# APOLLO 15

## ...first manned lunar roving vehicle

NASA




# apollo 15 crew

**DAVID R. SCOTT**
**Commander**

A veteran space pilot, Scott took part in the first successful docking of two vehicles in space during the Gemini 8 flight. He later flew as Command Module Pilot on the 10–day Apollo 9 mission in 1969. In addition, he was backup commander for the Apollo 12 mission in 1969.

An Air Force colonel, Scott became a NASA astronaut in 1963. Since then, he has accumulated over 251 hours in space.

He was born in San Antonio, Texas, June 6, 1932. He is a graduate of the U. S. Military Academy and the Massachusetts Institute of Technology.

Scott holds the NASA Distinguished Service Medal, the NASA Exceptional Service Medal, the Air Force Distinguished Service Medal, the Air Force Command Pilot Astronaut Wings, the Air Force Distinguished Flying Cross and the AIAA Astronautics Award.

He is married and the father of two children, Tracy and Douglas.

**ALFRED M. WORDEN**
**Command Module Pilot**

Astronaut Worden is making his first venture into space as an Apollo 15 crewman. He was selected in the NASA astronaut program in 1966 and served as an astronaut support crewman for the Apollo 9 flight and backup Command Module Pilot for the Apollo 12 mission in 1969.

Born in Jackson, Michigan, Worden graduated from the U. S. Military Academy in 1955 and from the University of Michigan in 1963.

An Air Force major, he served as an aerospace research pilot in both the U. S. and England and was an instrument flight instructor before joining NASA.

He is married and the father of two daughters, Merrill and Alison.

**JAMES B. IRWIN**
**Lunar Module Pilot**

An Air Force lieutenant colonel, Irwin was also selected for the NASA astronaut program in 1966 and, like his fellow crewman Worden, is making his first flight in space. He was an astronaut support crewman for the Apollo 10 mission in 1969 and was backup Lunar Module Pilot for the Apollo 12 flight also in 1969.

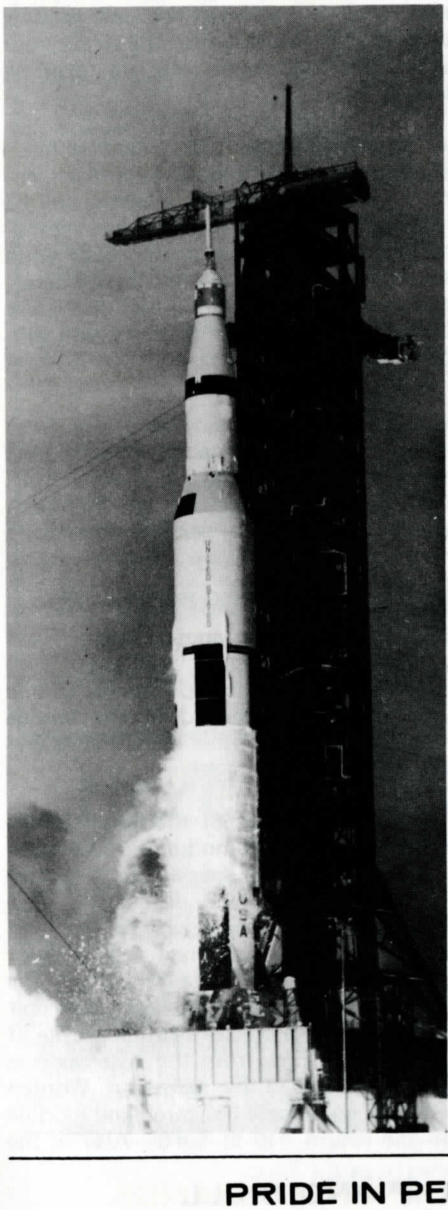
Irwin was born in Pittsburgh, Pennsylvania, March 17, 1930, but he considers Colorado Springs, Colorado as his home town.

He graduated from the U. S. Naval Academy in 1951 and from the University of Michigan in 1957.

He is a member of the Air Force Association and the Society of Experimental Test Pilots. Married, he is the father of three daughters, Joy, Jill, and Jan, and a son, James.

**SUCCESSFUL MISSIONS RESULT FROM QUALITY PERFORMANCE**


# schedule of events



| DATE | EDT | EVENT AND BRIEF DESCRIPTION |
| --- | --- | --- |
| Mon Jul 26 | 9:34 a.m. | LAUNCH<br>From Launch Complex 39A. Insertion into Earth orbit occurs 12 minutes later. |
| | 12:23 p.m. | TRANSLUNAR INJECTION (TLI)<br>Leave Earth orbit on course to intercept Moon. |
| Wed Jul 29 | 4:05 p.m. | LUNAR ORBIT INSERTION (LOI)<br>Occurs on far side of Moon as spacecraft brakes speed for "capture" by lunar gravity. Enters orbit 70 x 204 miles. |
| | 4:47 p.m. | SPENT S–IVB STAGE IMPACTS MOON<br>At point some 186 miles east of Apollo 14 landing site. |
| | 8:13 p.m. | DESCENT ORBIT INSERTION<br>Still attached, the two spacecraft change orbit to 11 x 70 miles. |
| Thu Jul 30 | 1:47 p.m. | LUNAR MODULE DESCENT PREPARATION<br>Lunar module undocks and separates from spacecraft. |
| | 3:08 p.m. | COMMAND SERVICE MODULE (CSM) CIRCULARIZATION<br>Burn inserts CSM into 65 x 77 mile orbit. |
| | 6:02 p.m. | POWERED DESCENT INITIATION (PDI)<br>Three-phase burn to brake lunar module out of transfer orbit. |
| | 6:14 p.m. | LUNAR MODULE LANDING<br>Touchdown, landing. Lunar surface stay time about 67 hours. |
| | | STAND UP EXTRAVEHICULAR ACTIVITY<br>Commander will stand in the top hatch for photography and planning for lunar rover trips. |
| | | EXTRAVEHICULAR ACTIVITY (EVA 1)<br>Lunar Roving Vehicle deployed and checked out on a short trip south to the Apennine front. Three soil and rock samples planned plus deployment of the Apollo Lunar Surface Equipment Package on return to lunar module. 7 hours duration, 10 miles distance. |
| | | EXTRAVEHICULAR ACTIVITY (EVA 2)<br>Trip south to the Apennine front for additional samples. 7 hours duration, 10 miles distance. |
| | | EXTRAVEHICULAR ACTIVITY (EVA 3) Six hour trip west to the rille wall, then north along the rille wall for samples and photography. Study of volcanic crater formation. 7 miles distance. |
| Mon Aug 2 | 1:11 p.m. | LUNAR MODULE ASCENT<br>Lift–off of lunar module from Moon and rendezvous with command service module. |
| | 3:04 p.m. | DOCKING<br>Lunar module docks with command service module. Commander and Lunar Module Pilot transfer back to command module with lunar samples and film. |
| | 7:04 p.m. | LUNAR MODULE JETTISON<br>Jettisoned onto lunar surface to impact near the Apollo 15 landing site. |
| Wed Aug 4 | 5:17 p.m. | TRANSEARTH INJECTION (TEI)<br>Apollo 15 departs lunar orbit for Earth. |
| Sat Aug 7 | 4:45 p.m. | SPLASHDOWN<br>Landing in the Pacific Ocean 330 miles north of Hawaii. Total mission time is 295 hours, 11 minutes and 45.6 seconds. |

**PRIDE IN PERFORMANCE MEANS SUCCESS IN SPACE**

# mission objectives

Apollo 15 promises to yield the greatest scientific harvest so far in the United States manned lunar landing series.

The fourth Apollo landing is scheduled in the Hadley-Apennine region some 465 miles north of the lunar equator at $26^{0}$ 4' 54" N and $3^{0}$ 39' 30" E. Earlier Apollo missions have been within 70 miles of the lunar equator.

The Hadley Rille is a 60 mile long canyon thought to be 1,200 feet deep and a mile across in places, while the Apennine mountains, among the Moon's highest, rise three miles above the landing site to the south and east. Also in the landing area are possible volcanic craters as well as many secondary craters.

Plans call for the Apollo 15 crewmen to remain on the Moon surface for about 67 hours and make three traverses totaling about 20 hours. The scientific safari to be conducted by Commander David R. Scott and Lunar Module Pilot James B. Irwin will involve a 480 pound Lunar Roving Vehicle.

Primary objectives of the mission are as follows:

**Perform inspection, survey, and sampling of materials and surface features in the Hadley-Apennine region.**

**Emplace and activate surface experiments.**

**Evaluate Apollo equipment capability to provide extended stay time on Moon, increased extravehicular activity, and surface mobility.**

**Conduct in-flight experiments and photographic tasks from lunar orbit.**

Launch of Apollo 15 will be comparable to the flight profile for the Apollo 14 mission with lift–off from Launch Complex 39A at Kennedy Space Center. During the boost to a 108–mile parking orbit, the S–IC and S–II stages will be expended. A partial burn of the third (S–IVB) stage will be required to achieve the orbit.

Following a coasting period around Earth of at least 1.8 revolutions but not over 2.8 revolutions, the S–IVB's engine will be reignited to boost Apollo spacecraft to a trajectory for the Moon.

As in earlier Apollo flights, the command and service module will separate and then dock with the lunar module. Subsequently, these mated vehicles will separate from the spent S–IVB stage. The S–IVB will continue toward the Moon following the Apollo. It is scheduled to impact the lunar surface some 186 miles (310 kilometers) east of the Apollo 14 landing site.

After landing, the commander will open a hatch in the top of the lunar module and stand up to inspect the landing site.

Later, the rover will be unfolded from the lunar module storage bay and lowered to the Moon's surface.

The men will checkout the vehicle on a short drive south to the Apennine front. Their first stop is the rille rim where documented samples of the rille wall will be taken. They will collect sample ejecta from a crater penetrating the Apennine front and a second crater penetrating the rille rim. They will also take samples of the Apennine front. After returning to the lunar module, they will deploy the Apollo Lunar Surface Experiments Package.

The second trip in the rover is again south toward the Apennines for samples and examination of the area, expecially an excavated area.

Some of the small craters in the region are thought to be caused by material thrown out when a meteor impacted 250 miles (400 kilometers) to the north, forming crater Autolyclus.

The third journey is west to the rille wall, and then north. Stops are planned along the route for sampling and photography, including a study of what appears to be a group of craters formed by volcanic activity at the northern point of the trip. The three trips cover distances of about 5 miles (8 kilometers), 9½ miles (16 kilometers), and 7 miles (12 kilometers) respectively. In addition to the greater distances covered on the Moon, the stay time on the lunar surface increased from 33 and one–half hours for the Apollo 14 crew to some 67 hours for the Apollo 15 astronauts.

Excursions outside the lunar module will be increased from two to three and the duration of traverse increased from five to seven hours on Apollo 15.

A portable transmitter will let Scott and Irwin take the TV camera with them to the mountains and the gorge. The transmitter will let them range out of sight of the lunar module without losing communication with Mission Control in Houston. In addition to its new mobility, the TV camera can be controlled from Earth. The flight controllers will be able to follow the astronauts whenever they leave the lunar roving vehicle. They will also point the camera at the lunar module as it lifts off the Moon for the rendezvous with the command module orbiting above.

A new heat–flow experiment will be conducted on the Moon. Several experiments on earlier Apollo missions will be repeated, including the passive seismometer, surface magnetometer, solar wind spectrometer, suprathermal ion detector, cold cathode ionization, and the lunar dust detector. A laser reflector will also be emplaced.

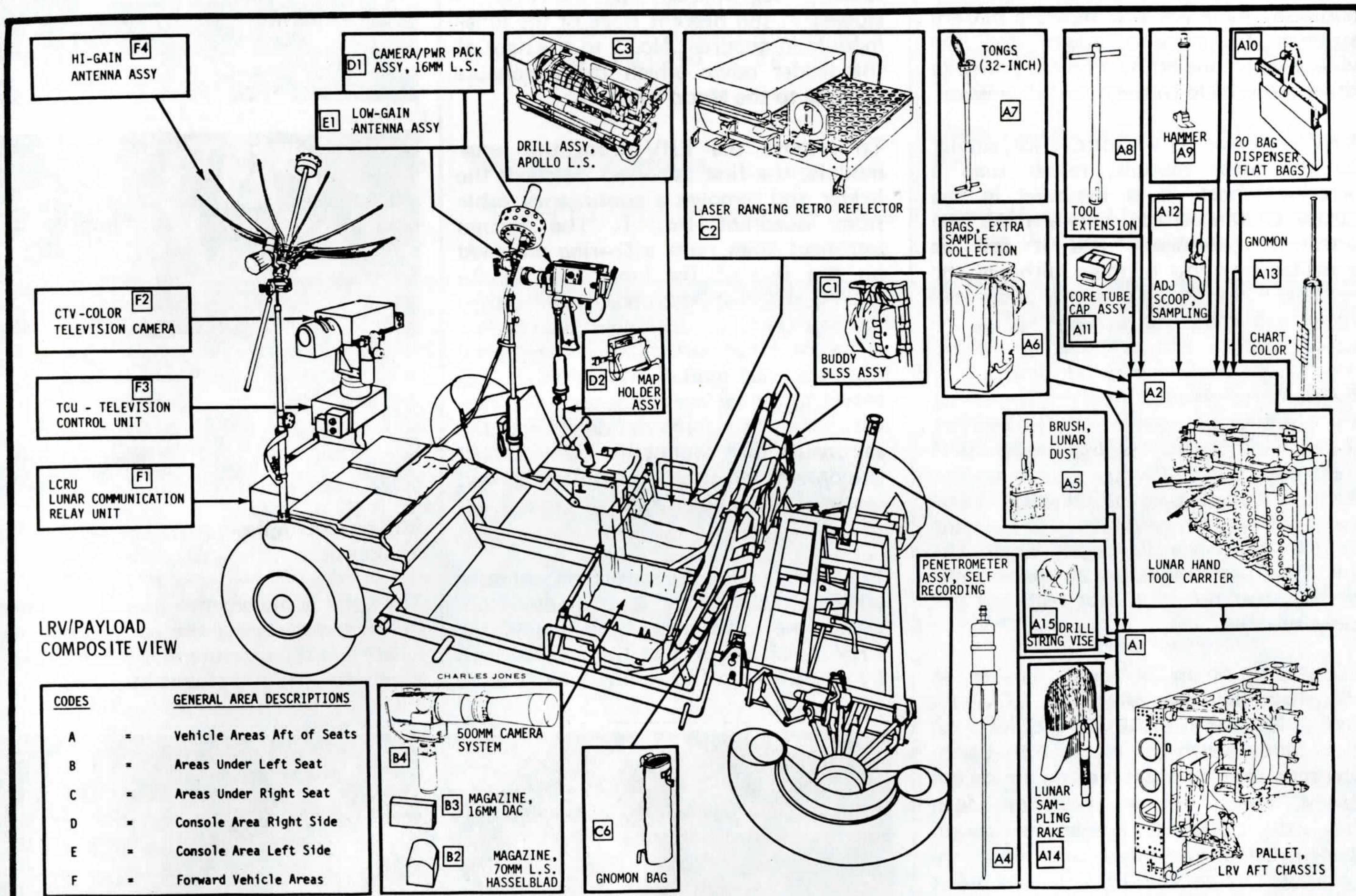
While Scott and Irwin carry out their lunar surface assignments, Worden will conduct experiments in lunar orbit, including the launch of an 80-pound satellite containing a particle detector, a magnetometer, and an S–band transponder.

The satellite will get enough energy from solar cells to transmit data about two hours each day of its expected life of one year. It will be carried in the service module along with other experiments and photographic equipment.

An accurate picture of the lunar surface along the command module's orbital path is expected from a special photo-system in the service module. It consists of a high-resolution panoramic camera; an accurate metric camera; and a laser altimeter providing data to correct the panoramic picture. The laser altimeter alone will give a precise altitude profile of the surface. Film from the two cameras will be retrieved by astronaut Worden who will go outside the command module on the return trip to Earth. Also in the service module, but not to be retrieved, will be X-ray, mass, alpha-particle, and gamma ray spectrometers. These experiments will transmit data during the lunar orbital phase of the mission.

Geologists should learn much from the Apollo 15 mission. They suspect that the Imbrium Basin contains a major mascon, which is a large mass strong enough to perturb the orbit of a spacecraft. Some scientists think mascons are concentrations of very dense rocks deep under the surface. Samples collected at the base of the towering Apennines should contain pieces of the original lunar crust and rocks thrown from deep inside the Moon when the Sea of Rains was formed.

While the Mare Imbrium and the mountains that surround it are widely held to be the result of a violent impact, Hadley Rille is the subject of several theories. Samples, visual observations, and photographs may tell if water was involved in its formation, or whether Hadley and other rilles are collapsed tunnels through which lava once flowed, or whether some sort or erosion by volcanic ash or surface materials caused their formation.




**A variety of scientific instruments and other equipment is carried on the lunar rover by the astronauts of Apollo 15.**

# ...first manned lunar roving vehicle

Lunar Roving Vehicle (LRV) is a small, dune—buggy—like car that will permit two Apollo astronauts to drive away from the immediate vicinity of their landing site on the Moon, make geological and astronomical observations, collect rock and soil samples, deploy scientific instruments, and return to their lunar module base. On Earth the LRV weighs some 480 pounds; however, on the Moon it will weigh about 80 pounds. As light as it is, it can carry the two astronauts, their portable life support systems, scientific instruments, and their collection of lunar material samples. In all, the LRV can carry about twice its own weight.

While it may look like a dune—buggy, it is designed for low speed and high torque. It is limited to a maximum of 8 miles per hour, for safety reasons. Higher speed could present a danger to the crew due to the rough lunar surface. But it has power to climb a 25 degree slope.

LRV is slightly over 10 feet long, 6 feet wide, and has a wheelbase of 7½ feet. It has a ground clearance of 13 inches on level soil. Since both the front and rear wheels steer, the LRV has a very tight turning radius--no more than its own length. It is powered by electric batteries that furnish energy to an electric motor in each of four, 32–inch wheels.

The drive and steering mechanism has several built–in safety devices. If either the rear or front steering mechanism fails, the other will provide full service. Similarly, if a motor on a wheel should go out, it can be decoupled; and the remaining motors can drive the LRV. In addition, there are two separate battery systems to provide power for the wheels--each one with sufficient power to drive the vehicle through its full mission.

LRV is steered by a control stick, similar to the lunar module, rather than a steering wheel. It is mounted in the center of the vehicle, between the two astronaut passengers; and it can be operated by either of them, although the astronaut on the left is the designated driver. To start, the driver flips on the power switch and tilts the stick forward. The LRV then moves in that direction. If he wants to turn left or right, he merely tilts the stick in the appropriate direction. To back up, he tilts the stick backward. If he wants to apply the four–wheel brakes, he pulls straight back on the stick. It also has a parking brake which will hold the loaded LRV on a 30–degree slope. The LRV can cross crevasses 28 inches wide and go over bumps a foot high and still remain stable.

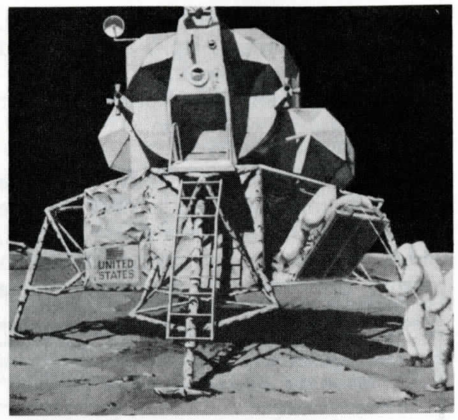
Since the Moon is much smaller in diameter than the Earth, the LRV will move over the horizon more quickly on the Moon than it would on Earth. Inasmuch as a compass is of no use on the Moon, which has no north or south magnetic poles, a special navigation system has been devised to continuously compute where the LRV is and what direction and distance it is back to the lunar module base. The system uses the angle of the Sun and the declination of the lunar module from it to set a gyroscope before the astronauts leave in the LRV. An instrument mounted on the "dashboard" continuously displays the heading of the vehicle in terms of an assumed lunar north, the bearing in degrees back to the lunar module, the distance (in kilometers) back to it, and the total number of kilometers travelled by the LRV. Another instrument shows the speed of the LRV in kilometers per hour.

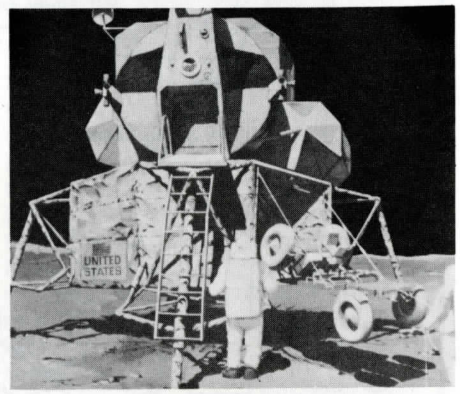
Also carried on board the LRV is a color TV camera and communication system that permit the astronauts to transmit pictures and voice communications directly from the vehicle to Earth. In addition, a still–picture camera is mounted on the chest of each astronaut. The TV camera can be remotely controlled from Mission Control Center in Houston.

For the trip to the Moon, the LRV is literally folded up and stowed inside the lunar module. The chassis is hinged in three places and the four wheels are pivoted nearly flat against the folded chassis, occupying only 30 cubic feet of space. Thus trebled up, the LRV is stowed in the descent stage of the lunar module in quadrant No. 1 to the right of the ladder down which the astronauts descend to the Moon's surface.

To remove the LRV from the lunar module, the first astronaut descends the ladder and removes a contingency cable from quadrant No. 1. The second astronaut then pulls a D–ring mounted on the side of the lunar module. By pulling the ring, the LRV is released at the top. The first astronaut then pulls a series of cables which lowers the LRV from the lunar module and unfolds it as it moves to the surface. Once on the surface with the four wheels deployed, the astronauts then mount the camera, load equipment, and scientific instruments and prepare for the lunar trip.

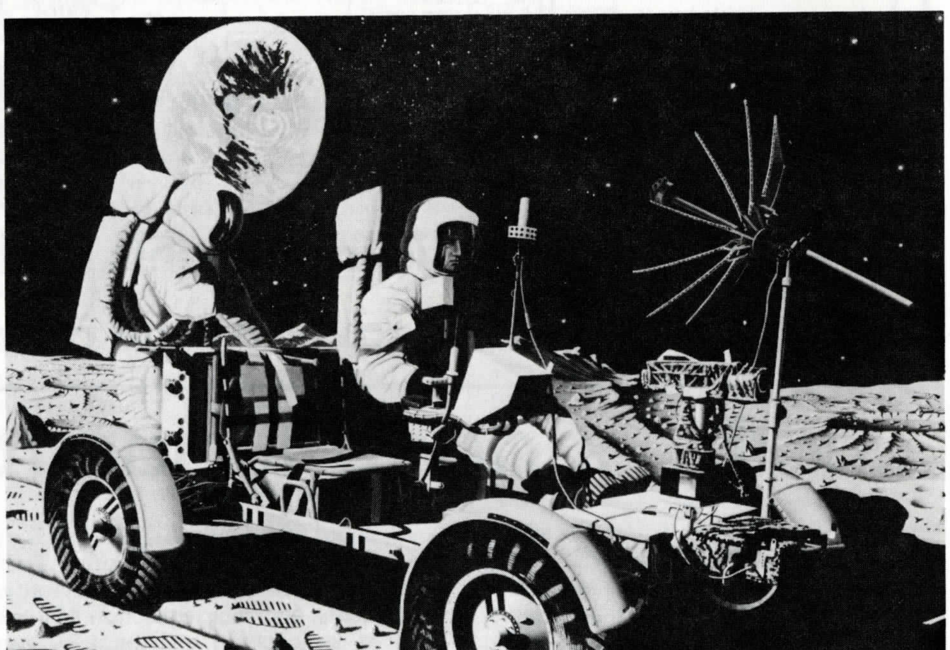
For safety's sake, the astronauts will drive within a radius of the lunar module from which they can walk back should the LRV break down. But the area covered by the LRV on the Moon includes some




**50 square miles--plenty of room for exploration.**

**The LRV is designed to have a life–time of 78 hours during the harsh lunar day where the temperature in the Sun is $243^{0}$ F and the shadows plunge to $-279^{0}$F**



**BE AWARE—USE CARE IN EVERYTHING YOU DO**

# general lunar data

There are 32 known satellites in the Solar System with our Moon ranking fifth in size among them. However, with a diameter about a fourth that of Earth, the Moon is much larger in relation to its parent planet than any of the other satellites.

Most conspicuous of the visible features of the Moon are the maria, or seas, which are the dark, level plains. Early astronomers thought the maria to be water-filled areas. For the most part, the Moon is mountainous and crater pitted, the mountains rising as high as 29,000 feet and the craters ranging from inches to 180 miles in diameter. The surface is covered with a layer of fine grained material resembling silt or sand, as well as small rocks and boulders. There is no air, wind, or moisture.

Among scientists there are three theories on the origin of the Moon: (1) it was once part of the Earth and split off into its own orbit, (2) it evolved as a separate body at the same time as Earth, and (3) it formed elsewhere in space and wandered until it was captured by Earth's gravitational field.

**Physical Characteristics**

Diameter - 2,160 miles (about 1/4 that of Earth)

Distance from Earth - 238,857 miles mean; (221,463 minimum to 252,710 maximum)

Surface Temperature - +243 F (Sun at zenith) -279 F (night)

Surface Gravity - 1/6 that of Earth

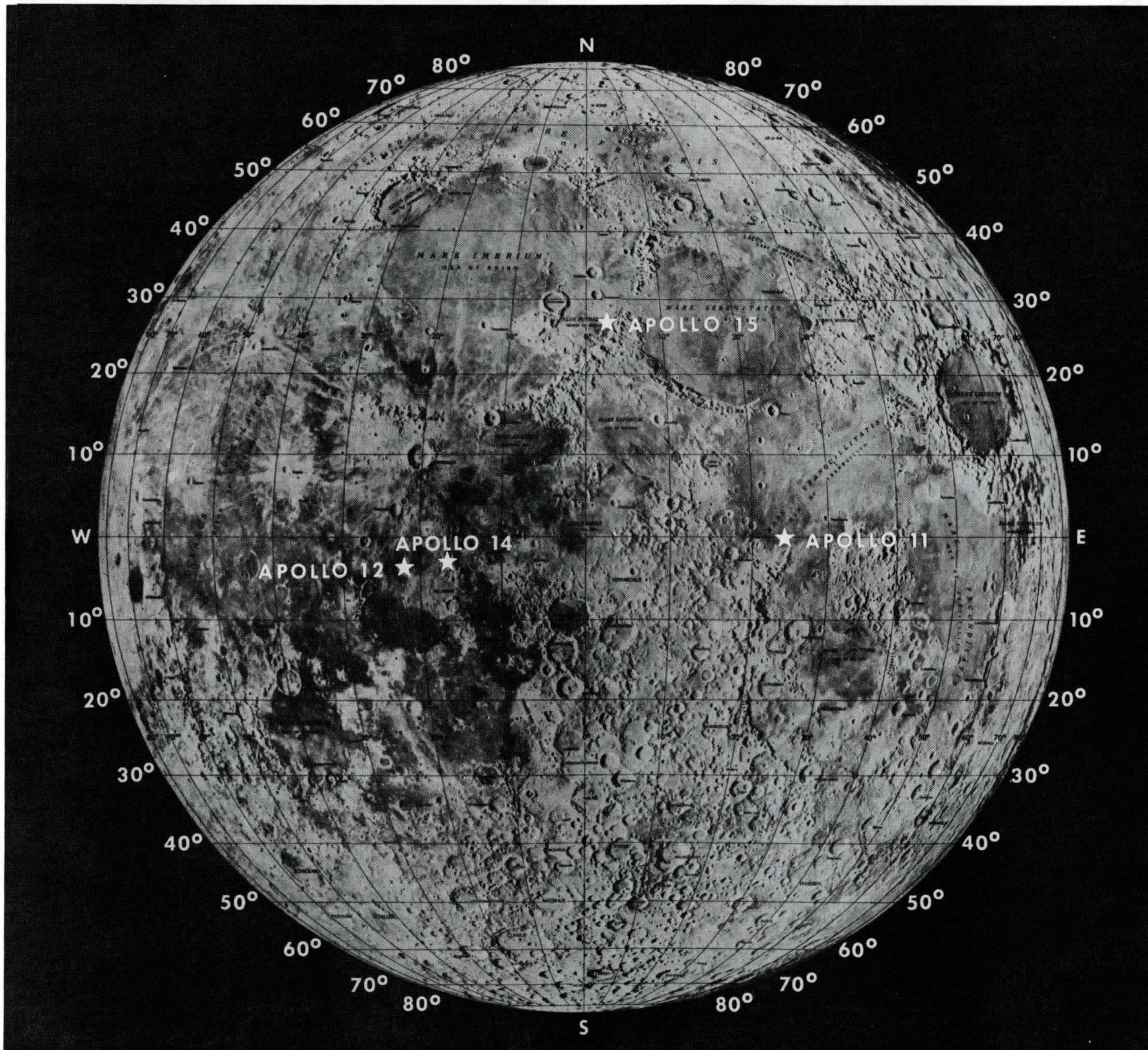
Mass - 1/100 that of Earth

Volume - 1/50 that of Earth

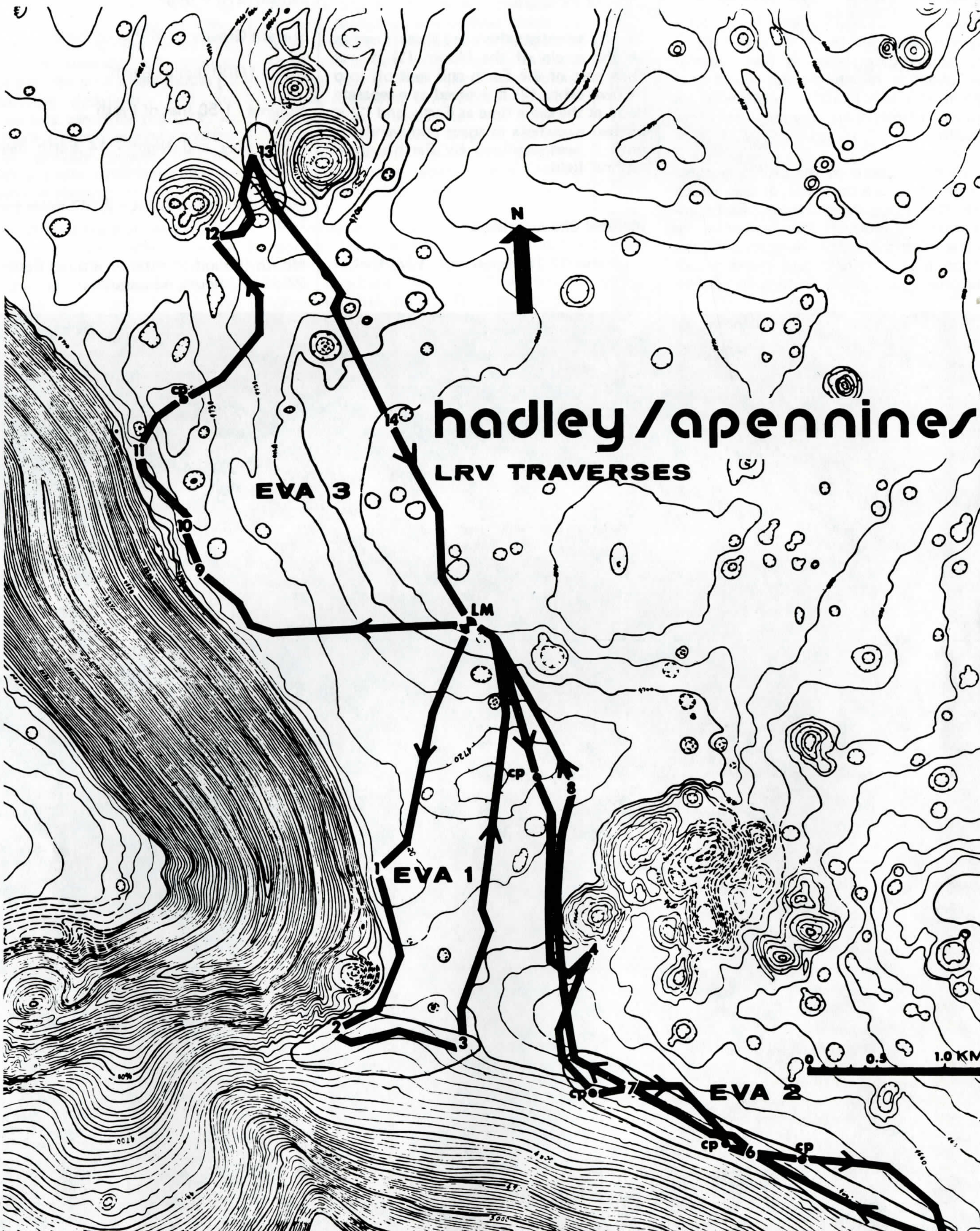
Lunar Day and Night - 14 Earth days each

Mean velocity in Orbit - 2,287 miles-per-hour

Month (Period of rotation around Earth - 27 days, 7 hours, 43 minutes



# lunar landing site



# apollo 15 vehicle characteristics

## VEHICLE DATA

| STAGE/ MODULE | DIMENSIONS DIAMETER FEET | LENGTH FEET | WEIGHT AT LAUNCH (LBS) |
|---|---|---|---|
| Launch* Vehicle | 33.0 | 365 | 6,408,042 |
| S–IC | 33.0 | 138 | 4,930,000 |
| S–II | 33.0 | 81.5 | 1,101,000 |
| S–IVB | 21.7 | 59.3 | 260,000 |
| IU | 21.7 | 3.0 | 4,500 |
| SLA | 21.7 Base<br>12.8 Top | | 4,200 |
| LM** | | | 36,200 |
| C & SM | 12.8 | 22 | 66,900 |

## ENGINE DATA

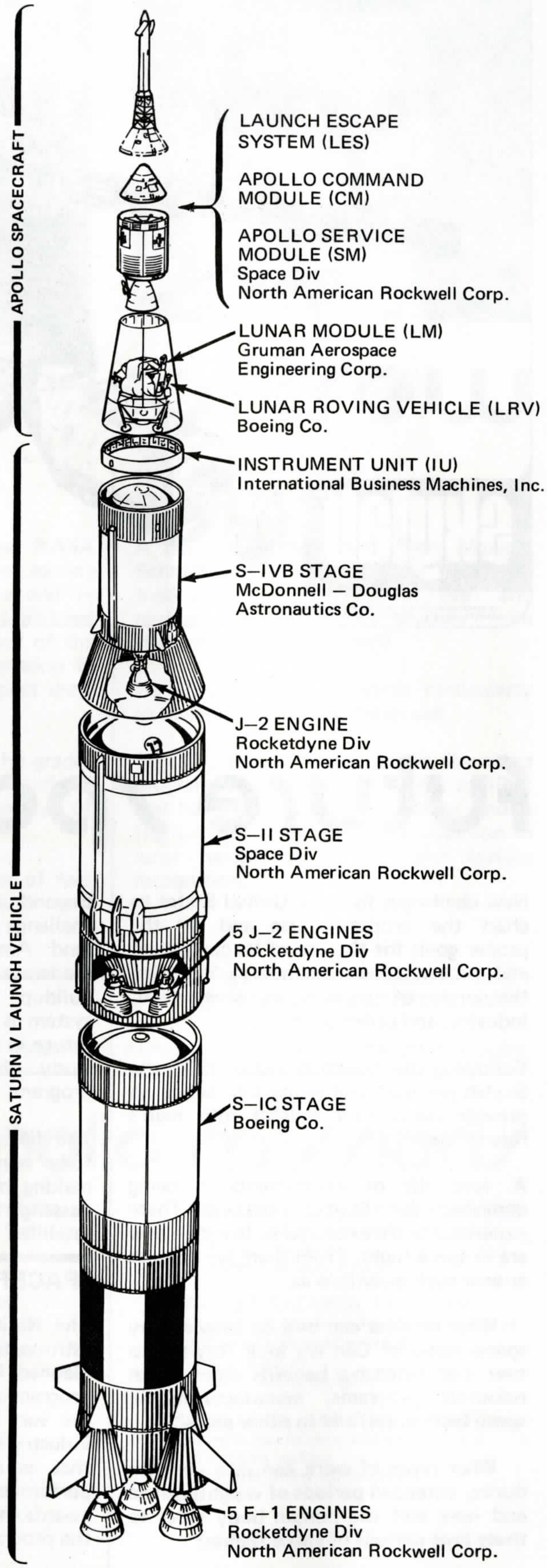
| STAGE/ MODULE | QTY | MODEL | NOMINAL THRUST LBS (EACH) | (TOTAL) | BURNTIME (MINS) |
|---|---|---|---|---|---|
| S–IC | 5 | F–1 | 1,522,000 | 7,787,495 | 2.7 |
| S–II | 5 | J–2 | 232,840 | 1,164,210 | 6.5 |
| S–IVB | 1 | J–2 | 200,130 | 200,130<br>193,720 | 1st 2.43<br>2nd 6.0 |
| LM | | | | | |
| Descent | 1 | | 10,000 | 10,000 | |
| Ascent | 1 | | 3,500 | 3,500 | |
| SM | 1 | | 20,500 | 20,500 | |
| LES | 1 | | 150,000 | 150,000 | |

## FLIGHT DATA

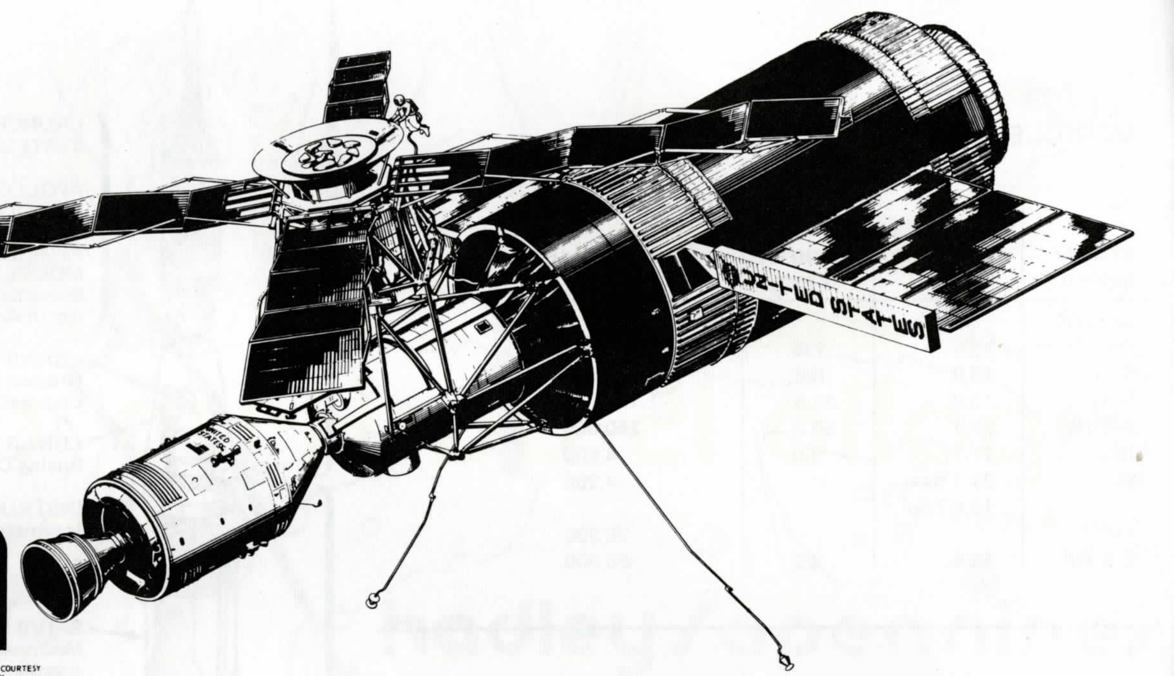
| STAGE/ MODULE | EVENT | VELOCITY (MPH) |
|---|---|---|
| S–IC | Engine Cutoff | 6,100 |
| S–IIC | Engine Cutoff | 15,600 |
| S–IVB | Earth Orbital Insertion | 17,170 |
| S–IVB | Trans Lunar Injection | 23,800 |
| CSM/LM | Lunar Orbit Insertion | 3,585 |
| S–IVB | Lunar Impact | 5,800 |
| LM | Lunar Touchdown | 0–2 |
| LM | Lunar Lift–off | |
| LM Ascent | Lunar Impact | 3,756 |
| CSM | Trans Earth Insertion | 5,640 |
| CM | Earth Insertion | 24,640 |

*Includes 1,210 pounds of frost on outside of vehicle

**Payload Weight on Apollo 15 is 107,300 lbs.—almost 5,000 lbs heavier than any previous mission




**MISSION SUCCESS AND SAFETY ARE APOLLO PREREQUISITES**




# skylab

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# future space challenges

New challenges face the United States to chart the proper course and set the proper goals for the use of its competent and proven space technology involving thousands of persons in government, industry, and universities.

Following the Apollo flights in 1972, the Skylab program will swing into action to provide many new insights into man's role in space.

A long list of experiments is being compiled for Skylab missions. These experiments are expected to launch a new era in space flight. From them we hope to answer such questions as:

**What services can best be provided by space stations? Can we look forward to new and extensive benefits from Earth resources programs, manufacturing in space techniques, and in other areas?**

**What types of work can man perform during extended periods of weightlessness and how will the human body react to these long periods of space flights?**

Beyond Skylab looms a major new challenge comparable to the decision to send Americans to the Moon. At a moderate and economical pace, the buildup of new space transportation system is envisioned as the bridge to our future in space. This new system is in the study phase and is not an approved program.

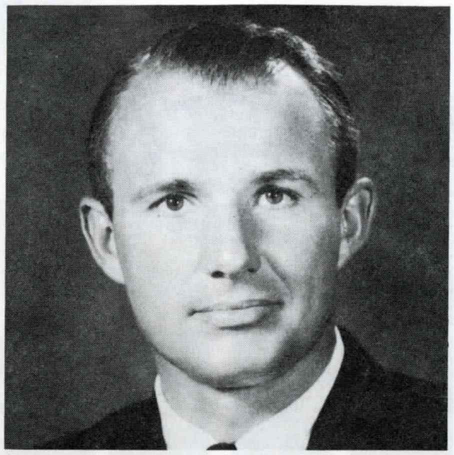
The first component is the economical, fully reusable space shuttle capable of making many round trips to orbit with passengers and cargo. It will return satellites from orbit for refurbishment and reuse and will allow scientists, not trained as astronauts, to accompany their experiments into space. The second is the permanent space station in Earth orbit where men can live and work for extended periods. With these components it will be possible to capitalize upon the full promise of space in the 1980's and 1990's.

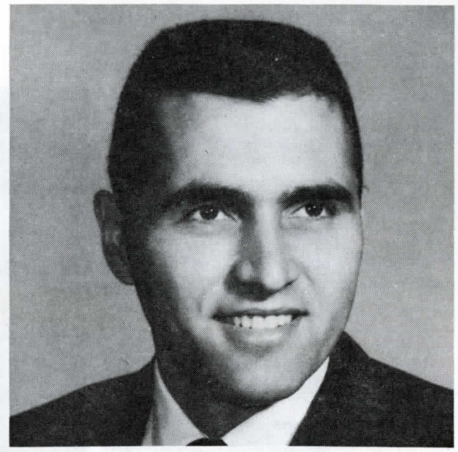
Future manned space flight challenges can only be successful if each member involved in each program works with the same careful awareness and dedication to detail that he has in the past.

## SPACEFLIGHT AND SAFETY

The National Aeronautics and Space Administration helps insure the safety of our astronauts and the success of their space missions through a special program called **Manned Flight Awareness.** It is designed to make every American worker in the space program aware of the importance of his role and his personal responsibility in providing the very best service and products for out astronauts. Workers in government and industry across the nation are constantly reminded of the necessity for preventing errors that could mean costly failures in rocket boosters or spacecraft. Outstanding performance on the job by members of the team is recognized through a system of awards including a trip to Cape Kennedy. With craftsmanship and perfection as its goals, the program is summed up by its motto: **be aware, use care.**

**QUALITY AND RELIABILITY INSURE PROGRESS IN SPACE**





# apollo 15 back-up crew

**RICHARD F. GORDON, JR.**
**Commander**

A native of Seattle, Gordon graduated from the University of Washington in 1951.

He became a naval aviator in 1953 and subsequently attended All–Weather Flight School and jet transitional training. He later conducted flight tests on at least five new Navy aircraft and was winner of the Bendix Trophy Race in 1961, in which he established a coast–to–coast speed record of 869.74 miles per hour.

He was pilot of the Gemini 11 mission in 1966 and was Command Module Pilot on the Apollo 12 mission in 1969. He has logged 315 hours in space.

Gordon is married and the father of four sons, Richard, Lawrence, Thomas, and James, and two daughters, Carleen and Diane.

**VANCE D. BRAND**
**Command Module Pilot**

Brand was selected for the NASA astronaut program in 1966 after serving for four years as a Marine aviator and six years as a civilian test pilot for Lockheed Aircraft Corp. He was a member of the back–up crew for Apollo 8 mission in 1968 and was also on the support crew for Apollo 13 in 1970.

Born in Longmont, Colorado, he graduated from the University of Colorado in 1953 and from the University of California in 1964.

Brand is married and the father of two sons, Patrick and Keven, and two daughters, Susan and Stephanie.

**HARRISON H. SCHMITT**
**Lunar Module Pilot**

A native of Santa Rita, New Mexico, Schmitt graduated from the California Institute of Technology in 1957 and received his Ph D in geology from Harvard University in 1964.

He holds a number of awards, particularly in the area of geological sciences.

Schmitt, who is single, joined the space program as a scientist-astronaut in 1965 and has been active in providing Apollo flight crews with detailed instruction in lunar navigation, geology and feature recognition.

**ASTRONAUT SUPPORT CREW:**

**KARL G. HENIZE • ROBERT A. PARKER • JOSEPH P. ALLEN**

# apollo missions

**APOLLO 4 / NOVEMBER 9, 1967**
First unmanned flight of Saturn V; reentry test of command module

**APOLLO 5 / JANUARY 22, 1968**
Saturn 1B, vehicle 204, puts first unmanned lunar module in Earth orbit

**APOLLO 5 / JANUARY 22, 1968**
Second unmanned Earth orbital flight of Saturn V tests Apollo spacecraft

**APOLLO 7 / OCTOBER 11-22, 1968**
First manned Apollo flight aboard Saturn 1B, 205, tests spacecraft command and service modules in Earth orbit
(Schirra, Eisele, Cunningham)

**APOLLO 8 / DECEMBER 21-27, 1968**
First manned flight of Saturn V that orbited the Moon
(Borman, Lovell, Anders)

**APOLLO 9 / MARCH 3-13, 1969**
First manned flight of the lunar module in Earth orbit
(McDivitt, Scott, Schweickart)

**APOLLO 10 / MAY 18-26, 1969**
Dress rehearsal for lunar landing; flying complete spacecraft to lunar orbit (Stafford, Young, Cernan)

**APOLLO 11 / JULY 16-24, 1969**
First lunar landing and exploration of Moon's surface
(Armstrong, Aldrin, Collins)

**APOLLO 12 / NOVEMBER 14-24, 1969**
Second lunar landing and exploration of Moon's surface
(Conrad, Gordon, Bean)

**APOLLO 13 / APRIL 11-17, 1970**
Circled the Moon and returned to Earth without landing after trouble in the service module
(Lovell, Haise, Swigert)

**APOLLO 14 / JAN. 31-FEB. 9, 1971**
Third lunar landing and exploration of Moon's surface
(Shepard, Mitchell, Roosa)

**INSURE ASTRONAUT SAFETY THROUGH QUALITY PERFORMANCE**

# MANNED FLIGHT AWARENESS

Marshall Space Flight Center, PM—SS/Huntsville, Alabama 35812

be
aware
use
care