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 a man on the Moon and return him to Earth before the end of the decade. At the time President Kennedy proposed the Apollo Program, the United States had achieved only one manned 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 Saturn family of launch vehicles, spacecraft, and a deep-space tracking network began. The 10 missions of the manned Gemini Program were invaluable in learning how humans could operate in space. The unmanned Ranger series 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 Grissom, White, and Chaffee. Because of this tragedy, spacecraft greatly improved, 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 manned 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 unmanned sample return missions; these sample are still being productively analyzed using new 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 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 lead 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-satellite tracking, a valuable technique used to map Earth's gravity field.

The total cost of the Apollo Program was $25 billion, spent between 1962 and 1972. The program is generally agreed to have been the supreme technological achievement of a millennium now drawing to a close, a unifying experience for the human race, and the beginning of humanity’s expansion into the universe.

### Fast Facts

**Namesake:** Apollo—Greek God of Prophecy, Sunlight, Poetry, and Music

**Lunar Mission:** Three Circumlunar (no landing); Six Landings

**Samples Returned:** 385 Kilograms of Rock and Soil; Soil Includes Implanted Hydrogen and Helium Atoms from the Sun.

### Significant Dates

1961 — President John F. Kennedy proposed that the U.S. land a man on the Moon and return him before the end of the decade

1965 — First manned Gemini mission; demonstrated two-man spacecraft, propulsion, and radar

1968 — First manned Apollo mission; Earth orbit, 11 days

1968 — First manned flight to Moon, Apollo 8; 10 orbits, no landing

1969 — First manned landing on Moon, Apollo 11

1971 — First manned surface vehicle on moon, Apollo 15

1972 — Last Apollo mission to Moon, Apollo 17

1975 — Apollo-Soyuz Test Program, joint Soviet/American mission

### About the Image

Astronaut Harrison ("Jack") Schmitt collects samples of a huge boulder in the Moon's Littrow Valley during the Apollo 17 Mission in December 1972. This region is one of the most rugged and scenic visited by the six landings of the Apollo Program. Beyond the large boulder is the flat floor of the Littrow Valley, covered by dark mare material (lava flows). Beyond the valley are the Taurus Mountains, made up of older, heavily cratered highland rocks. The Lunar Rover, used by the astronauts to explore the surface, is visible to the right of the rock.

### References


3. Apollo 17 View of the Earth, HQL-255, NASA Headquarters, Washington, DC