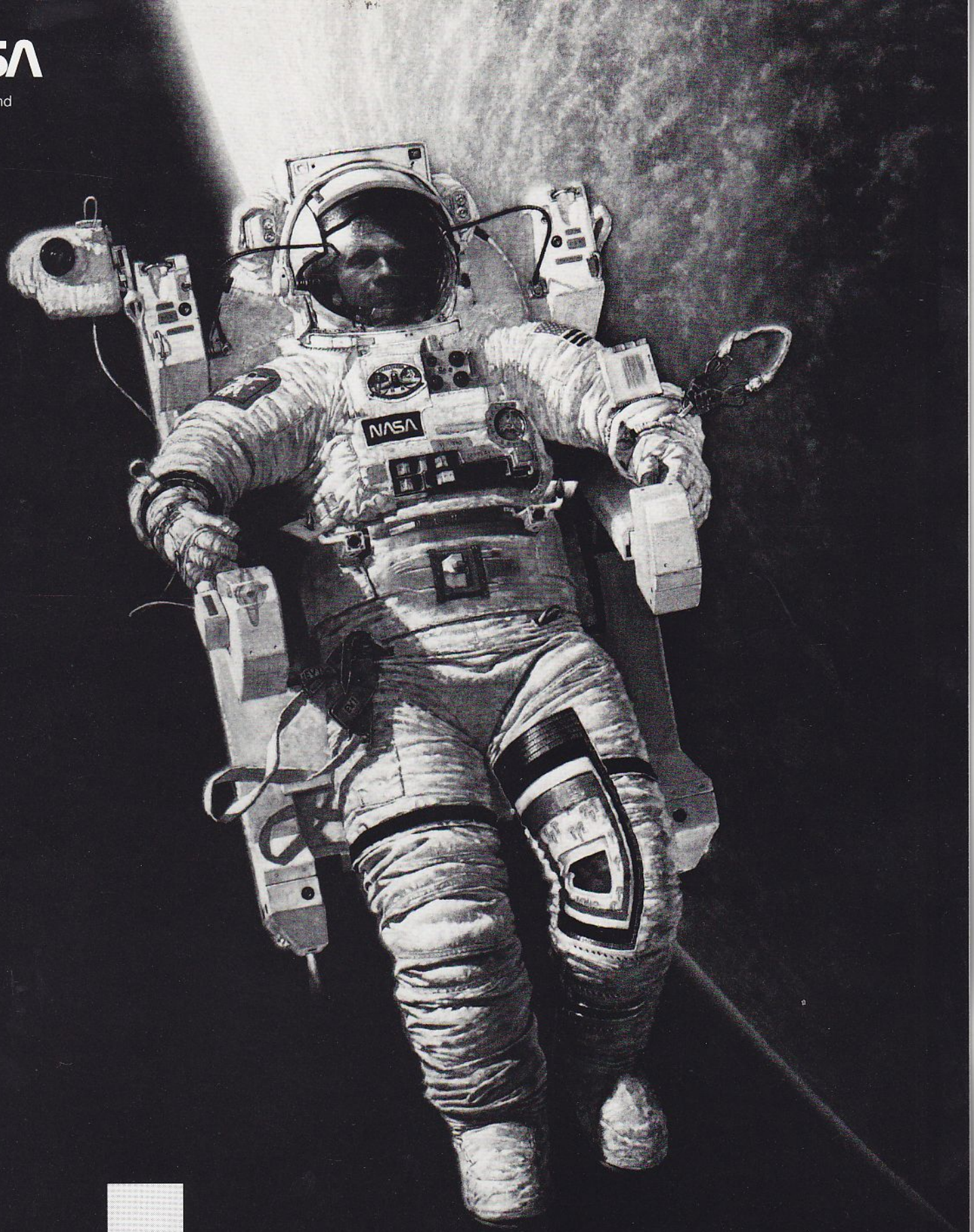
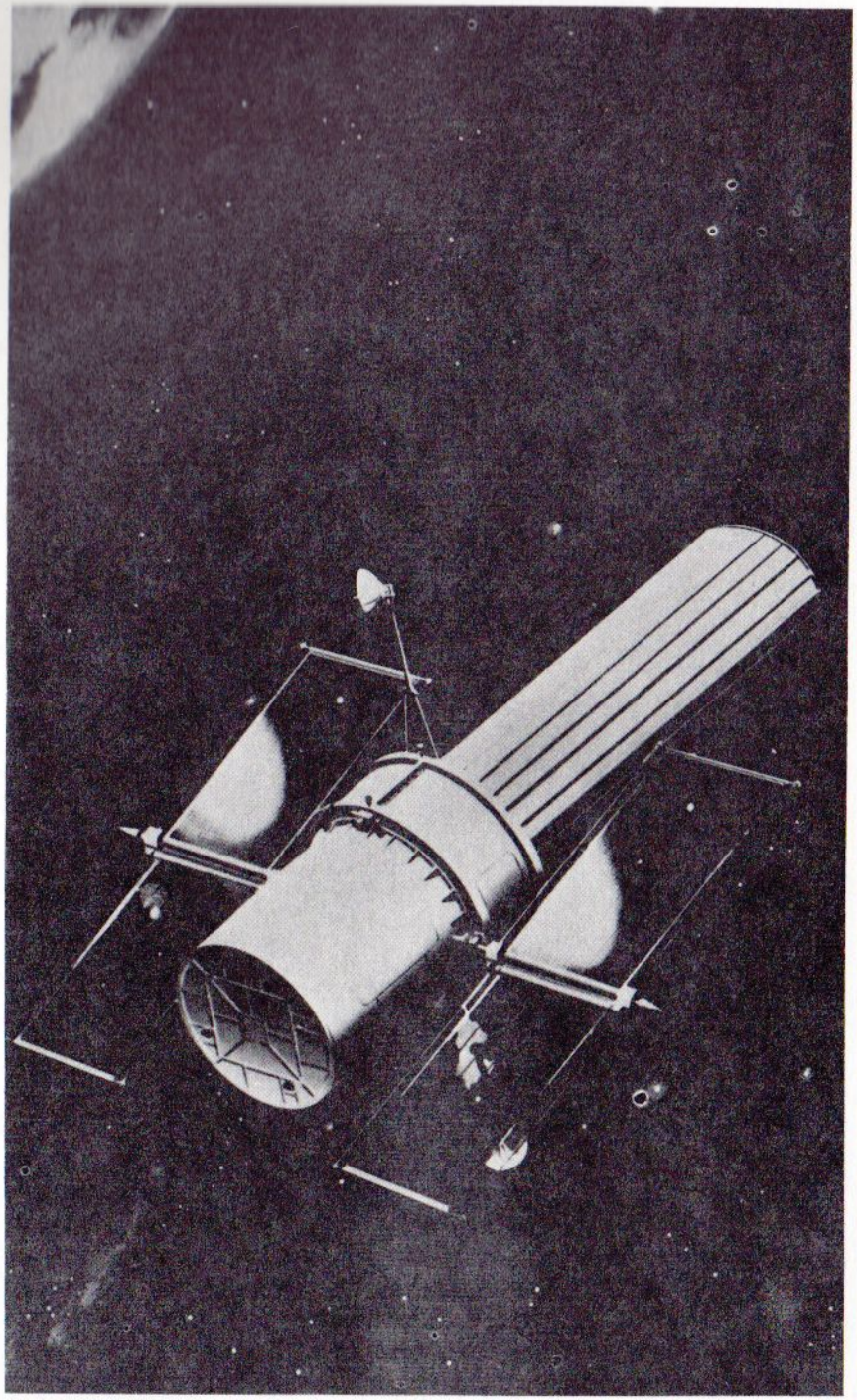


Spacesuit guidebook

NASA SP–392

The Space Telescope

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



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THE SPACE TELESCOPE

This volume contains the authors' summaries of their papers on the Space Telescope presented at the 21st annual meeting of the American Astronautical Society at Denver, Colorado, August 26–28, 1975

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Includes author index.

1. Orbiting astronomical observatories—Congresses. 2. Telescope, Reflecting—Congresses.

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FOREWORD

For over a decade, astronomers have been developing a new approach to observational astronomy and astrophysics because of the exciting new windows opened to space astronomy with the advent of the first Earth satellite. Since then, the ultraviolet portion of the spectrum has revealed new data about the stars and the universe. The proposed Space Telescope will unveil an exciting portion of the electromagnetic spectrum from the far ultraviolet to the near infrared and will make high-resolution observations in the visible portion that cannot be made from ground-based telescopes.

With the Space Telescope we will be on the threshold of new discoveries in space astronomy. It will allow astronomers to detect stars that are 50 times fainter than those observable with the most powerful ground-based instrument—the 5-meter (200-inch) Hale Telescope at Palomar. It will expand our understanding of the content, scale, structure, and evolution of the universe with a capability not possible with ground-based observatories.

The Space Shuttle, which NASA is developing for the early 1980's, will have the capability to launch the Space Telescope into its proper orbit. With the Space Shuttle to provide in-orbit maintenance, instrument update, and refurbishment for a period of 10 to 15 years, the Space Telescope will become a permanent observatory in space.

Launch of the Space Telescope will inaugurate a new era for astronomy and astrophysics. It is anticipated that it will provide an insight into new energy mechanisms and answers to many questions about the universe. Historically, astronomy has opened up new vistas that ultimately have very practical applications to our everyday terrestrial activities and problems. To predict what the contributions from the Space Telescope will be and when they will happen is folly; that they will occur is certainty.

Noel W. Hinners
Associate Administrator
for Space Science

SPACE TECHNOLOGY SERVES MANKIND

IN MANY WAYS

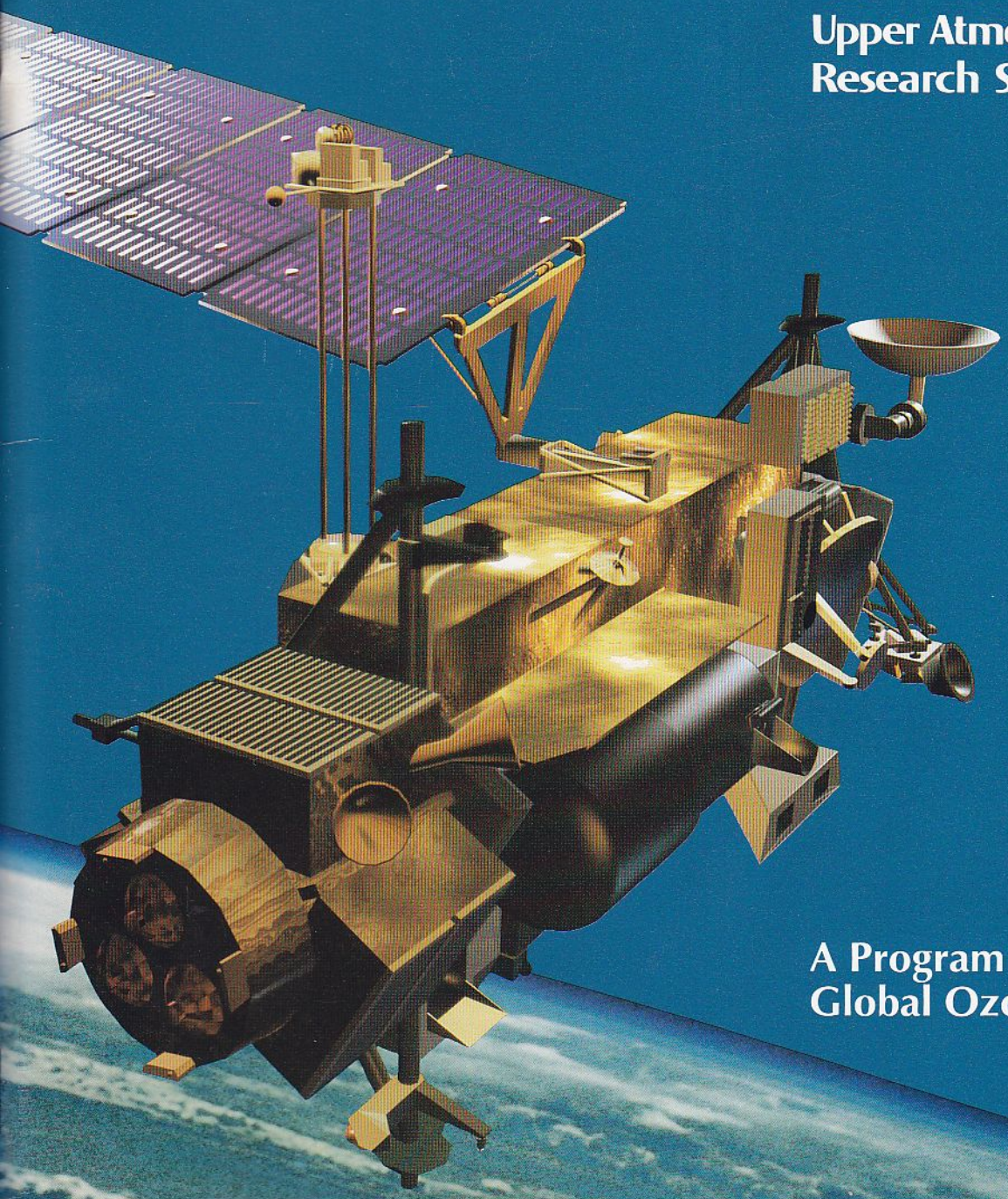
TECHNOLOGY UTILIZATION PROGRAM

JOHN F. KENNEDY SPACE CENTER, NASA

KENNEDY SPACE CENTER, FLORIDA

UARS

Upper Atmosphere Research Satellite



A Program to Study
Global Ozone Change

California Institute
of Technology

Engineering & Science

Spring 1991

In this issue

DECEMBER, 1976 VIKING PROJECT BULLETIN SPECIAL ISSUE

VIKING PROJECT
mission to mars!

An Educational Publication
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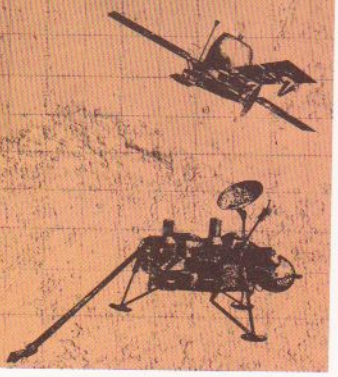
Space Administration

The Colors Of Mars



THE HISTORIC INFLUENCE OF THE COLOR OF MARS

Nergal. . . Ares. . . Mars, legendary names for a pinpoint of reddish light in the night sky, observed to move relative to the star field even in ancient times. Because of its color, Mars was an important part of the mythology of early civilizations, serving as an abode for gods of fire, war and terror in the minds of many populaces up through the centuries. These people couldn't see the universe as we understand it today, nor could they provide causal explanations for the environment and human motivations that so profoundly affected their daily lives. Complex myths and specialized gods evolved and were associated with elements of the unknown. Today mythology is no longer necessary – though its quality of imagination remains as a tool of science in the quest for new knowledge about the universe. In the unique case of Mars, color no longer suggests aspects of mythical violence. Why then the persistent interest in its color? Science. The implications of the planet's color relate directly to Mars' chemistry, its environment, and to its physical/environmental history. Turn these pages now and sample the red planet in all of its colorations. Leave myth behind and be prepared to "think in color" about the science of Mars.

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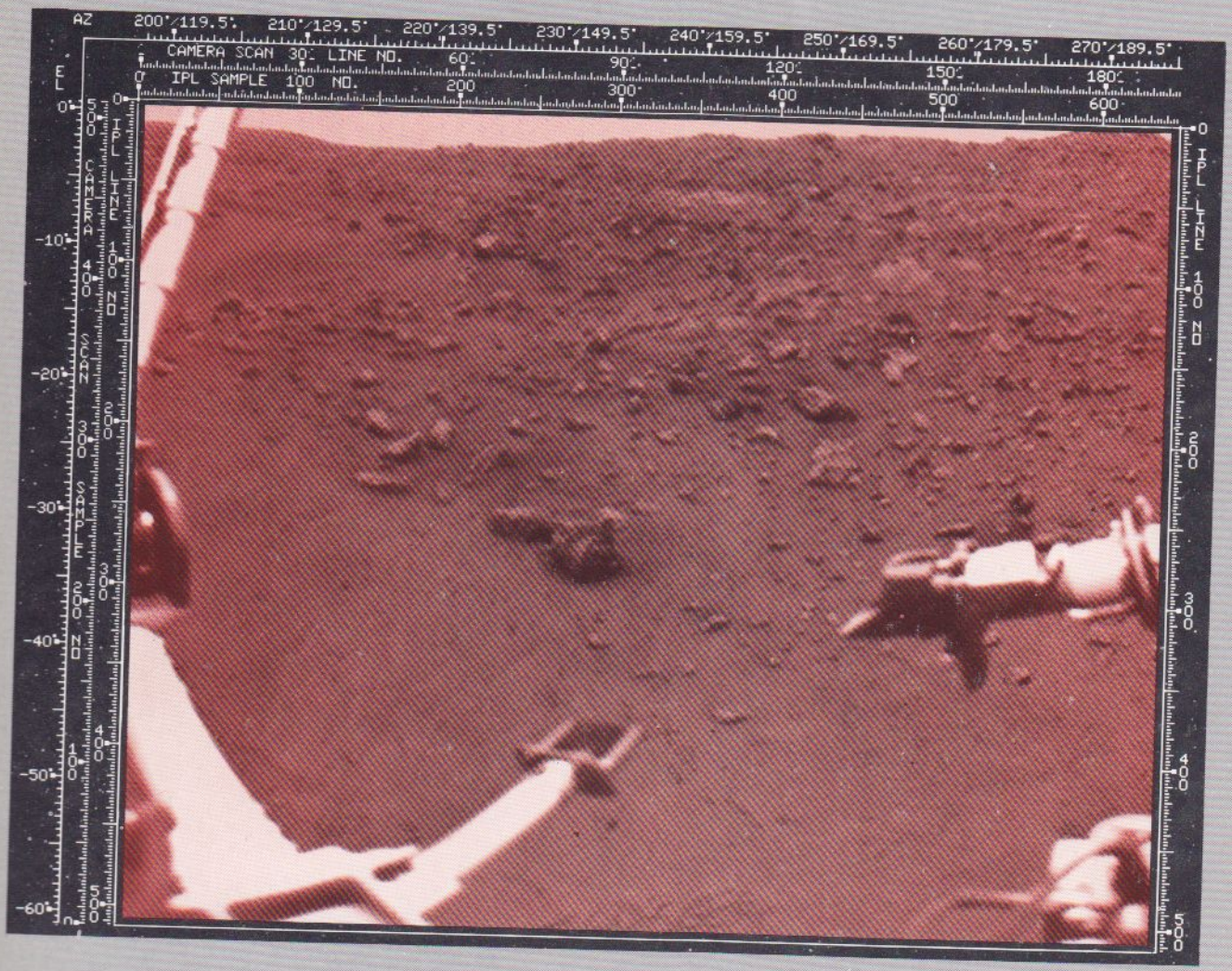
EARLY RESULTS



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

n, the biggest volcanic pile on Earth.
ally, nearly half of Mars seems to be
anic in origin and extensive lava flows
visible. However, there is no evidence
urrent volcanic activity.

here is also an interesting Martian
on called "chaotic." About the size of
ka, its series of short ridges, slumped
ys, and other irregular topography
mble the after-reffects of a landslide
uake. Nowhere on Earth is a compar-
feature so vast.

nother mysterious Martian region is a
smooth one called Hellas. Craters
pock the Martian surface stop short
ellas, which is about as large as Texas.
ntists term Hellas a "featureless" area
as yet, cannot explain it. Perhaps,
surface is obscured by dust clouds.
hile much of the Viking focus is on
search for life on Mars, Viking's
ctives are quite broad. This recognizes
fact that so relatively little is known
ut Mars. Because of this, the area of
nce in which the most significant
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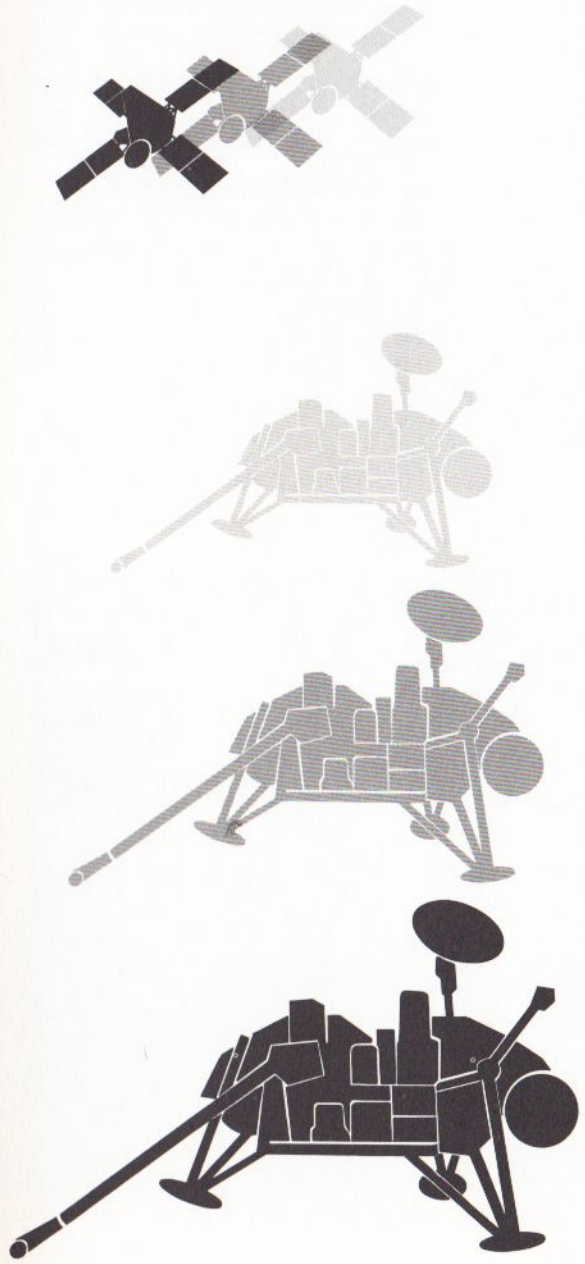
Mission to Mars



VIKING AND THE SEARCH FOR LIFE ON MARS

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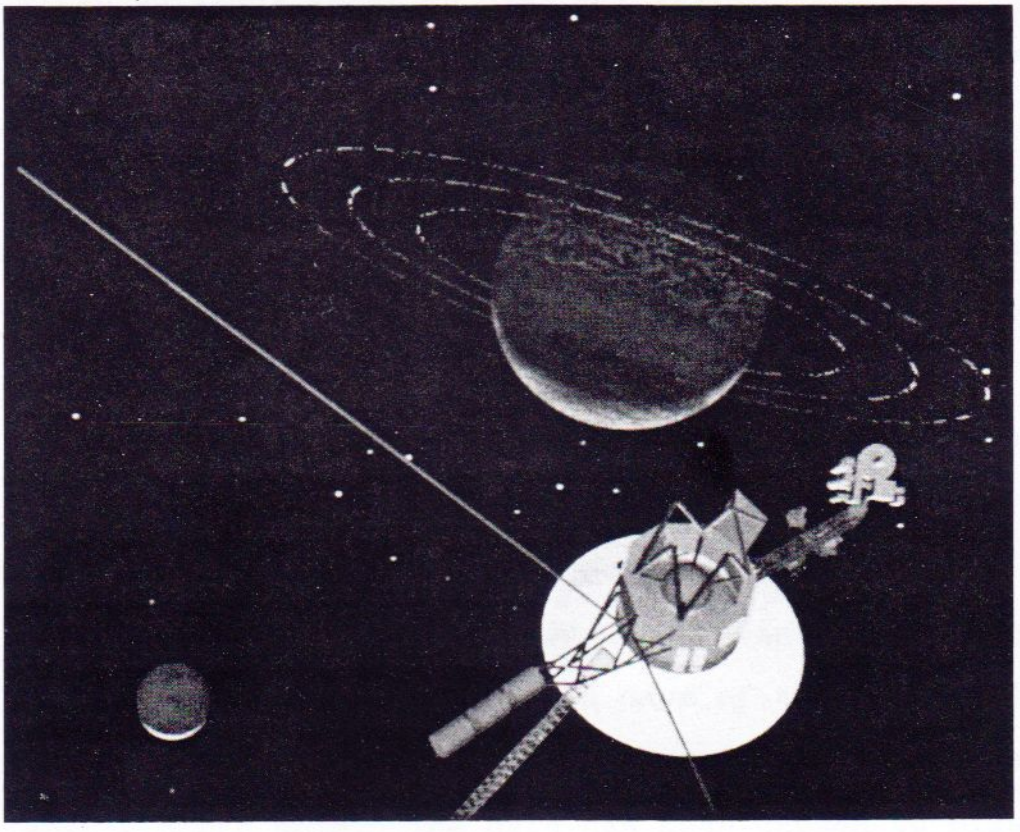

VOYAGER 2 ENCOUNTER OF NEPTUNE

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Encounter With Uranus

The *first* discovery of Uranus came more than two centuries ago, when not even the Earth was fully explored, and the true scale of the solar system was not yet imagined.

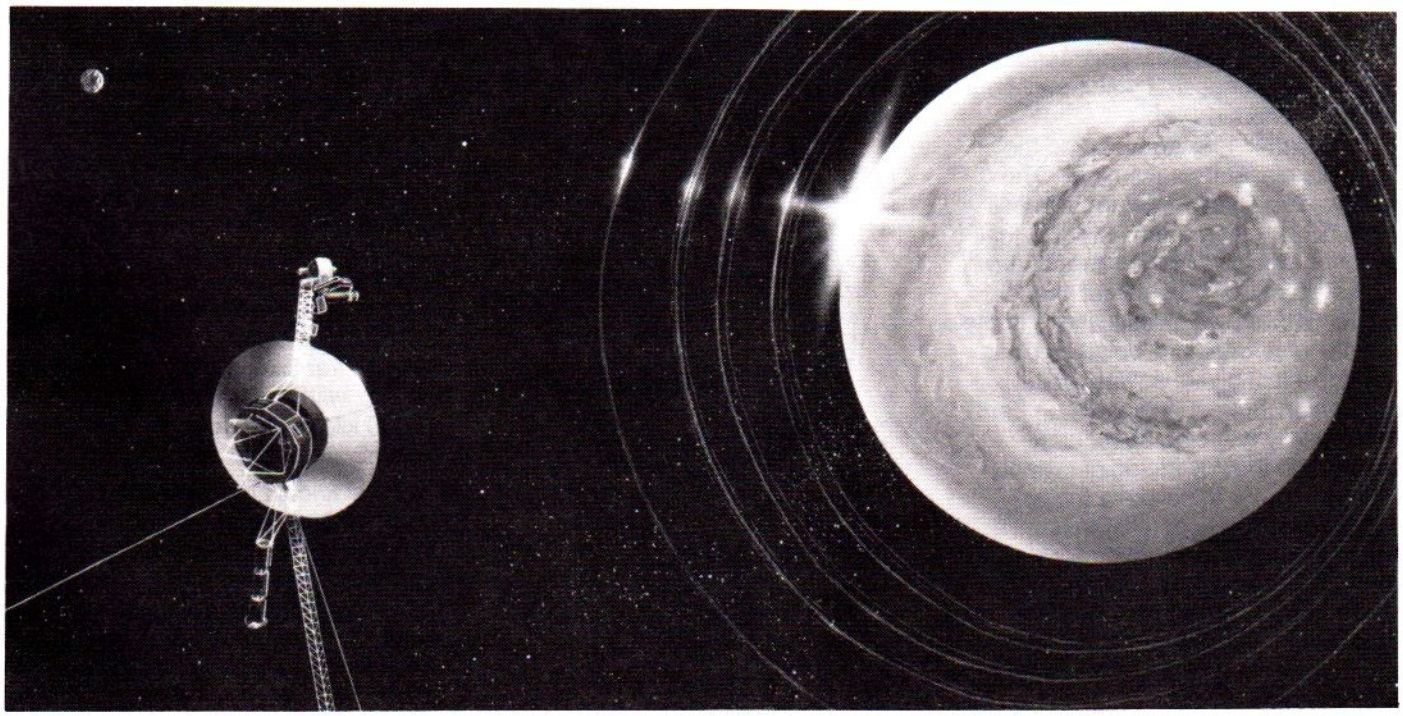
On the night of March 13, 1781, the English musician and amateur astronomer William Herschel was conducting a survey of the sky with his six-inch reflecting telescope (he had determined "never to pass by any, the smallest, portion of [the heavens] without due investigation"), when he stumbled across an object of "uncommon appearance" between the constellations Auriga and Gemini. Supposing it to be a comet, Herschel reported his find to the international astronomical community, but within a few months the object was recognized as something much rarer and more important—a "new" world, circling the Sun at nearly twice the distance of the farthest known planet, Saturn.

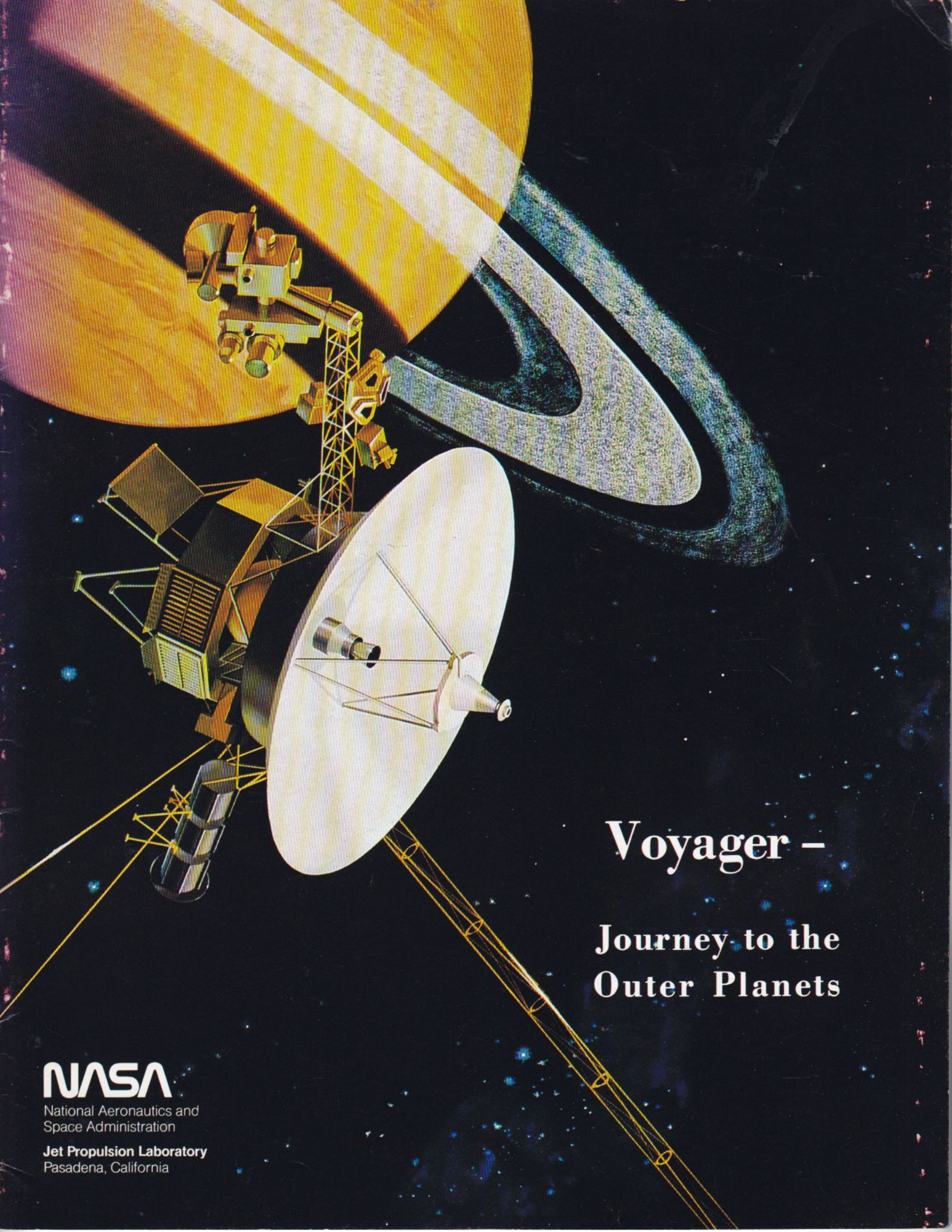
Uranus' *second* discovery—a more revealing one—is happening right now, in our time. Four planets and nearly two billion miles away from its starting point on the beaches of Florida in 1977, the Voyager 2 spacecraft is approaching a world so pale and distant that not even 200 years of observation have much improved our understanding of it. Voyager's next stop, in January 1986: Uranus, the seventh planet from the Sun.

The Story So Far

The two Voyager spacecraft are halfway through a "grand tour" of the giant gas planets of the outer solar system—Jupiter, Saturn, Uranus, and Neptune. Until the time of the Voyager launches, only the inner, Earthlike planets had been photographed and explored in any detail. Jupiter and Saturn had been only very briefly surveyed by two modestly equipped Pioneer probes, and Uranus and Neptune were mysterious points of light in the telescope.

It happened that in 1977, for the first time since Thomas Jefferson was president, the large outer planets were





Voyager –

Journey to the Outer Planets

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Voyage To Jupiter

David Morrison
and Jane Samz

NASA Scientific and Technical Information Branch 1980
National Aeronautics and Space Administration
Washington, DC

199 pages

VOYAGER AT NEPTUNE AND TRITON: 1989

NASA SP-451

Voyages to Saturn

David Morrison

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