# Apollo 16 Description

## Mission Overview

Apollo 16 was launched on 16 April 1972 UT 17:54:00 on a Saturn V rocket from Kennedy Space Center. Lunar orbit insertion took place on 19 April 1972 UT 20:22:28. The Lunar Module (LM) landed on the Moon on 21 April 1972 UT 02:23:35, in the Descartes highland region at 8.972 S, 15.498 E, just north of the Dolland crater, while the Command/Service Module (CSM) remained in lunar orbit. The lunar ascent module launched from the Moon on 24 April UT 01:25:48. The command module was returned to Earth on 27 April 1972 UT 19:45:05.

The astronauts on Apollo 16 were commander John Young, command module pilot Thomas Mattingly, and lunar module pilot Charles Duke.

Three excursions on the first Lunar Roving Vehicle (LRV) lasted a total of 20 hours and 14 minutes and traversed 27 km. The lunar surface stay-time was 71 hours. During the stay, the Apollo Lunar Surface Experiment Package (ALSEP) was placed and activated, and 94.7 kg of rock and soil samples were collected. The duration of the lunar orbit was 126 hours for a total of 64 orbits. The small sub-satellite was spring-launched at 21:56:09 UT on April 24 into an elliptical orbit with a lifetime of one month, rather than the planned one-year orbit.

## Surface Operations

The LM separated from the CSM at 18:08:00 UT on 20 April 1972 and landed at 02:23:35 UT on 21 April (9:23:35 p.m. EST, 20 April) in the Descartes highland region just north of the crater Dolland at 8.9730 South latitude, 15.5002 East longitude (IAU Mean Earth Polar Axis coordinate system). Young and Duke made three moonwalk extra-vehicular activities (EVAs) totaling 20 hours, 14 minutes. During this time they covered 27 km and collected 94.7 kg of rock and soil samples, stopping at 11 sites. The LRV was used during EVAs to extend the range of surface lunar exploration. The first EVA was on 21 April from 16:47:38 UT to 23:58:40 UT, during which the astronauts set up the ALSEP and other instruments, deployed the LRV, and explored the area around the LM and surrounding craters in a 4.2-km traverse, stopping at Flag Crater and Spook Crater. During the second EVA on 22 April from 16:33:35 UT to 23:56:44 UT the astronauts explored a ridge and mountain slope during a 11.1-km traverse and visited the Cinco Crater area, halfway up the slope of Stone Mountain, and the base of Stone Mountain. On the third EVA, of 11.4 km, on 23 April from 15:25:28 UT to 21:05:31 UT they travelled to the southeast rim of North Ray Crater, House Rock, and the base of Smoky Mountain. During all these EVAs the astronauts collected samples and took photographs and performed other tasks at some sites. The LM lifted off from the Moon on 24 April at 01:25:48 UT after 71 hours, 2 minutes on the lunar surface.

## Surface Experiments

The Apollo 16 astronauts performed and deployed many experiments on the lunar surface along with the geologic studies, sample return, and surface photography:

* The Solar Wind Composition experiment collected samples of solar wind on a large piece of foil which was returned to Earth
* The Cosmic-Ray Detector recorded heavy (high energy) cosmic rays from solar, stellar, and galactic sources on detector plates which were returned to Earth
* The Portable Surface Magnetometer studied the strength local magnetic sources in the traverse areas. It was run by an astronaut with the results radioed back to Earth
* The Soil Mechanics Investigations studied the physical properties of the lunar regolith using observations recorded by video and audio and a surface penetrometer which recorded data on a drum which was returned to Earth
* The Far-Ultraviolet Camera/Spectrometer recorded ultraviolet astronomical observations which were returned to Earth ion film

Other experiments were part of the Apollo Lunar Surface Experiments Package (ALSEP) which was emplaced at the landing site by the astronauts. The instruments, connected by cables to a central station which controlled power and communications, ran autonomously. Data collected was converted to a telemetry format and transmitted to Earth. Many of these experiments returned data until September 1977, when the ALSEP network was turned off due to budgetary constraints.

The Apollo 16 ALSEP instruments consisted of:

* A Passive Seismometer, designed to measure seismic activity and physical properties of the lunar crust and interior
* An Active Seismic Experiment to study the physical properties of lunar surface and subsurface materials and the structure of the local near-surface layers
* A Lunar Surface Magnetometer (LSM), designed to measure the magnetic field at the lunar surface
* A Heat Flow Experiment, designed to measure the rate of heat loss from the lunar interior and the thermal properties of lunar material

The central station, located at 8.9754 S latitude, 15.4981 E longitude, was turned on at 19:38 UT on 21 April 1972 and shut down along with the other ALSEP stations on 30 September 1977.

## Orbital Science Experiments

Investigations were also carried out from lunar orbit in the Apollo 16 Command and Service Module. Hand-held photography was performed from the command module, and a suite of instruments operated from the Scientific Instrument Module (SIM) in the Service Module, comprising:

* Metric and Panoramic cameras to take photographs of the lunar surface from orbit
* A Laser Altimeter using reflected laser pulses to profile the topography of lunar surface
* A Gamma-ray Spectrometer Experiment to measure gamma ray emissions from the lunar surface to determine composition
* An X-ray Fluorescence Spectrometer Experiment to measure secondary X-ray emissions from the lunar surface to determine composition
* An Alpha Particle Spectrometer Experiment to measure radon gas emissions from the lunar surface
* An S-Band Transponder Experiment designed to carefully track the CSM orbit and measure the lunar gravity field
* An Orbital Mass Spectrometer Experiment to study the tenuous lunar atmosphere and search for active lunar volcanism
* A Bistatic Radar Experiment used measurements of S-Band and VHF reflections to probe electromagnetic and structural properties of the lunar surface
* A Subsatellite released from the CSM into lunar orbit with instruments to measure the Moon’s gravity field, magnetic field, and distribution of charged particles.

Additional experiments were also performed in lunar orbit and during the cruise between Earth and the Moon:

* The Ultraviolet Photography Experiment took images of Earth and the Moon in UV;
* The Gegenschein Photography Experiment took images of the reflections from dust particles at the Moulton point
* The Window Meteoroid experiment studied micrometeoroid impacts on the Apollo 16 Command Module heat shield windows to obtain information about the mass flux of micro-meteorites

* The Skylab-Apollo Contamination Experiment took images of scattered visible light produced by any residual cloud around the spacecraft and studied particle dynamics during liquid dumps
* The Biostack experiment studied the biological effects of galactic cosmic radiation
* The Microbial Ecology Evaluation Device studied the response of microbes to the space environment
* The Light Flashes Experiment studied the subjective observations of faint light flashes seen by nearly all Apollo astronauts while in space

## Mission Objectives Overview

The primary scientific objectives of the Apollo 16 mission were to:

* Carry out a geological survey, comprehensive sampling, and photographic documentation in the Descartes region
* Emplace and activate surface experiments
* Conduct experiments and photographic tasks from lunar orbit

## References

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