The Apollo Program
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 unpowered 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 “broadest” 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.

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### 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.