# Apollo 17 Description

## Mission Overview

Apollo 17 was launched on 7 December 1972 UT 5:33:00 on a Saturn V rocket from Kennedy Space Center. Lunar orbit insertion took place on 10 December 1972 UT 19:47:23. The Lunar Module (LM) landed on the Moon on 11 December 1972 UT 19:54:57, on the southeastern rim of Mare Serenitatis in a valley at Taurus-Littrow (20.19 North longitude, 30.77 East latitude (Davies and Colvin, 2000), while the Command/Service Module (CSM) orbited the Moon. The lunar ascent module launched from the Moon on 14 December 1972 UT 22:54:37. The command module was returned to Earth on 19 December 1972 UT 19:24:59. Apollo 17 was the final lunar landing mission in NASA’s Apollo program.

The astronauts on Apollo 17 were commander Eugene Cernan, command module pilot Ronald Evans, and lunar module pilot Harrison Schmitt. Three excursions, using the Lunar Roving Vehicle (LRV), lasted a total of 22 hours, 4 minutes and traversed 35.7 km. The lunar surface stay-time was 75 hours. During the stay, the Apollo Lunar Surface Experiment Package (ALSEP) was placed and activated, and 110.5 kg of rock and soil samples were collected. The duration of the lunar orbit was 147.6 hours for a total of 75 orbits.

## Surface Operations

Cernan and Schmitt made three moonwalk extra-vehicular activities (EVAs). The LRV was used to explore regions within 7.5 km of the LM landing site. The first moonwalk EVA started on 11 December at 23:54:49 UT and ended on 12 December at 07:06:42 UT, during which time the LRV was unloaded, deployed, and driven. Photographs of the lunar surface were taken and geologic samples were collected from the LM site and during all three geological traverses. The ALSEP was deployed 185 meters West-Northwest of the LM landing site. The traverse on the first EVA covered 3.3 km, out to Steno and Emory craters and back. The surface electrical properties experiment was set up during this traverse and a seismic explosives charge deployed.

The second EVA started on 12 December at 23:28:06 UT and ended on 13 December at 07:05:02 UT. The LRV was driven out to Nansen crater and back by way of Lincoln scarp, Shorty crater, and Camelot crater. It covered 20.3 km and included deployment of several seismic explosives packages. The tape recorder from the surface electrical properties experiment, the cosmic ray experiment, and the lunar neutron probe were retrieved at the end of this EVA. The third EVA ran from 13 December 22:25:48 UT until 14 December 05:40:56 UT. This traverse went out to the North massif and Sculptured Hills, and returned via Cochise, Shakespeare, Van Serg, and Sherlock craters. The traverse covered a distance of 12.1 km. The LM lifted off the Moon on 14 December at 22:54:37 UT after 75 hours on the lunar surface.

## Surface Experiments

The Apollo 17 astronauts performed and deployed many experiments on the lunar surface along with the geologic studies, sample return, and surface photography.

* The Lunar Traverse Gravimeter Experiment was designed to make a high-accuracy survey of the gravitational field in the Apollo 17 landing area
* The Soil Mechanics Experiment studied the physical properties of the lunar regolith using observations recorded by video and audio
* The Surface Electrical Properties Experiment obtained data about the electromagnetic energy transmission, absorption, and reflection characteristics of the lunar surface and subsurface
* The Lunar Surface Cosmic Ray Experiment was a set of detectors hung from the LM, designed to measure solar wind particles, low energy cosmic rays, and radon
* The Neutron Probe was designed to measure the rates of low-energy neutron capture as a function of depth in the lunar regolith

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 17 ALSEP instruments consisted of:

* A Lunar Ejecta and Meteorites Experiment, designed to measure the frequency with which the Moon was impacted by primary cosmic dust particles and lunar ejecta
* A Lunar Atmospheric Composition Experiment, designed to study the composition and variations in the tenuous lunar atmosphere
* A Lunar Surface Gravimeter, designed to obtain highly accurate measurements of the lunar gravity and its temporal variations at a selected point on the surface
* A Heat Flow Experiment, designed to measure the rate of heat loss from the lunar interior and the thermal properties of lunar material

* A Lunar Seismic Profiling Experiment, designed to acquire data on the physical properties of the lunar near-surface materials and to monitor natural seismic activity

## Orbital Science Experiments

Investigations were also carried out from lunar orbit in the Apollo 17 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 Far Ultraviolet Spectrometer provided UV observations of the lunar surface, lunar atmosphere, zodiacal light, solar atmosphere, Earth, and galactic and stellar sources
* An Infrared Scanning Radiometer designed to measure the thermal emission from the lunar surface in order to obtain a surface temperature map
* A Lunar Sounder Experiment, a synthetic aperture radar, mapped the topography and subsurface electrical conductivity structure and measured galactic electromagnetic radiation in the lunar environment
* An S-Band Transponder Experiment designed to carefully track the CSM orbit and measure the lunar gravity field

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

* The Mapping Camera Aspect Stellar Photography Experiment took stellar photographs simultaneously with the metric photography to provide more accurate spacecraft position reference data
* The Biological Cosmic Ray Experiment (BIOCORE) consisted of a group of pocket mice with implanted cosmic ray detectors to determine the biological effects of cosmic rays
* The Biostack Experiment was designed to study the effects of cosmic radiation on various biological specimens
* The Window Meteoroid experiment studied micrometeoroid impacts on the Apollo 17 Command Module heat shield windows to obtain information about the mass flux of micro-meteorites
* The Heat Flow and Convection experiment was an engineering test performed on board the Apollo 17 Command Module to measure and observe the behavior of fluid flowing in the absence of gravity.

For more information about the experiments, see the ‘Apollo 17 Preliminary Science Report’ by Johnson Space Center, (1973) (Apollo 17A, 1973).

## Mission Objectives Overview

The primary scientific objectives of the Apollo 17 mission were to:

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

## References

Apollo 17 Preliminary Science Report, NASA SP-330, published by NASA, Washington, D.C., 1973.

Davies, M. E., and T. R. Colvin, Lunar coordinates in the regions of the Apollo landers, Journal of Geophysical Research, Volume 105, Issue E8, pages 20,227-20,280, 2000.

Ertel, I. D., R. W. Newkirk, and C. G. Brooks, The Apollo Spacecraft: A Chronology Volume 4, 21 January 1966 - 13 July 1974, NASA SP-4009, published by NASA, Washington, D.C., 1978.