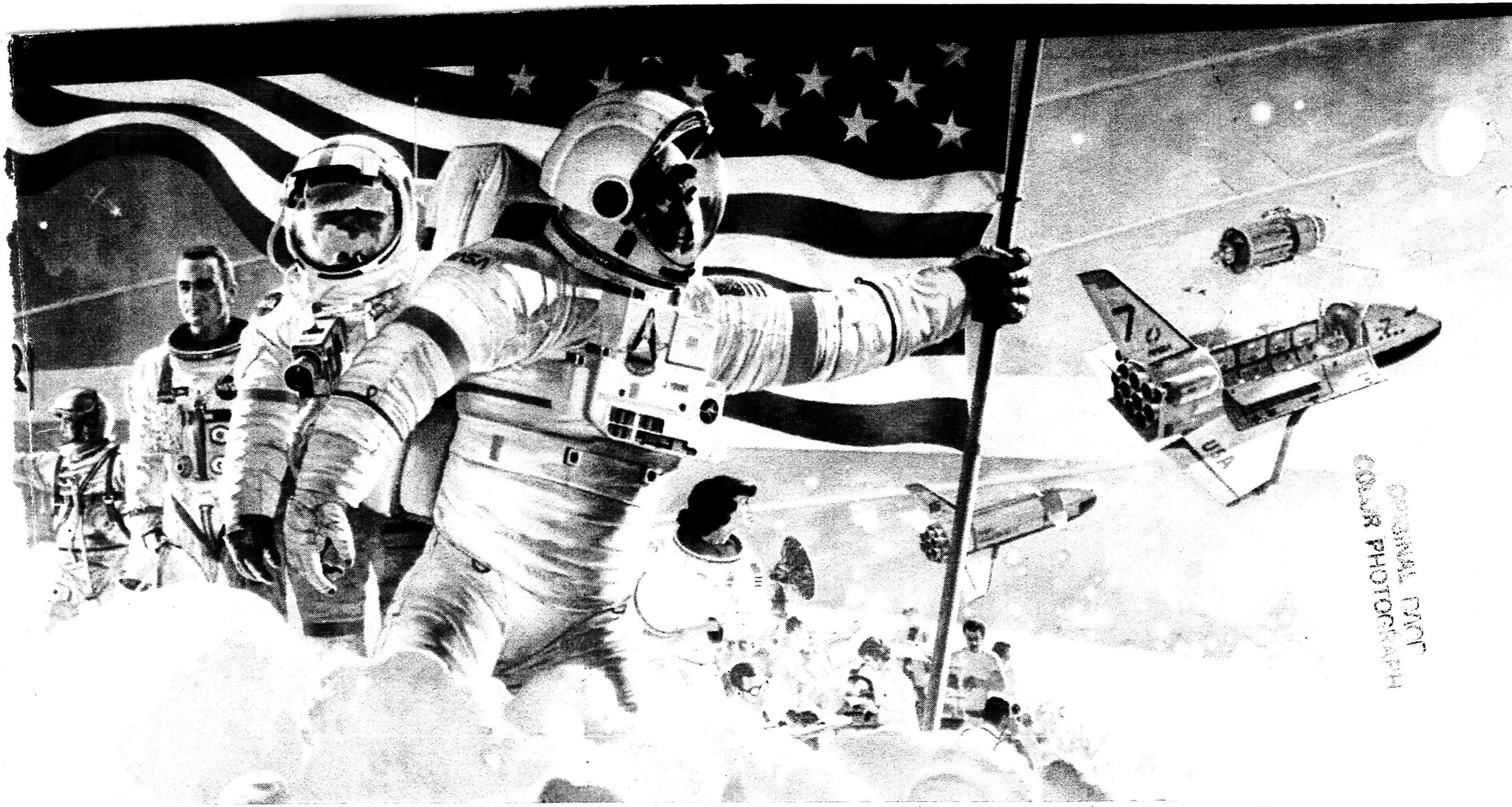

(NASA-TM-101781) THE BEST WE CAN BE (NASA) N89-26873
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THE BEST WE CAN BE

Robert McCall's mural *Opening the Space Frontier—The Next Giant Step*—Johnson Space Center

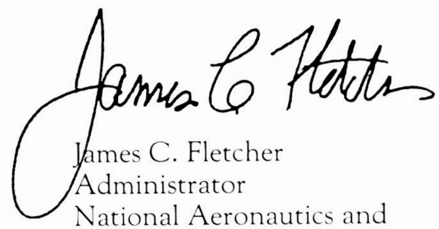
BEING OUR BEST

On any scale, the achievements of America's manned space program are remarkable. They constitute a record of which every American can be proud. And for those of us privileged to have had a hand in the exciting results, that record is a source of special pride and pleasure.

The purpose of this booklet is twofold: to document our record in manned space flight and to salute the people who made it happen. Highlighted in the pages that follow are successes that reflect not only the skills and daring of our astronauts but also the dedication and hard work of the entire NASA/industry team.

Make no mistake—each of you is an important part of that team, and only through *your* commitment will we continue to succeed, to build on the past and move forward to meet the increasing challenges of the future. Those challenges will demand the best that is in us—the best we can be.

As we prepare to reach for tomorrow's goals, it is well to remind ourselves that the exploration of space has only just begun. Space is the final frontier, and the opportunities ahead are as limitless as space itself. Every mystery that we solve, every discovery that we make benefits not only America but all of mankind. History will judge our efforts, and I believe the verdict will be favorable. For when posterity looks back on the 20th century, we will be remembered as the generation that took the first steps on the road to the planets.



James C. Fletcher
Administrator
National Aeronautics and
Space Administration

The best we can be

THE EARLY DAYS

Can it have been over a quarter of a century? It seems only yesterday that Alan Shepard took his 15-minute suborbital ride in *Freedom 7*, launching America's manned exploration of space.

The date was May 5, 1961, three weeks before President John F. Kennedy committed the nation to landing a man on the moon and returning him safely to earth. It would be another nine months before John Glenn flew America's first orbital mission.

So much had to be done before we reached the moon. Today, in retrospect, everything about the early manned space program seems small for so monumental a task. There were only seven astronauts, and the one-man Mercury capsule was a long way from the capability needed to carry a crew to the moon and back.

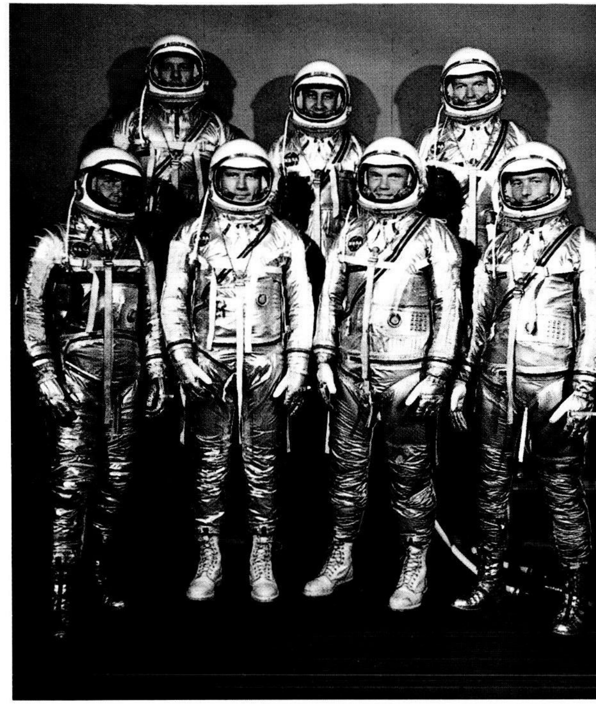
But the capability was coming along. With every flight of Mercury, our astronauts stayed in orbit longer and did more. On the last mission, Gordon Cooper orbited the earth 22 times, spending a day and a half in space.

Those six Mercury flights laid the technical groundwork for the lunar landing. By March 1965, some two years after Project Mercury ended, the two-man Gemini spacecraft was flying. Through Gemini, we learned how to live, function, and maneuver in space. Mission times increased from hours in orbit to days, and America's first space walk made space seem a lot less hostile and the moon appear a lot nearer.

The Mercury and Gemini missions were solid successes. From them, America built an experienced ground team, not only in the control room and at tracking stations but also in industry.

That team was, and is, a national resource. It grew in size and performance along with the astronaut corps and the manned space effort, eventually stretching across the United States and embracing every scientific and technical discipline. And when the Gemini missions were finished, this unparalleled combination of astronauts, controllers, engineers, scientists, technicians, and workers in virtually every trade and craft in industry turned its full attention to Apollo and the lunar landing.

It was an awesome capability; America was ready to meet its historic commitment.



Top, the original seven astronauts: front row, from left, Walter M. Schirra, Jr., Donald K. Slayton, John H. Glenn, Jr., M. Scott Carpenter; back row, Alan B. Shepard, Jr., Virgil I. Grissom, L. Gordon Cooper, Jr.

Right, Gemini VII as seen from Gemini VI during rendezvous maneuvers

Mercury/Redstone 3 ***(Freedom 7)*****—**Suborbital flight; first American in space. Crew: Alan B. Shepard, Jr. Launched May 5, 1961.

Mercury/Redstone 4 ***(Liberty Bell 7)*****—**Suborbital flight. Crew: Virgil I. Grissom. Launched July 21, 1961.

Mercury/Atlas 6 ***(Friendship 7)*****—**Three-orbit flight; first American in orbit. Crew: John H. Glenn, Jr. Launched February 20, 1962.

Mercury/Atlas 7 ***(Aurora 7)*****—**Three-orbit flight. Crew: M. Scott Carpenter. Launched May 24, 1962.

Mercury/Atlas 8 ***(Sigma 7)*****—**Six-orbit flight. Crew: Walter M. Schirra, Jr. Launched October 3, 1962.

Mercury/Atlas 9 ***(Faith 7)*****—**Twenty-two-orbit flight. Crew: L. Gordon Cooper, Jr. Launched May 15, 1963.

Gemini/Titan III ***(Molly Brown)*****—**Three-orbit flight; maneuver on first pass changed orbital path of a manned spacecraft for first time. Crew: Virgil I. Grissom and John W. Young. Launched March 23, 1965.

Gemini/Titan IV—Four-day flight; first American space walk (20 minutes). Crew: James A. McDivitt and Edward H. White II. Launched June 3, 1965.

Gemini/Titan V—Eight-day flight; first use of fuel cells for electric power. Crew: L. Gordon Cooper, Jr., and Charles Conrad, Jr. Launched August 21, 1965.

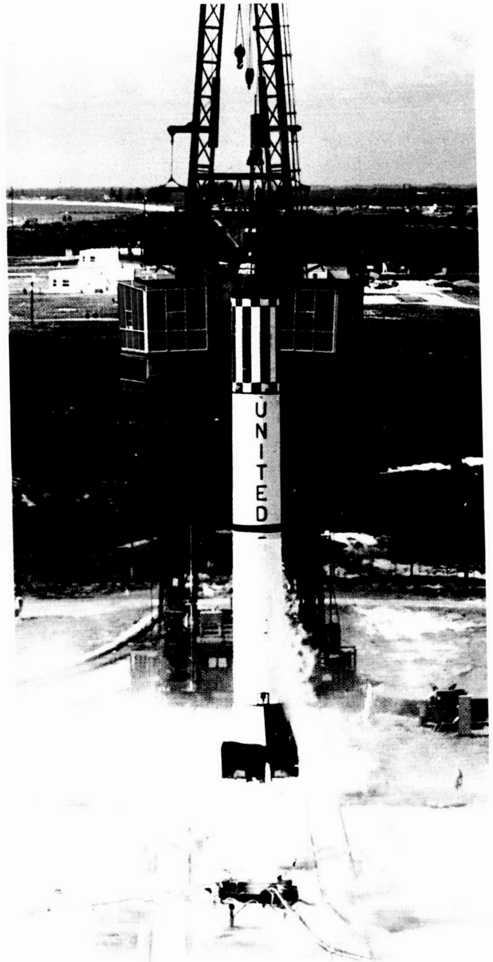
Gemini/Titan VII—Two-week flight (longest Gemini mission); served as rendezvous target for Gemini VI-A. Crew: Frank Borman and James A. Lovell, Jr. Launched December 4, 1965.

Gemini/Titan VI-A—One-day flight; made first space rendezvous, with Gemini VII. Crew: Walter M. Schirra, Jr., and Thomas P. Stafford. Launched December 15, 1965.

Gemini/Titan VIII—Ten-hour flight; first docking of a vehicle in space—Gemini with Agena. Crew: Neil A. Armstrong and David R. Scott. Launched March 16, 1966.

Gemini/Titan IX-A—Three-day flight; more than 2 hours of extravehicular activity. Crew: Thomas P. Stafford and Eugene A. Cernan. Launched June 3, 1966.

Gemini/Titan X—Three-day flight; rendezvoused with two vehicles—Gemini VIII and Agena; extravehicular activity included retrieval of experiment from Agena. Crew: John W. Young and Michael Collins. Launched July 18, 1966.



Gemini/Titan XI—Three-day flight; after docking with Agena, reached Gemini record altitude of 739.2 miles; vehicles later made two revolutions of earth in tethered configuration. Crew: Charles Conrad, Jr., and Richard F. Gordon, Jr. Launched September 12, 1966.

Gemini/Titan XII—Four-day flight; 5 hours 20 minutes of extravehicular activity. Crew: James A. Lovell, Jr., and Edwin E. Aldrin, Jr. Launched November 11, 1968.

Left, lift-off of Redstone/Mercury on first suborbital flight

Above, astronaut Alan Shepard being hoisted into recovery helicopter after suborbital flight

The best we can be

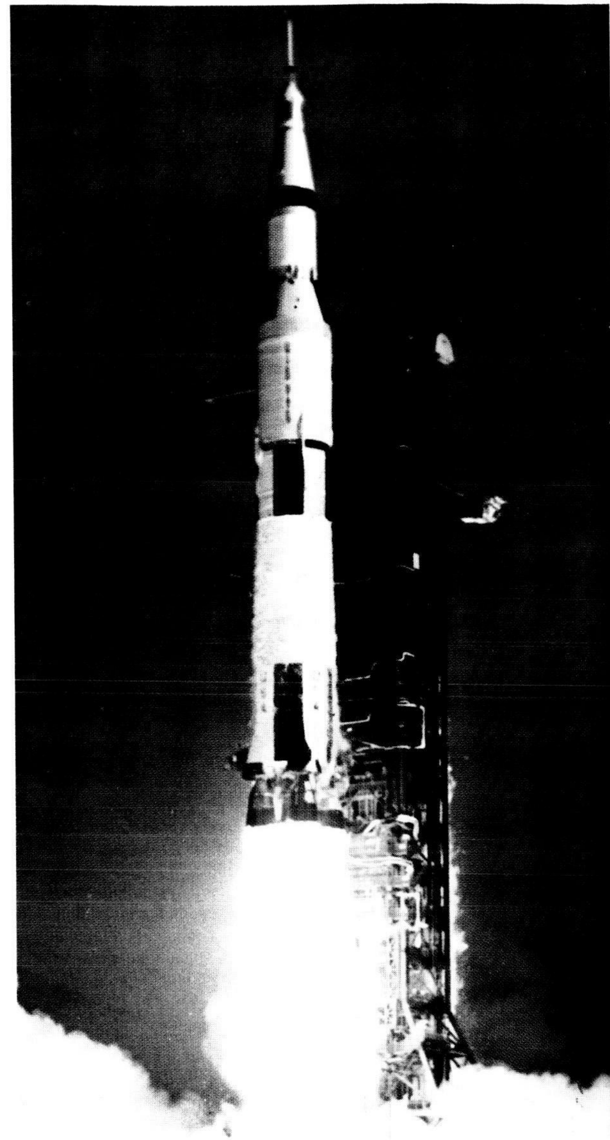
GOING TO THE MOON

It seems almost an understatement to say that the Apollo program was the greatest peacetime undertaking in history. In scope and global interest, it has no rival. At its inception in 1961, America was behind in space; in less than a decade—spurred by President Kennedy's commitment—we were number one, with men on the moon to prove it.

Of the 11 manned Apollo flights, nine were to the moon and six were lunar landings. The first landing, Apollo 11, was witnessed by the largest audience the world has ever known—hundreds of millions of people around the earth watched or listened as Neil Armstrong made man's first step upon the moon. The last landing, some three and a half years later, produced the greatest single haul of scientific data ever yielded by the moon, or by any other celestial body.

America did not just land men on the moon—we explored it. Twelve Apollo astronauts "worked" on the lunar surface, traveling up to 22 miles from their spacecraft bases. They took thousands of photographs and brought back over 800 pounds of lunar material. Their discoveries surprised many people on earth, because no one had predicted the moon that they found. Indeed, some scientists believe that nothing was known about the moon, other than its broadest physical characteristics, before the Apollo landings. And what the Apollo lunar evidence has shown is changing our view of the solar system, and giving us a new perspective on earth's place in it.

That was the primary Apollo goal—to reach and explore the moon—but the legacy of Apollo encompasses much more than lunar findings. Apollo gave us the technological advances that led to Space Shuttle. It brought us benefits too numerous to name, benefits that have touched every area of society. It taught us how to manage technical elements and human resources of enormous proportions. And it gave us the skills, experience, and confidence to move onward in space.



Saturn V/Apollo 11 lifting off for the moon

Apollo 7—First manned Apollo flight; demonstrated ability of CSM to fly earth-orbital mission. Crew: Walter M. Schirra, Jr., Donn F. Eisele, R. Walter Cunningham. Launched October 11, 1968.

Apollo 8—First manned lunar-orbital mission (Christmas 1968). Crew: Frank Borman, James A. Lovell, Jr., William A. Anders. Launched December 21, 1968.

Apollo 9—Second earth-orbital mission; first manned flight with lunar module (LM). Crew: James A. McDivitt, David R. Scott, Russell L. Schweickart. Launched March 3, 1969.

Apollo 10—First lunar-orbital flight of entire Apollo spacecraft (CSM and LM). Crew: Thomas P. Stafford, John W. Young, Eugene A. Cernan. Launched May 18, 1969.

Apollo 11—First manned landing on the moon. Crew: Neil A. Armstrong, Michael Collins, Edwin E. Aldrin, Jr. Launched July 16, 1969.

Apollo 12—Second manned lunar landing—and second before the end of the decade. Crew: Charles Conrad, Jr., Richard F. Gordon, Jr., Alan L. Bean. Launched November 14, 1969.

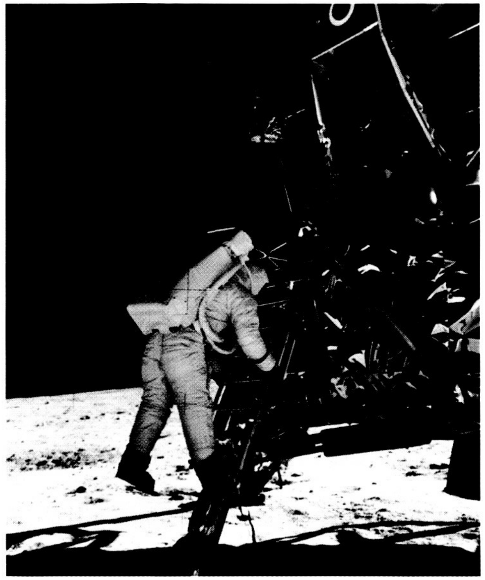
Apollo 13—The only Apollo mission whose lunar landing was aborted; showed that the Apollo team—astronauts in space and engineers on the ground—could bring home a crippled spacecraft. Crew: James A. Lovell, Jr., John L. Swigert, Fred W. Haise, Jr. Launched April 11, 1970.

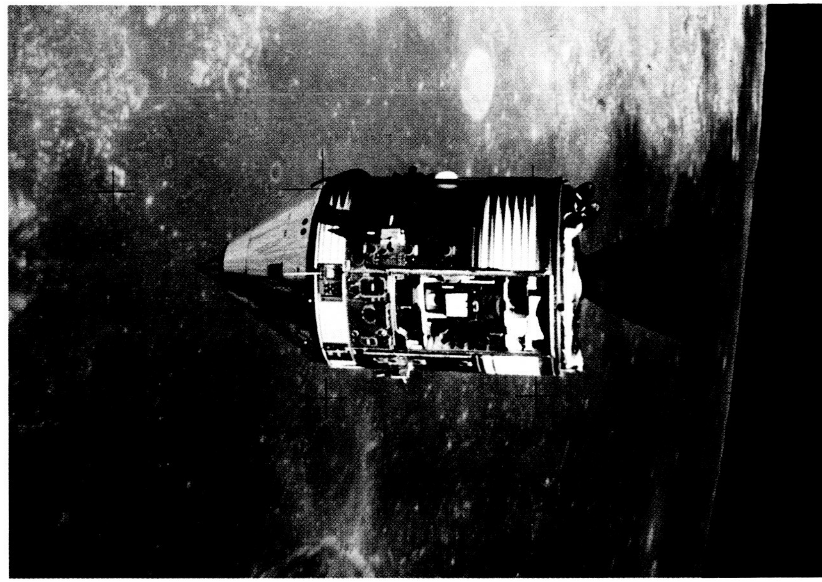
Apollo 14—First investigation of a hilly region of the moon. Crew: Alan B. Shepard, Jr., Stuart A. Roosa, Edgar D. Mitchell. Launched January 31, 1971.

Apollo 15—First of three lunar missions with greatly expanded capability for conducting scientific investigations. First use of lunar rover. Crew: David R. Scott, Alfred M. Worden, Jr., James B. Irwin. Launched July 26, 1971.

Apollo 16—Second mission with scientific instruments in the CSM. Lunar rover extended exploration to almost 17 miles. Crew: John W. Young, Thomas K. Mattingly II, Charles M. Duke, Jr. Launched April 16, 1972.

Apollo 17—Last Apollo lunar mission; produced more scientific information than did any other Apollo flight. Crew: Eugene A. Cernan, Ronald E. Evans, Dr. Harrison H. Schmitt. Launched December 7, 1972.





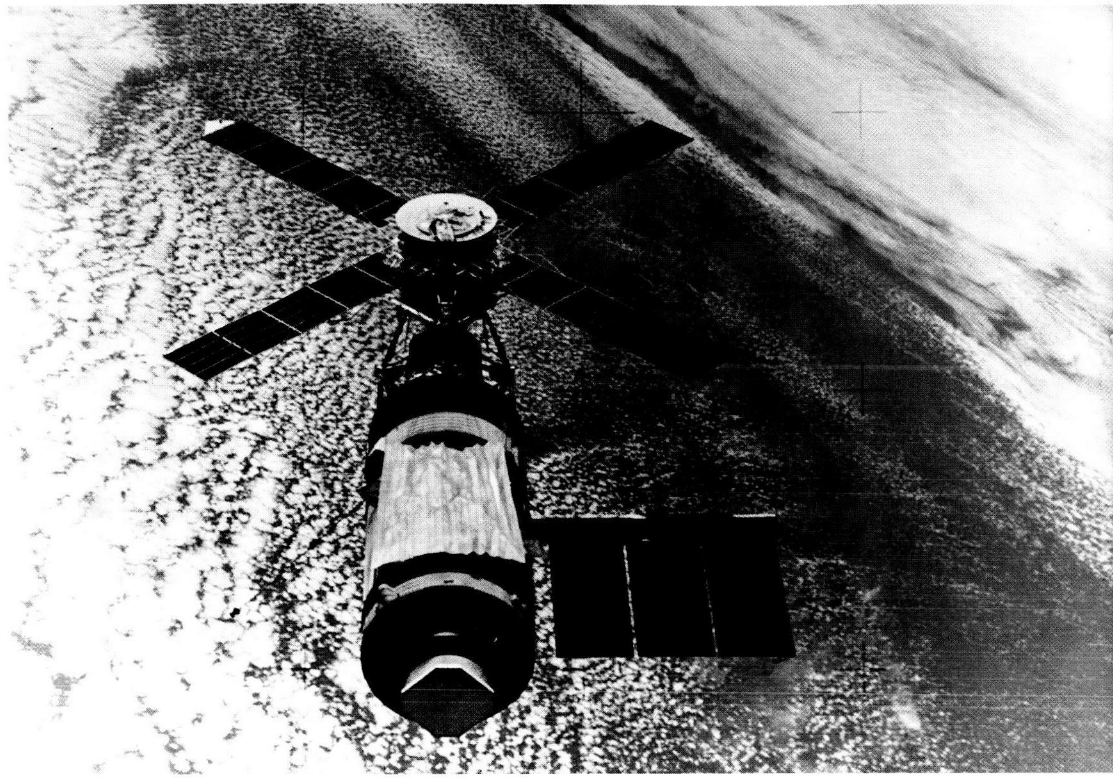
Clockwise, "The Eagle *has landed." (Apollo 11—July 20, 1969); Apollo 15 CSM (command and service modules) orbiting the moon; a composite lunar scene showing astronaut Harrison Schmitt standing next to a boulder with lunar rover in the distance*

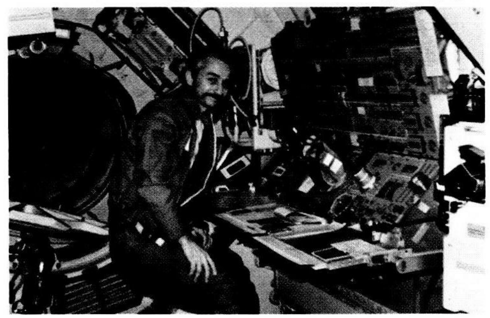
The best we can be

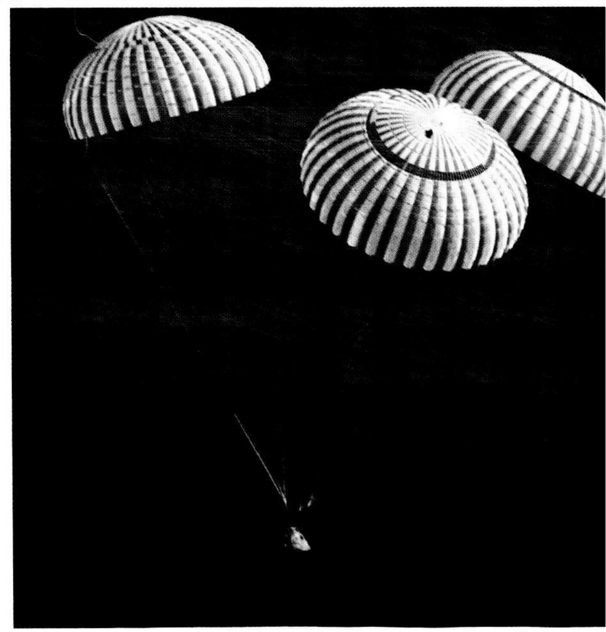
AN ORBITAL WORKSHOP

On May 14, 1973, a refitted third stage of the Saturn V rocket was launched into orbit, becoming America's first manned station in space. Its name was Skylab and its purpose was twofold: to prove that human beings could live and work in space for extended periods and to expand our knowledge of solar astronomy. In meeting both goals, Skylab immeasurably advanced our ability to design, develop, and build a permanently manned space facility.

Skylab was outfitted on the ground and launched unmanned. During lift-off, vibrations ripped off the meteoroid shield, which took one of the solar panels with it and prevented the other from deploying. So, the first task of the first Skylab crew, launched 11 days later, was to repair the damage and to devise a makeshift sunshade. This solved the mechanical problems, and Skylab's performance was never diminished.







Top, view of Skylab from the Apollo CSM

Above, astronaut Owen Garriott aboard Skylab

Right, last Skylab command module floating to splashdown

Over the next nine months, two more three-man crews flew their Apollo CSM's to the workshop. The three crews spent 171 days aboard Skylab and conducted almost 300 scientific and technical experiments, ranging from observations of the sun to the adaptability of humans to microgravity. And when the last crew secured the workshop and headed for home, Skylab had added another successful chapter to America's manned space program. Besides the scientific data collected, Skylab had proven that people not only could exist in space for long periods but also could do impressively useful work.

Skylab circled the earth for more than six years. After almost 35,000 orbits, it entered the atmosphere on July 11, 1979, disintegrating over the Indian Ocean.

Manned Skylab Missions

1: Modified CSM ferried first crew to orbiting Skylab. Crew repaired damaged Skylab, saving the program. Crew: Charles Conrad, Jr., Paul J. Weitz, Joseph P. Kerwin. Launched May 25, 1973.

2: CSM carried second crew to Skylab for a working stay of 2 months. Crew: Alan L. Bean, Jack R. Lousma, Owen K. Garriott. Launched July 28, 1973.

3: CSM transported last crew to Skylab workshop. After a stay of 84 days, crew returned with 20,500 photos of earth and 29 miles of taped data. Crew: Gerald P. Carr, William R. Pogue, Edward G. Gibson. Launched November 10, 1973.

Apollo-Soyuz Test Project—American-developed docking module was used in first international space mission, linking a CSM and a Soviet Soyuz spacecraft in earth orbit to test rendezvous and docking techniques and to conduct joint experiments. Crew: Thomas P. Stafford, Donald K. Slayton, Vance D. Brand. Launched July 15, 1975.

In July 1975, a year and a half after the final Skylab mission, the last Apollo was flown, linking up with a Soviet Soyuz spacecraft in earth orbit. The Apollo-Soyuz Test Project, the first international manned space mission, demonstrated the compatibility of the American and Soviet rendezvous and docking systems, opening the way for future joint space flights and for international space rescue operations.

The mission was flawless. Soyuz was launched from the Soviet Union about seven hours before Apollo lifted off. Fifty-two hours after launch, the Apollo CSM rendezvoused and docked with Soyuz. During the next two days, the crews exchanged visits to each other's spacecraft and conducted experiments. The Soviet craft returned to earth 43 hours after separation; Apollo remained in space six days more.

The best we can be

INTERNATIONAL COOPERATION IN SPACE

Top, Soyuz spacecraft as seen from Apollo

Above, astronaut Thomas Stafford and cosmonaut Alexei Leonov in the Soyuz spacecraft

The best we can be

THE SPACE SHUTTLE ERA

Development of Space Shuttle was begun in late 1972, and the first orbiter, *Enterprise*, was rolled out from the Rockwell International assembly facility in September 1976. In 1977, from atop its Boeing 747 carrier craft, the *Enterprise* completed 13 flights in the Approach-and-Landing Test, verifying the aerodynamic and control characteristics of the vehicle and paving the way for the space-rated orbiters that would follow.

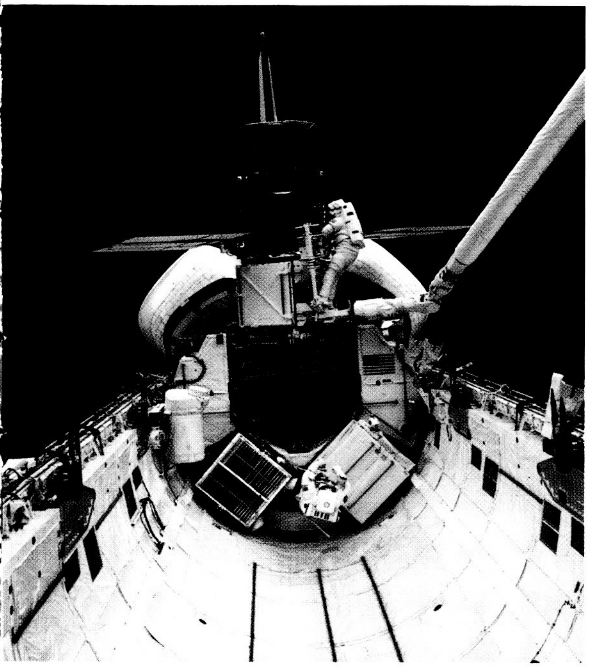
Columbia made Space Shuttle's inaugural orbital flight on April 12, 1981, landing two days later. The flight was a spectacular success, and the crew—John Young and Robert Crippen—called the orbiter a "fantastic flying machine."

Columbia was joined on the flight line by *Challenger* in April 1983, *Discovery* in September 1984, and *Atlantis* in October 1985.

The world's first reusable spacecraft, Shuttle is also the most versatile spaceship ever developed. Transporting payloads for both domestic and foreign users, it also functions as a scientific platform, research center, and repair ship. It is launched from Kennedy Space Center in Florida but can land at any of several primary and backup sites. Its crews, numbering up to eight per mission, have included members of the United States Congress and researchers from the international scientific community. Shuttle orbiters have carried cargo ranging in size from small, self-contained payloads to a space-exposure facility that occupied virtually the entire cargo bay, and in complexity from student experiments to the European-built Spacelab. The workhorse of America's launch opera-

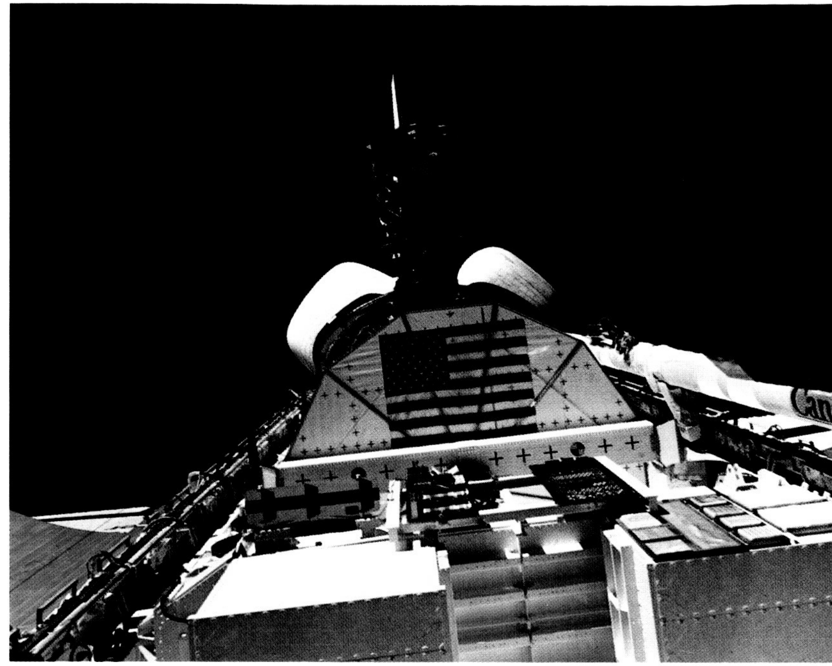
Right, Columbia *lifting off from Kennedy Space Center on the first Space Shuttle flight*

Below, working in Spacelab



tions, Shuttle has delivered numerous satellites to earth orbit, while its crews have retrieved and repaired or returned others. Yet some of the highest praise has been for its stability and ease of handling in orbit. And though most of its customers have been in the scientific and commercial sectors, Space Shuttle has also served national defense.

The Shuttle is the heart of America's Space Transportation System, a key to our long-range goals in space. Indeed, it is essential to the assembly and the operation of the permanently manned Space Station. By the mid-1990's, the United States will have both Space Shuttle and Space Station, an enormous advantage as we approach the challenging space opportunities of the next century.

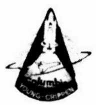


Left, saving a multimillion-dollar satellite

Top right, deploying a communications satellite

Right, orbiter gliding toward landing at Edwards Air Force Base, California

SPACE SHUTTLE MISSIONS



STS-1/*Columbia*
April 12-14, 1981

John W. Young (C)
Robert L. Crippen (P)

STS-2/*Columbia*
November 12-14, 1981

Joe H. Engle (C)
Richard H. Truly (P)

STS-3/*Columbia*
March 22-30, 1982

Jack R. Lousma (C)
C. Gordon Fullerton (P)

STS-4/*Columbia*
June 27-July 4, 1982

Thomas K. Mattingly II (C)
Henry W. Hartsfield, Jr. (P)

STS-5/*Columbia*
November 11-16, 1982

Vance D. Brand (C)
Robert F. Overmyer (P)
Joseph P. Allen (MS)
William B. Lenoir (MS)

STS-6/*Challenger*
April 4-9, 1983

Paul J. Weitz (C)
Karol J. Bobko (P)
Donald H. Peterson (MS)
F. Story Musgrave (MS)

STS-7/*Challenger*
June 18-24, 1983

Robert L. Crippen (C)
Frederick H. Hauck (P)
John M. Fabian (MS)
Sally K. Ride (MS)
Norman E. Thagard (MS)

STS-8/*Challenger*
August 30-September 5, 1983

Richard H. Truly (C)
Daniel C. Brandenstein (P)
Dale A. Gardner (MS)
Guion S. Bluford, Jr. (MS)
William E. Thornton (MS)

STS-9/*Columbia*
November 28-December 8, 1983

John W. Young (C)
Brewster H. Shaw, Jr. (P)
Owen K. Garriott (MS)
Robert A. Parker (MS)
Ulf Merbold (PS)
Byron K. Lichtenberg (PS)

41-B/*Challenger*
February 3-11, 1984

Vance D. Brand (C)
Robert L. Gibson (P)
Bruce McCandless II (MS)
Robert L. Stewart (MS)
Ronald E. McNair (MS)

41-C/*Challenger*
April 6-13, 1984

Robert L. Crippen (C)
Francis R. (Dick) Scobee (P)
George D. Nelson (MS)
Terry J. Hart (MS)
James D. van Hoften (MS)

41-D/*Discovery*
August 30-September 5, 1984

Henry W. Hartsfield, Jr. (C)
Michael L. Coats (P)
Richard A. Mullane (MS)
Steven A. Hawley (MS)
Judith A. Resnik (MS)
Charles D. Walker (PS)

41-G/*Challenger*
October 5-13, 1984

Robert L. Crippen (C)
Jon A. McBride (P)
Kathryn D. Sullivan (MS)
Sally K. Ride (MS)
David C. Leestma (MS)
Marc Garneau (PS)
Paul D. Scully-Power (PS)

51-A/*Discovery*
November 8-16, 1984

Frederick H. Hauck (C)
David M. Walker (P)
Anna L. Fisher (MS)
Dale A. Gardner (MS)
Joseph P. Allen (MS)

51-C/*Discovery*
January 24-27, 1985

Thomas K. Mattingly II (C)
Loren J. Shriver (P)
James F. Buchli (MS)
Ellison S. Onizuka (MS)
Gary E. Payton (PS)

51-D/*Discovery*
April 12-19, 1985

Karol J. Bobko (C)
Donald E. Williams (P)
Margaret R. Seddon (MS)
Jeffrey A. Hoffman (MS)
S. David Griggs (MS)
Charles D. Walker (PS)
E. Jake Garn (PS)

51-B/*Challenger*
April 29-May 6, 1985

Robert F. Overmyer (C)
Frederick D. Gregory (P)
Don L. Lind (MS)
Norman E. Thagard (MS)
William E. Thornton (MS)
Lodewijk van den Berg (PS)
Taylor G. Wang (PS)

51-G/*Discovery*
June 17-24, 1985

Daniel C. Brandenstein (C)
John O. Creighton (P)
Shannon W. Lucid (MS)
Steven R. Nagel (MS)
John M. Fabian (MS)
Sultan Salman Abdul Azziz Al Sa'ud (PS)
Patrick Baudry (PS)

51-F/*Challenger*
July 29-August 6, 1985

C. Gordon Fullerton (C)
Roy D. Bridges (P)
F. Story Musgrave (MS)
Karl G. Henize (MS)
Anthony W. England (MS)
Loren W. Acton (PS)
John-David Bartoe (PS)

51-I/*Discovery*
August 27-September 3, 1985

Joe H. Engle (C)
Richard O. Covey (P)
James D. van Hoften (MS)
John M. Lounge (MS)
William F. Fisher (MS)

51-J/*Atlantis*
October 3-7, 1985

Karol J. Bobko (C)
Ronald J. Grabe (P)
Robert L. Stewart (MS)
David C. Hilmers (MS)
William A. Pailes (PS)

61-A/*Challenger*
October 30-November 6, 1985

Henry W. Hartsfield, Jr. (C)
Steven R. Nagel (P)
James F. Buchli (MS)
Guion S. Bluford, Jr. (MS)
Bonnie J. Dunbar (MS)
Reinhard Furrer (PS)
Ernst Messerschmid (PS)
Wubbo Ockels (PS)

61-B/*Atlantis*
November 26-December 3, 1985

Brewster H. Shaw, Jr. (C)
Bryan D. O'Connor (P)
Mary L. Cleave (MS)
Sherwood C. Spring (MS)
Jerry L. Ross (MS)
Rodolfo Neri Vela (PS)
Charles D. Walker (PS)

61-C/*Columbia*
January 12-18, 1986

Robert L. Gibson (C)
Charles F. Bolden, Jr. (P)
George D. Nelson (MS)
Steven A. Hawley (MS)
Franklin R. Chang-Diaz (MS)
Robert Cenker (PS)
Bill Nelson (PS)

51-L/*Challenger*
January 28, 1986

Francis R. (Dick) Scobee (C)
Michael J. Smith (P)
Ellison S. Onizuka (MS)
Judith A. Resnik (MS)
Ronald E. McNair (MS)
Gregory Jarvis (PS)
Sharon Christa McAuliffe (PS)

STS-26/*Discovery*
September 29-October 3, 1988

Frederick H. Hauck (C)
Richard O. Covey (P)
John M. Lounge (MS)
David C. Hilmers (MS)
George D. Nelson (MS)

STS-27/*Atlantis*
1988

Robert L. Gibson (C)
Guy S. Gardner (P)
Richard M. Mullane (MS)
Jerry L. Ross (MS)
William M. Shephard (MS)

KEY
C: commander
P: pilot
MS: mission specialist
PS: payload specialist

The best we can be

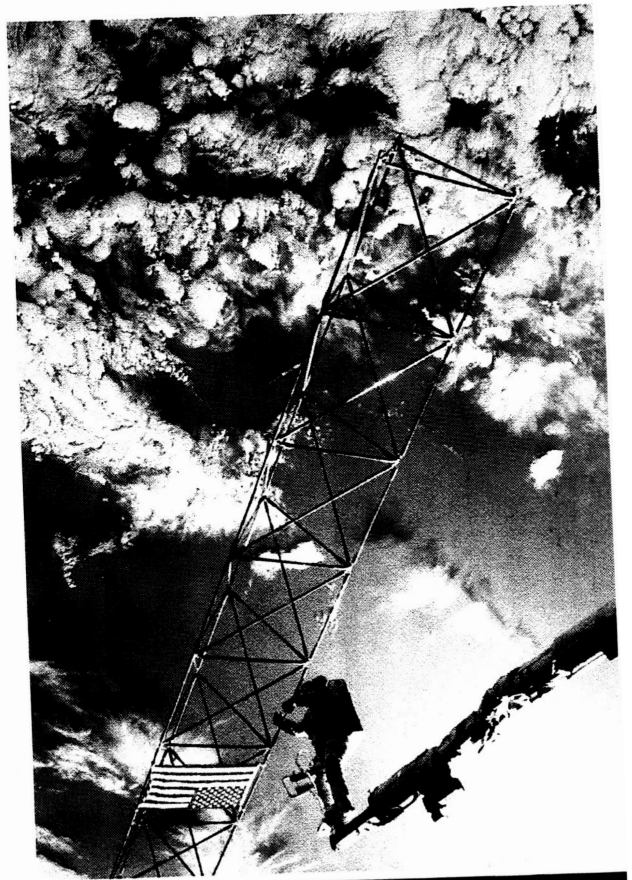
KEY TO THE FUTURE

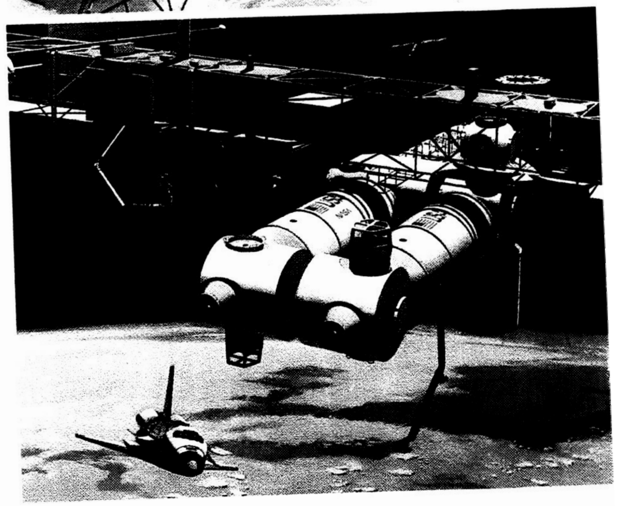
The progress in America's manned space program has been remarkable. In a quarter of a century, we have gone from suborbital flights to lunar landings to increasingly useful operations in earth orbit. Not only have we become familiar with space but we have learned how to live and work and do things there that were unthinkable a generation ago. Yet these extraordinary successes are barely the beginning of our quest in space, and they pale by comparison to the unlimited opportunities that we will have in the decades ahead.

Those opportunities will depend on America's Space Station, the next logical step in space. Orbiting some 200 miles above earth, this permanently manned facility will give us continuous access to the space environment, where Space Shuttle has repeatedly demonstrated the value of scientific research and the advantage of a human presence. The station will improve our space operations and provide a unique workplace for the development of new technology, processes, and products. In brief, it will enable us to do things that we could never do before, and do them without interruption.

Though the Space Station is an American concept, other nations have been invited to help develop and build it. This international involvement would result in a better station and would greatly strengthen free-world ties, ties that will be increasingly important to the expanded space operations of the 21st century.

The first quarter of that century promises a dramatic agenda in space. Imagine space factories, the mining of asteroids, permanent encampments on the moon, and manned missions to Mars. These and other exciting prospects are in America's future, if we fol-

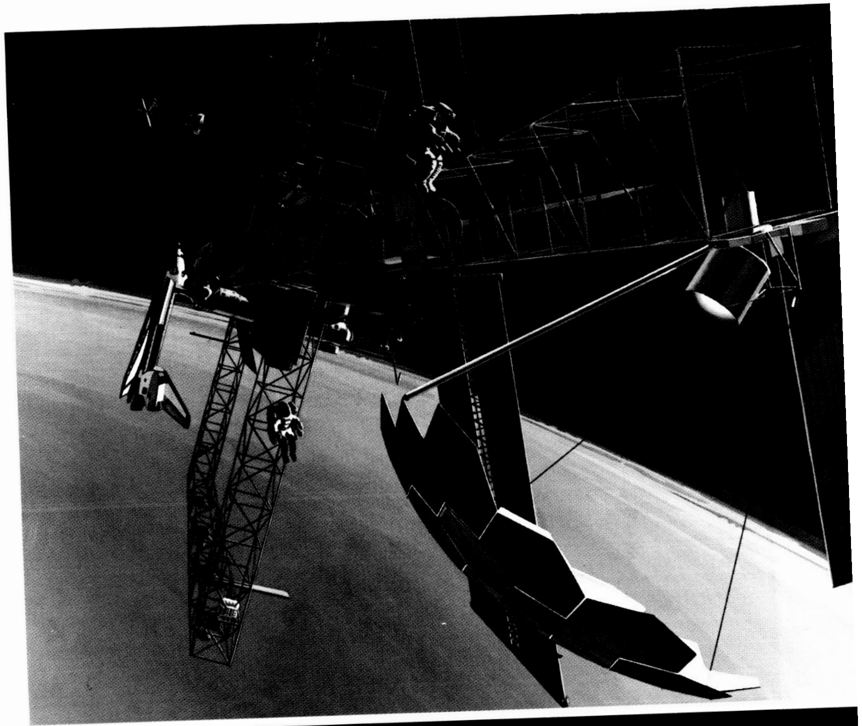


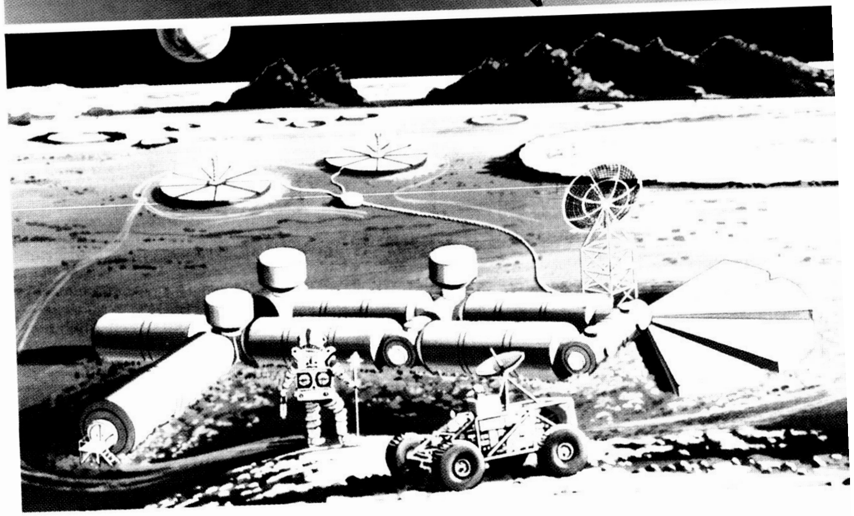


Top, a Space Shuttle crew practices for Space Station assembly. As presently planned, more than a dozen Shuttle flights will be required to assemble the permanently manned station.

Right, the Space Station's pressurized modules will house experiments and equipment, while other instruments and payloads for viewing the earth and stellar objects will be located on the truss. An unmanned platform, in background, will be used for automated experiments and processing. (Artist's concept) low the course charted by the National Commission on Space. Charged with looking at what the United States should be doing in space over the next 50 years, the commission has outlined an ambitious program, one that would "see growing numbers of people working at Earth orbital, lunar, and eventually Martian bases, initiating the settlement of vast reaches of the inner solar system." This phased development program would result in permanent human settlements on the moon by 2017 and on Mars a decade later, supported by a network of spaceports between earth, the moon, and Mars.

The key to reaching these goals is the Space Station. The National Commission on Space calls the station, which will serve as the initial spaceport, the "technology of opportunity" for our long-range plans in space. Besides maintaining our leadership in space, it will expand our ability to operate productively in the space environment, contribute significantly to our technological and scientific progress, and enable us to explore, ultimately to migrate, far beyond our world. In addition to all that, it will help ensure a bright economic future for generations to come.





Above, "astronauts" at work positions in Space Station model demonstrate shirt-sleeve environment that station's pressurized modules will provide. The habitability module will feature separate sleeping compartments, bathroom facilities with a whole-body shower, microwave cuisine, exercise equipment, a library, and private audio/video access to the ground.

Top right, Space Shuttle orbiter docks with the Space Station. Shuttle orbiters will deliver supplies, equipment, and crews to the station and return cargo and crews to earth. (Artist's concept)

Right, an outpost on the moon could be in operation shortly after the turn of the century. Mining the moon for usable elements—such as ilmenite, an oxygen-rich component of lunar soil—would be the primary mission of the lunar spaceport. (Artist's concept)

Because manned space flight involves uncommon risks, uncommon quality must go into the hardware and software on which our astronauts depend. The purpose of Manned Flight Awareness (MFA) is to impress on NASA and industry employees the importance of their work on systems that carry astronauts into space. The overriding objective is to ensure astronaut safety and mission success.

MFA was formalized as a program following the Mercury and Gemini projects, when NASA took steps to infuse the space program with a renewed and strengthened consciousness of quality and flight safety. The associate administrator for manned space flight requested NASA centers to expand their assistance to government agencies and contractors in enhancing employee motivation, and MFA soon became the watchword of the manned space program.

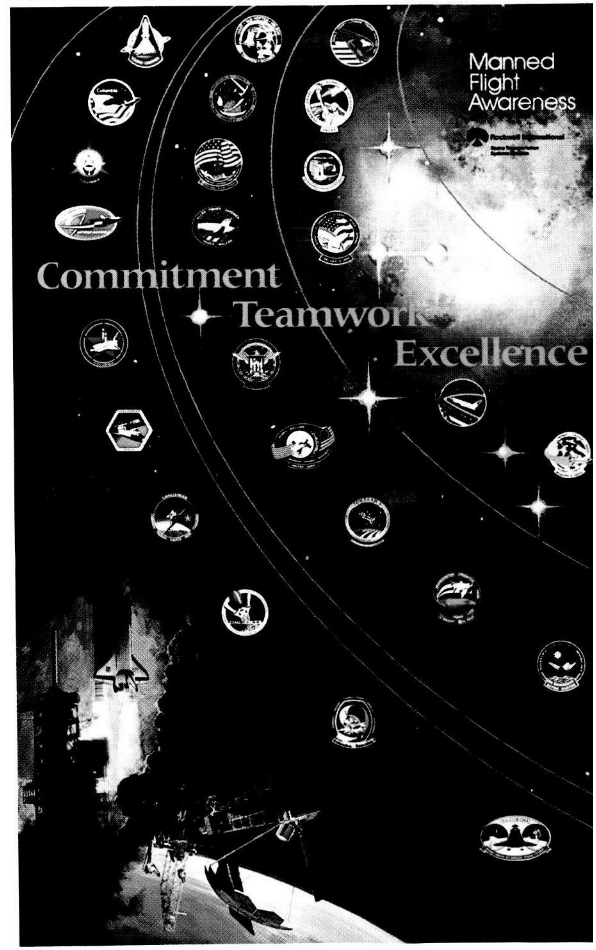
Growing in stature, the MFA Program played an integral and increasingly forceful role in the Saturn, Apollo, Skylab, and Apollo-Soyuz projects. By the time Space Shuttle was flying, the program had begun to promote its goals through various motivational activities, including awards, films, publications, and posters. Today those motivational elements—especially the awards—distinguish a vigorous, effective program for involving the hearts and hands of employees in the production of quality man-rated space flight products.

Of the MFA awards, the Silver Snoopy perhaps best symbolizes the intent and spirit of the Manned Flight Awareness Program. This award is presented personally by the astronauts to employees whose performance has been outstanding. And since the Snoopy represents the astronauts' own recognition of excellence, receiving it is a special honor.

The best we can be

MANNED FLIGHT AWARENESS—AND YOU

The Silver Snoopy

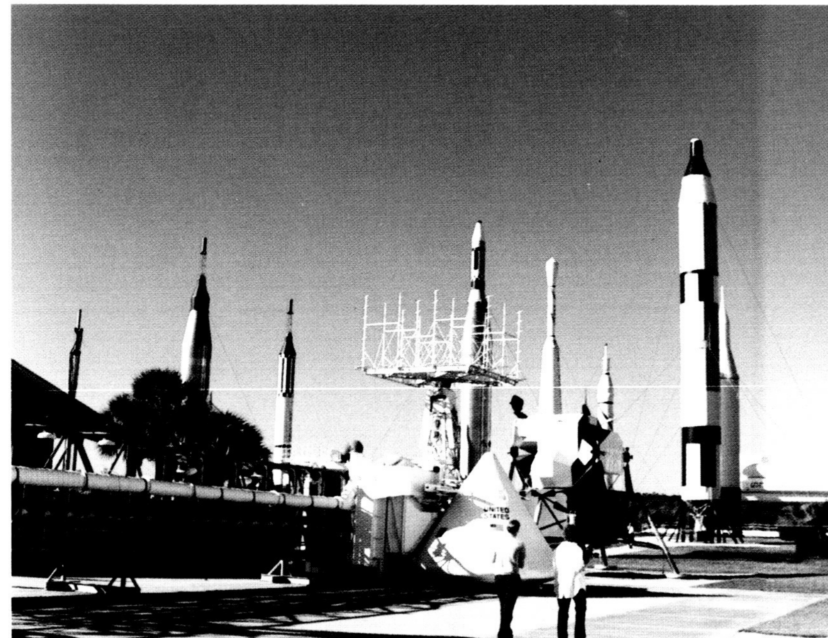


The most coveted of MFA awards is the one granted by the Honoree Program. It recognizes employees for commendable performance and rewards them with an invitation to visit a space facility as NASA VIP's. The honoree award is the highest tribute paid by NASA to government and industry employees for dedication to quality and flight safety.

The importance that NASA accords these awards and the goal of Manned Flight Awareness is reflected by the position of the MFA Program in the NASA organization. MFA is directed by the Office of Space Flight, NASA Headquarters, and the MFA National Panel is composed of representatives from all NASA centers and major Space Shuttle contractors. Manned Flight Awareness is a continuous, team-wide effort dedicated to safe flight, and one of its most enthusiastic participants is the associate administrator for space flight.

MFA embraces all of manned space flight; no one is exempt. If you work on a manned space program, whatever your job, your performance is important to crew safety and mission success. Only by continually reminding ourselves of what is riding on every mission can we sustain the required level of quality consciousness and workmanship demanded by manned flight. Excellence in all that we do must be our standard—every day.

Manned Flight Awareness
NASA

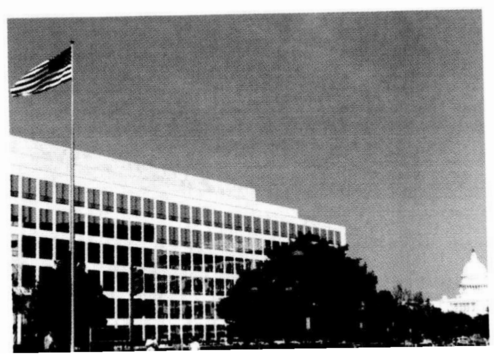


Government Centers Supporting the Space Shuttle Program

NASA HEADQUARTERS

NASA Headquarters, located in Washington, D.C., exercises management over the space flight centers, research centers, and other installations that constitute the National Aeronautics and Space Administration. Headquarters responsibilities include the determination of programs and projects; establishment of management policies, procedures, and performance criteria; evaluation of progress; and review and analysis of all phases of the aerospace program.

Planning, direction, and management of NASA's research and development programs are the responsibility of six program offices: Office of Aeronautics and Space Technology, Office of Space Flight, Office of Space Science and Applications, Office of Space Station, Office of Space Operations, and Office of Commercial Programs.



GODDARD SPACE FLIGHT CENTER (GSFC)

Goddard Space Flight Center, in Greenbelt, Maryland, is staffed by one of the world's leading groups of scientists, engineers, and administrative managers devoted to research in space and earth sciences and applications. Named for Dr. Robert H. Goddard, the father of American rocketry, GSFC plays a major role in sounding rocket and balloon research and in the development of spacecraft, and serves as the primary NASA facility for tracking and communicating with the Space Shuttle and unmanned satellites. It is deeply involved in research in extraterrestrial physics, astronomy and solar physics, oceans, high-energy astrophysics, the atmosphere, and terrestrial physics. The center is also a major participant in the development of both the Hubble Space Telescope and America's Space Station.

In addition to the Greenbelt complex and tracking stations around the world, Goddard's facilities include Wallops Flight Facility, Wallops Island, Virginia; Goddard Institute for Space Studies in New York City; and the National Scientific Balloon Facility in Palestine, Texas.

JOHNSON SPACE CENTER (JSC)

Johnson Space Center, located about 20 miles southeast of downtown Houston, Texas, is NASA's primary center for design, development, and test of spacecraft and associated systems for the manned space program. It plays a significant role in the development of the Space Shuttle, including the orbiter, payload integration, and STS program integration. The center, which includes mission control for manned space flights, is responsible for operational planning, astronaut selection, crew and console operator training, flight control, and control of experiments and payloads in flight for the Space Transportation System. JSC is also engaged in life sciences research, including the definition and development of in-flight biomedical experiments.

Besides its project management role in the Space Shuttle Program, JSC is responsible for development of the external trusses, external distributed systems, nodes, and on-orbit operations of the Space Station. In addition, the center is in charge of the Space Shuttle-Space Station interfaces.

KENNEDY SPACE CENTER (KSC)

Kennedy Space Center, Florida, has historically served as the primary NASA center for the test, checkout, and launch of manned space vehicles and unmanned Deltas, Atlas-Centaurs, Titan-Centaurs, and Atlas-Agenas. (Unmanned launches are now handled by the builders of the vehicles, under an agreement with the Air Force for the use of its facilities and range instrumentation support.) Today the center is responsible for the assembly, checkout, and launch of Space Shuttle vehicles and their payloads; landing operations; turnaround of Shuttle orbiters between missions; Shuttle logistics; design and construction of new facilities; and the processing of NASA payloads for expendable launch vehicles.

KSC is also responsible for the operation of the KSC Resident Office at Vandenberg Air Force Base in California. This office serves as the interface with the Air Force to arrange for base support of NASA elements and for Vandenberg launch site and range support.

MARSHALL SPACE FLIGHT CENTER (MSFC)

The Marshall Space Flight Center lies inside the Army's Redstone Arsenal at Huntsville, Alabama. Two other sites are managed by MSFC: the Michoud Assembly Facility in New Orleans, where the Space Shuttle external tanks are manufactured, and the Slidell Computer Complex in Slidell, Louisiana, which provides computer services to Michoud.

MSFC is contributing to many of the nation's space objectives. It plays a principal role in the development of the Space Shuttle, providing the orbiter engines, the external tank, and the solid-rocket boosters. In addition, the center has a key role in the development of Shuttle payloads, including Spacelab—a reusable, modular scientific research facility carried in the Shuttle cargo bay—as well as many of the experiments performed in Spacelab.

MSFC has management responsibility for the Hubble Space Telescope, the Tethered Satellite System, and the orbital maneuvering vehicle. It is also responsible for design of the habitability, laboratory, and logistics modules for the Space Station.

STENNIS SPACE CENTER (SSC)

NASA's John C. Stennis Space Center, formerly the National Space Technology Laboratories, is located near Bay St. Louis, Mississippi. Its scientific community is actively engaged in several research and development programs involving space, the oceans, and earth.

The SSC complex includes industrial, laboratory, and specialized engineering facilities that support the testing of large rocket propulsion systems. Its primary mission is support of Space Shuttle main engine and orbiter propulsion system testing.

SSC was accorded full field installation status by NASA in 1974. It has evolved into an excellent remote sensing center and is involved in earth science programs of national and international significance.

OTHER KEY NASA CENTERS

Several other NASA centers are contributing invaluable support to the development of space flight technology.

Ames Research Center is responsible for computational fluid dynamics research and wind tunnel testing; flight simulation and the testing of experimental and state-of-the-art aircraft; space, life, and earth sciences research; and artificial intelligence research and expert systems. The Ames-Dryden facility at Edwards Air Force Base, California, serves as the primary landing site for the Space Shuttle.

Langley Research Center, NASA's oldest center, has provided a cornerstone of technology for all of America's space programs. Langley, which managed the Mercury program, today contributes to the identification of the aerothermodynamics of spacecraft and the testing of Space Shuttle landing systems and crew emergency escape systems.

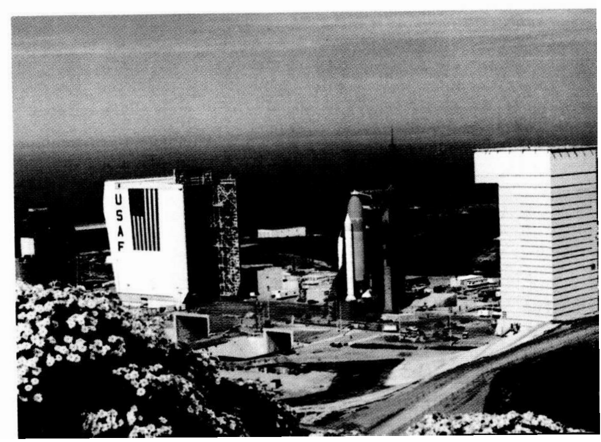
Lewis Research Center has primary responsibility for aircraft and space propulsion, space power, and satellite communications, and is NASA's lead center for development of the electric power system required for operation of the Space Station.

The Jet Propulsion Laboratory is engaged in activities associated primarily with automated scientific missions to deep space. A major part of the lab's work involves the development of advanced flight systems, including complete spacecraft.

DEPARTMENT OF DEFENSE (DOD)

DOD support of the Space Shuttle is provided by the Air Force Space Division, Los Angeles Air Force Base, a unit of the Air Force Systems Command. Responsible for the production, launch, and support of military space systems, the division is the focal point in DOD for operations associated with the military use of America's Space Transportation System (STS). The division also manages the development and production of the Inertial Upper Stage, provides for the command and control of the Defense Department's STS mission, and would supply the primary contingency support for the Space Shuttle in the event of an emergency landing.

The Space Division designed and developed the Shuttle Launch and Landing Site at Vandenberg Air Force Base in California. Presently maintained in caretaker status, the complex can launch Shuttle orbiters on high-inclination or polar-orbit missions for both DOD and NASA.



Major Contractors Supporting the Space Shuttle Program

ROCKWELL INTERNATIONAL, SPACE TRANSPORTATION SYSTEMS DIVISION

Rockwell's Space Transportation Systems Division (STSD), builder of the Space Shuttle orbiters, has been contributing to the national space program for three decades. The division developed and built the Saturn S-II (second stage of the Saturn V launch vehicle), the Apollo command and service modules, the docking module for the Apollo-Soyuz mission, and other advanced space systems. Today STSD is involved in programs ranging from Space Shuttle to the development of technology for advanced space applications, from Shuttle-C and other advanced launch systems to strategic defense.

Besides developing and building the Shuttle orbiters, the division is extensively involved in Shuttle operations. It assists NASA with the integration of the Shuttle system, maintains the technical integrity and configuration of the orbiters, provides logistic support, helps Shuttle users with the integration of their payloads, and serves as NASA's Space Transportation System operations contractor.

EG&G FLORIDA, INC.

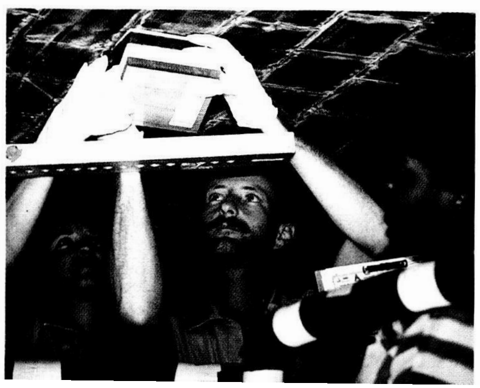
EG&G, a name formed by the initials of the company's three founders, is an international organization active in many scientific and technical areas. The corporation's activities embrace five major business segments: instruments, components, environmental and biomedical services, custom services and systems, and Department of Energy support.

As NASA's base operations contractor at the Kennedy Space Center, EG&G Florida supplies institutional and technical services in support of launch activities—from the operation of utilities to the maintenance of facilities, from administrative services to technical operations. The company provides technical support for KSC computers and data processing, instrumentation calibration and standards, and nondestructive evaluation testing. It also supplies and maintains space vehicle propellants, provides life support services, and is responsible for fire protection and security for the entire 36-mile-long KSC complex.

LOCKHEED SPACE OPERATIONS COMPANY

Lockheed Space Operations Company (LSOC) is responsible for all ground processing of the Space Shuttle fleet at the Kennedy Space Center. The company also provides services in support of Shuttle launch site maintenance at Vandenberg Air Force Base.

As the prime processing contractor, LSOC has overall responsibility for Shuttle processing, including operation of the Orbiter Processing Facility, the Vehicle Assembly Building, the Orbiter Refurbishment and Maintenance Facility, and two launch pads—39-A and 39-B. In addition, it operates the Logistics Facility, the Hypergolic Maintenance Facility, and numerous collateral facilities at both Kennedy Space Center and the Cape Canaveral Air Force Station. In carrying out the processing work, Lockheed is supported by its team members—Grumman Technical Services, Morton Thiokol, and Pan American World Services.



MARTIN MARIETTA, MANNED SPACE SYSTEMS

Martin Marietta Manned Space Systems designs and assembles the largest element and the structural backbone of the Space Transportation System—the external tank. The 154-foot tank contains almost half a million parts and carries 1.6 million pounds of propellant for use by the orbiter's three main engines. The external tank undergoes over 6 million pounds of thrust during its ascent to space. It is produced at NASA's Michoud Assembly Facility in New Orleans, in a building that covers 43 acres under one roof.

For its work on the external tank project, Manned Space Systems was honored in 1987 as recipient of the NASA Excellence Award for Quality and Productivity.

In addition to producing external tanks, Manned Space Systems is under contract to examine the use of tanks in orbit and to study options for an unmanned, cargo-carrying Shuttle-C launch vehicle.

MORTON THIOKOL, SPACE OPERATIONS

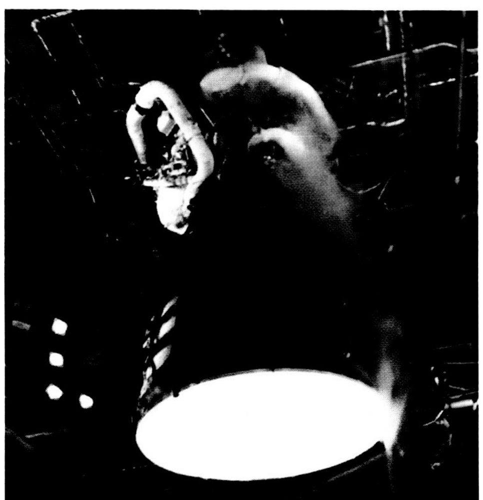
Morton Thiokol's Space Operations is deeply involved in the Space Shuttle Program as both a contractor and a subcontractor. Space Operations, as a prime NASA contractor, is responsible for designing, building, and testing the redesigned Space Shuttle solid-rocket motors (SRM's). Space Operations has developed a new design for case field joints that eliminates the deficiencies of the previous motors. A variety of subscale and full-scale hardware tests and full-scale motor firings were conducted to requalify the SRM for flight.

As a subcontractor for Lockheed Space Operations Company, Morton Thiokol Space Operations carries out major portions of the Shuttle processing work, including inspection, assembly, and checkout of the solid-rocket boosters and external tank. Operating the three-ship Shuttle processing fleet, Space Operations field offices also recover the spent boosters from the ocean and perform disassembly, cleaning, inspection, and initial refurbishment operations.

ROCKWELL INTERNATIONAL, ROCKETDYNE DIVISION

In providing power for America's space program over the last three decades, Rocketdyne has developed and built some of the most sophisticated rocket engines in the world. Its long inventory of power plants includes engines that launched the first manned missions, that took our astronauts to the moon and back, and that supply the main power for the Space Shuttle. Presently, besides its work on the Shuttle main engines, the division is designing and developing propulsion systems for advanced launch vehicles.

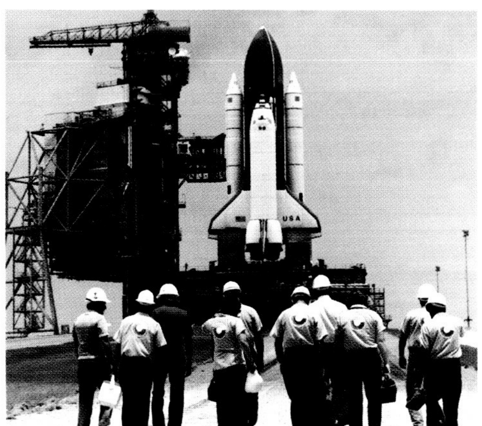
Though the Rocketdyne name is synonymous with launch power, the Rocketdyne of today offers much more, including development of engines for orbital transfer, propulsion for the National Aero-Space Plane, nuclear power for satellites and earth applications, and lasers for a variety of uses. And for the Space Station, the division is developing the electric power system.



UNITED TECHNOLOGIES, USBI

USBI, the first contractor to recover spent space hardware from the ocean and return it for refurbishment, processes and refurbishes the nonmotor segments of the Space Shuttle solid-rocket boosters (SRB's). These activities, which are performed in the SRB Assembly and Refurbishment Facility at the Kennedy Space Center, include replacement of insulation on booster components, installation of electronic and guidance systems, and installation of parachutes and ordnance.

The major SRB components refurbished are the frustum, forward skirt, and aft skirt. When mated with an expendable nose cap, the frustum and forward skirt form the 26-foot-high forward assembly of the SRB. In refurbishing the aft skirt, USBI also rebuilds the thrust vector control system, positioned inside the skirt. Besides these major structures, the company must manage some 70,000 parts for each pair of SRB's. This is done through an integrated logistics system so efficient that the company is using it to help plan Space Station logistic support.



It takes all of us

Besides the major contractors, the Shuttle program is supported by other contractors and suppliers throughout the United States and in other countries. Thousands of dedicated employees of these firms not only produce hardware and software for the Space Transportation System but also help supply services that keep it operating. They, too, are essential members of the Manned Flight Awareness family.

Making a success of Space Shuttle and America's space program takes the commitment of every employee of every contractor, a commitment that transcends national interests. For everyone who works on a part or provides a service for a manned space system is a link, ultimately, in the progress of mankind, contributing measurably and importantly as we reach out from earth to explore the worlds beyond.

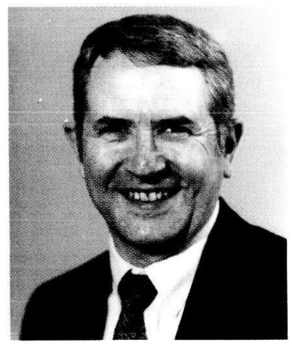
Prepared for NASA by Rockwell International's Space Transportation Systems Division.

THE UNWRITTEN CONTRACT

No matter how well spacecraft are made, the margins in manned space flight will always be small. For this reason, everyone associated with the manned space program is party to an unwritten contract with our astronauts. Each of us is obligated to doing our best on every job, every day, so that every manned spacecraft leaving the earth is the best that human minds and hands can create.

The purpose of the Manned Flight Awareness Program is to formalize that unwritten contract. As a former astronaut, I can tell you that obligation, that commitment to excellence, cannot be emphasized too much or too often. MFA exists for one reason: to guarantee that we shall never forget what is riding on each flight, never forget that human lives are at stake in everything we do, never forget that flight crews depend on each of us to be the best we can be. Our astronauts ask no more, and we can give nothing less.

America's manned space program has been a tremendous success. I want to take this opportunity to thank you for your contributions to that success, and to ask you in behalf of the astronaut corps to continue to dedicate yourself to excellence in everything you do.



Richard H. Truly
Associate Administrator for
Space Flight