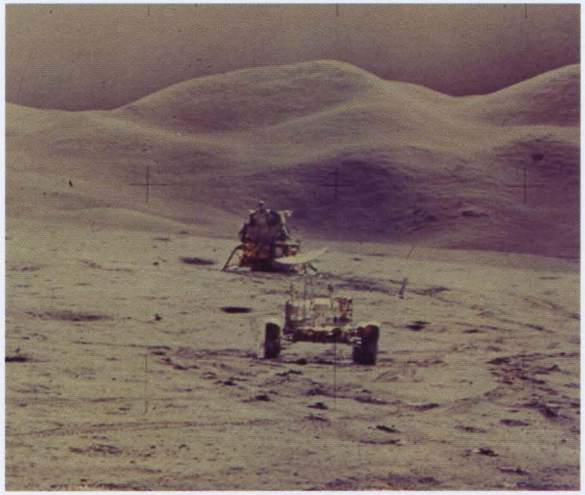
National Aeronautics and
Space Administration

The Apollo Program



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The Apollo program, begun in 1961 as a response to the challenge of Soviet space activities, rapidly became the backbone of the American space program. Its original objective was to land an American on the Moon and return safely to Earth before the end of the decade. At the time President Kennedy proposed the Apollo program, the United States had achieved only one human space flight—Alan Shepard's 15-minute suborbital Mercury-Redstone mission. Even the most optimistic space enthusiasts had doubts that the President's goal could be met. An entire new space technology had to be developed—a technology that included orbital rendezvous, extravehicular activities, rocket-powered landings, and deep space navigation, among others. Furthermore, in 1961, knowledge about the lunar surface was of the most general nature, based completely on Earth-based astronomical studies and radar. No features smaller than a kilometer could be resolved, and one school of thought believed the maria to be deep pits filled with electrostatically supported dust into which astronauts might sink.

The Apollo program was nevertheless approved, and development of the mighty Saturn V launch vehicle, spacecraft, and a deep space tracking network began. The 10 missions of the Gemini program were invaluable in learning how humans could operate in space. The robotic Ranger probes included three successful hard-landing missions, which produced the first high resolution views of the lunar surface. A spectacular series of five Lunar Orbiter reconnaissance missions gave us photographs of almost the entire Moon; these photos helped to determine Apollo landing sites. In 1966 and 1967, soft-landing Surveyor spacecraft produced detailed knowledge of the lunar surface, including physical properties and chemical composition.

In 1967 the Apollo program suffered a major setback. The Apollo 204 spacecraft caught fire during a ground test, killing astronauts Gus Grissom, Ed White, and Roger Chaffee. After finding the cause of this tragedy, improvements to the spacecraft resulted and rigid safety procedures were developed. By 1968, the first Earth-orbital mission, Apollo 7, was flown, followed within months by the first lunar orbiting mission, Apollo 8. The Apollo 9 mission tested the Lunar Module in Earth orbit, and Apollo 10 tested the Lunar Module in lunar orbit, paving the way for the first landing in July 1969.

The six Apollo lunar landings, during which 12 astronauts lived, in pairs, on the Moon for as long as 3 days, were extraordinarily productive. Astronauts carried out extensive remote-sensing surveys from lunar orbit that in themselves would have been major scientific accomplishments. The landings permitted the sampling of rocks and soils far beyond that possible with unpiloted sample return missions; these samples are still being productively analyzed using techniques developed in the decades since the samples were collected. The astronauts emplaced six complex geophysical observatories that operated for years; in fact, the laser retroreflectors emplaced with the observatories are still being used for Earth-based astronomical measurements.

The Apollo program was the central element of a much broader space initiative that included the Mercury, Ranger, Surveyor, Gemini, Lunar Orbiter, Skylab, and Apollo-Soyuz programs. All these were either necessary preparations for the Apollo program or later efforts using Apollo spacecraft and launch vehicles. The Earth-orbiting elements of the "broader" Apollo program were extremely productive. Earth terrain photography from the Gemini mission, for example, eventually led to Landsat. Radar altimetry from Skylab mapped the gravitationally determined shape of the sea surface from space, thus producing indirectly the first topographical view of the ocean floor. The Apollo-Soyuz mission demonstrated satellite-to-satellite tracking, a valuable technique used to map Earth's gravity field. Between 1961 and 1972, the Apollo program cost $25 billion. The program is generally agreed to have been one of the most significant technological achievements in human history, a unifying experience for the human race, and the beginning of humanity's expansion into the universe.

About the Images

Between 1969 and 1972 NASA astronauts successfully landed on the Moon six times, more than fulfilling the promise made by President John F. Kennedy in 1961. (1) In one of the important symbolic acts of each of these missions, Astronaut David R. Scott salutes the United States flag during the Apollo 15 lunar surface extravehicular activity (EVA) at the Hadley-Apennine landing site. The Lunar Module "Falcon" is partially visible on the right. Hadley Delta in the background rises approximately 4,000 meters (about 13,124 feet) above the plain. The base of the mountain is approximately 5 kilometers (about 3 statute miles) away. This photograph was taken by Astronaut James B. Irwin. (2) Astronaut Eugene A. Cernan makes a short checkout of the Lunar Roving Vehicle during the early part of the first Apollo 17 extravehicular activity (EVA-1) at the Taurus-Littrow landing site. The mountain in the right background is the East end of South Massif. (3) During Apollo 15, the first mission with a lunar rover, Astronauts James B. Irwin and David R. Scott positioned themselves about 150 yards from the landing site to take this photograph of the "Magnificent Desolation" of the Moon, as Astronaut Buzz Aldrin called it. In the distance is the lunar rover and the Lunar Module. The rover enabled astronauts Scott and Irwin to range over the lunar surface more than 15 miles, in the process leaving tire tracks and footprints that will remain for eons on that dead world.

Fast Facts

Namesake:	Apollo—Greek god of prophecy, sunlight, poetry, and music
Lunar Mission:	Three circumlunars (without landings); six landings
Samples Returned:	385 kilograms of rock and soil; soil included implanted hydrogen and helium atoms from the Sun.

Significant Dates

1961—President John F. Kennedy proposed that the U.S. land a human on the Moon and return him before the end of the decade
1965—First piloted Gemini mission; demonstrated two-member spacecraft, propulsion, and radar
1968—First human Apollo mission; Earth orbit, 11 days
1968—First human flight to Moon, Apollo 8; 10 orbits, no landing
1969—First human landing on Moon, Apollo 11
1971—First human surface vehicle on Moon, Apollo 15
1972—Last Apollo mission to Moon, Apollo 17
1975—Apollo-Soyuz Test Project, joint Soviet/American mission

References

1. NASA Apollo History: *http://spaceflight.nasa.gov/history/apollo*
2. NASA Apollo 11 30th Anniversary: *http://www.hq.nasa.gov/office/pao/History/ap11ann/introduction.htm*
3. *Apollo Over the Moon: A View from Orbit,* NASA SP-362, NASA Headquarters, Washington, DC. 1978.
4. *Apollo Expeditions to the Moon,* NASA SP-350, NASA Headquarters, Washington, DC. 1975.

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