

DESTINATION MOON

THE APOLLO 11 MISSION

FOR AS LONG AS HUMANS HAVE gazed at the sky, the Moon has been central to mythology and religion.

In the 1950s, as technology brought the dream of reaching the Moon closer to reality, two powerful countries, the United States and the Soviet Union, dominated geopolitics. Their global military and political competition was called the Cold War. After the Soviet Union launched *Sputnik*, the first satellite, in 1957, these two superpowers competed in space to demonstrate technical superiority and acquire global prestige. The Moon quickly became a focal point of their competition.

Reaching the Moon would give America the best chance to catch up to and surpass the Soviet space program. This was a formidable challenge. Not only did the United States need to figure out how to do it, they needed to invent technologies to make it possible, and to build critical experience. The nation was determined to realize that ambitious goal.

“I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth.”

PRESIDENT JOHN F. KENNEDY, 1961

All images courtesy NASA unless otherwise indicated.

Destination Moon: The Apollo 11 Mission is organized by the National Air and Space Museum and the Smithsonian Institution Traveling Exhibition Service. The exhibition is made possible by the support of Jeff and Mackenzie Bezos, Joe Clark, Bruce R. McCaw Family Foundation, the Charles and Lisa Simonyi Fund for Arts and Sciences, John and Susan Norton, and Gregory D. and Jennifer Wabton Johnson.



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Reaching for the Moon

TO PREPARE FOR A MOON LANDING, the National Aeronautics and Space Administration, NASA, developed three human spaceflight programs: Mercury, Gemini, and Apollo.

Through these programs, NASA trained the astronauts and developed the technology to live and work in space, rendezvous and dock with another spacecraft, and walk in space and on the Moon. Before Apollo 11, from 1961 to 1969, the agency launched 20 missions. While the first missions lasted only minutes in space, each one built on the lessons learned from the one that came before. By 1969, astronauts had shown they could spend many days in space. But it was not all smooth sailing. Crises and tragedies occurred, notably the deaths of three astronauts in a 1967 ground test.

GEMINI

In the Gemini spaceflight program (1965–66) two-man crews piloted 10 missions. Astronauts perfected vehicle rendezvous and docking techniques critical for future missions, tested walking in space, and proved that humans could survive in space for up to two weeks. On June 3, 1965, Gemini IV astronaut Edward White became the first American to walk in space. ▶

MERCURY

On two short journeys into space and four missions into orbit, one-man crews aboard the Mercury spaceflight program (1961–63) proved that an astronaut could not only survive but perform critical tasks in Earth orbit and return alive. Astronaut John Glenn became the first American to orbit the Earth on February 20, 1962. ▶

APOLLO

To achieve its goal of landing on the Moon, NASA created a spacecraft that consisted of a portion that would orbit the Moon, and another that would land on its surface. With three-man crews, the Apollo missions (1967–72) tested the Apollo orbiter and lander in Earth and lunar orbits. ▶ On July 20, 1969, Apollo 11 landed the first men on the Moon—Neil Armstrong and Buzz Aldrin—while Michael Collins remained in orbit. Five subsequent missions also landed men on the Moon.

NASA suffered a tragic setback when the first APOLLO crew scheduled to fly died when fire broke out in their capsule during a ground test in Florida. Astronauts Edward White, Virgil "Gus" Grissom, and Roger Chaffee died inside their spacecraft on January 27, 1967. ▶



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How We Got There

The Gigantic Saturn V Rocket

To reach the Moon, engineers designed the Saturn V rocket. Its three stages would stand 363 feet (109 meters) tall and weigh as much as 400 elephants—6.5 million pounds. To lift that weight, the first stage would have five gigantic engines that could generate millions of pounds of thrust by burning liquid oxygen and kerosene. The two upper stages would use the high-energy combination of liquid hydrogen and oxygen. Together they could send about 100,000 pounds (45 metric tons) to the Moon.



Direct



Earth Orbit Rendezvous



Lunar Orbit Rendezvous

The Method: Lunar Orbit Rendezvous

After much debate, NASA engineers chose lunar orbit rendezvous as the way to go to the Moon. Two astronauts would pilot a small lander to the lunar surface, while the main Apollo spacecraft would orbit the Moon with the third crewmember on board. After the lander's crew cabin launched from the Moon's surface back into orbit, it would rendezvous with the orbiting spacecraft.

The Apollo Spacecraft

COMMAND MODULE ▶

Command module Columbia was the primary command center and residence for the Apollo 11 crew. It contained navigation and life-support equipment. The command module was the only part of the spacecraft to return intact to Earth. It carried the three astronauts, equipment, and precious lunar samples through a fiery reentry into the Earth's atmosphere.

Courtesy National Air and Space Museum

SERVICE MODULE

The service module, attached to the command module, housed the propulsion system needed to maneuver Columbia into lunar orbit and return it to Earth.

LUNAR MODULE

The Apollo 11 astronauts landed on the Moon using the lunar module, *Eagle*. The module had two stages: The descent stage (with legs) powered the module down to the lunar surface. It then became the launch pad for the ascent stage, which returned the astronauts to the command and service module.



RIGHT, TOP: The command module Columbia, resting on its transport ring at its present home at the Smithsonian National Air and Space Museum. RIGHT, BELOW: Columbia command module pilot Michael Collins.



The People



THE APOLLO 11 CREWMEMBERS were all highly experienced pilots and astronauts. All had flown Gemini missions.

They were assisted by Mission Control, the tip of a huge pyramid of civil servants and contractors working on Apollo. For nearly a decade, hundreds of thousands of people, including the most brilliant engineers, scientists, and technicians, devoted their lives to achieving this technical miracle. Together, they invented and manufactured tens of millions of parts, overcame bureaucratic battles, endured tragedy and countless setbacks—and their success lifted not just a nation, but the entire world.

MISSION CONTROL

During the flight, Mission Control in Houston, Texas, was the astronauts' point of contact with the larger team. Mission controllers oversaw every phase of the flight and their expertise informed every decision as the astronauts progressed on their mission. They continuously monitored information from spacecraft instruments and the astronauts' own words. Computers at Mission Control helped navigate the spacecraft.

The Apollo 11 crew designed this mission patch, purposely omitting their own names to draw attention to the thousands involved in a lunar landing.

Over 400,000 Americans, of many backgrounds and educational levels, made Apollo 11's journey possible.

NEIL A. ARMSTRONG, COMMANDER

Born in Wapakoneta, Ohio, Neil Armstrong was an aeronautical engineer and a Navy fighter pilot during the Korean War. In 1955 he joined the National Advisory Committee for Aeronautics (which later became NASA) as a test pilot. Armstrong became an astronaut in 1962 and commanded the Gemini VIII mission, on which he performed the first successful docking of two vehicles in space.

MICHAEL COLLINS, COMMAND MODULE PILOT

Michael Collins attended West Point and became an Air Force fighter pilot and an experimental aircraft test pilot. He joined NASA in 1963, piloted Gemini X in 1966 and walked in space during that mission. Collins served from 1971 to 1978 as director of the Smithsonian's National Air and Space Museum.

EDWIN E. "BUZZ" ALDRIN JR., LUNAR MODULE PILOT

Buzz Aldrin attended West Point and became an Air Force fighter pilot during the Korean War. In 1963 he earned a Ph.D. from the Massachusetts Institute of Technology with a dissertation on orbital rendezvous, and joined NASA. On Gemini XII in 1966, Aldrin made two spacewalks and hand-calculated rendezvous maneuvers when the spacecraft computer failed. In 1988 he legally changed his given name to Buzz.



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The Eagle Has Landed



Liftoff!

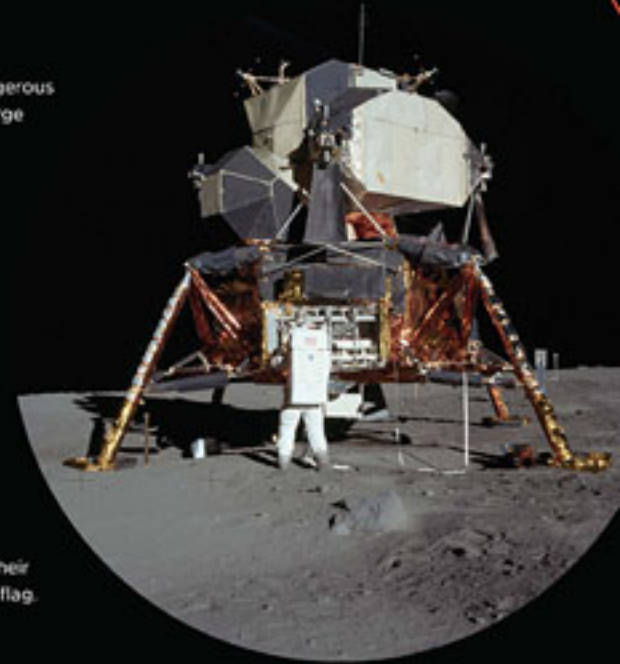
At 9:32 a.m. on July 16, 1969, Apollo 11 lifted off from Launch Complex 39A at the Kennedy Space Center in Florida. Several hours after liftoff, Columbia command module pilot Michael Collins separated the command and service modules from the upper stage of the Saturn V rocket, then turned around to dock with the lunar module *Eagle*, stowed in a compartment on top of the Saturn V.

After docking Columbia with *Eagle*, and removing *Eagle* from the third stage of the Saturn V rocket, Armstrong, Collins, and Aldrin settled down for their nearly three-day journey to the Moon.

Landing on the Moon

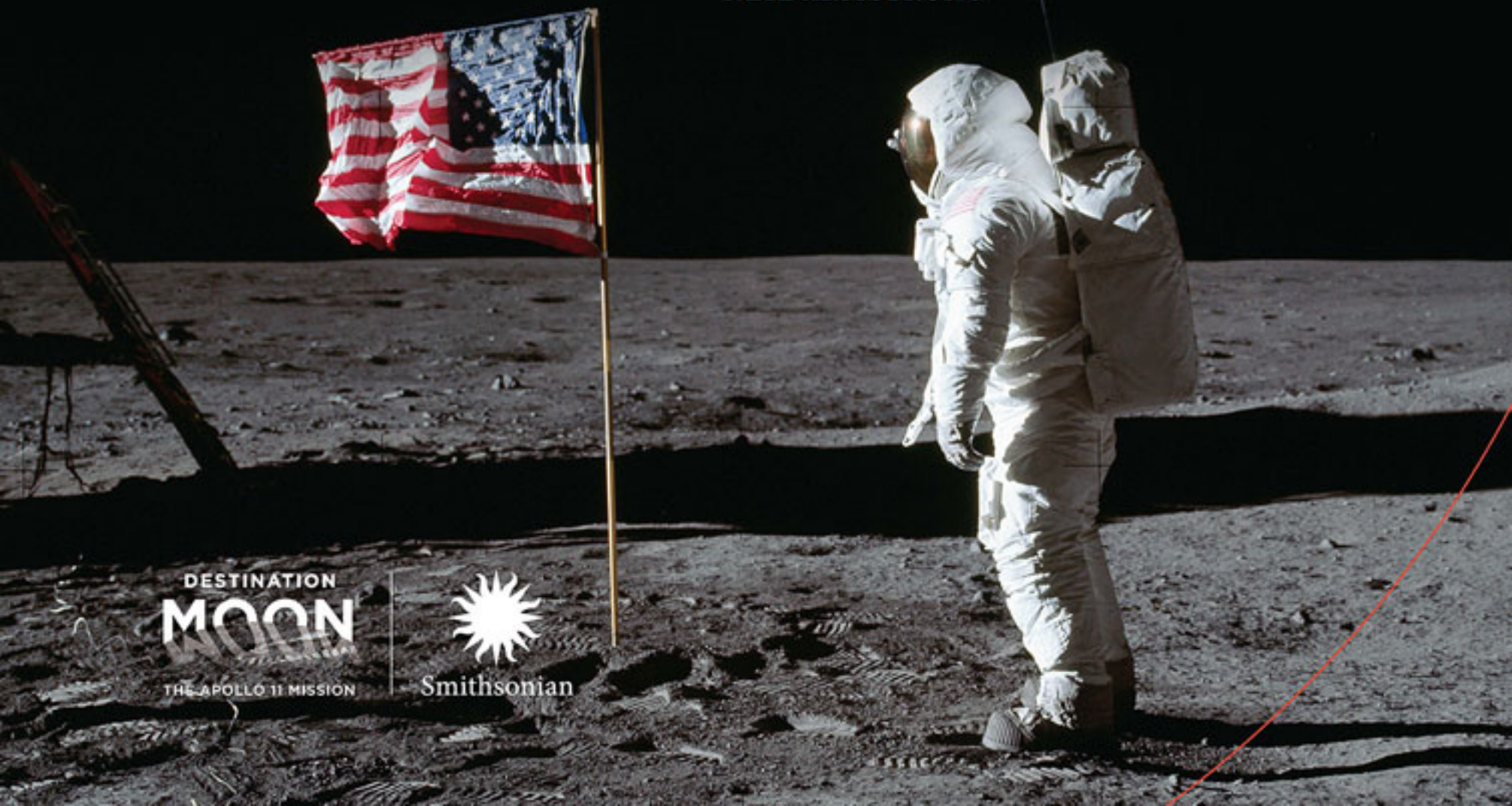
The landing was the most challenging and dangerous aspect of Apollo 11. Using the lunar module's large descent engine, Armstrong and Aldrin slowed themselves from several thousand miles per hour to near zero speed over the Moon's surface. Even though NASA chose a very flat landing site, Armstrong found the automated guidance system steering them toward a crater with large boulders. He took over manual control and thrust the spacecraft forward to find a safer place to land.

At 4:18 p.m. Eastern Time on July 20, 1969, Neil Armstrong and Buzz Aldrin landed on the Moon, fulfilling an age-old dream of humankind. At 10:56 p.m., Armstrong stepped onto the lunar surface. Aldrin followed him. They stayed outside for about 2 1/2 hours. They gathered samples, set up experiments, tested their suits and equipment, and planted an American flag.



*"That's one small step for man,
one giant leap for mankind."*

NEIL ARMSTRONG



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Triumphant Return

ON JULY 21, after 21 hours and 36 minutes on the Moon, Armstrong and Aldrin launched back into lunar orbit.

Soon they rejoined Collins in *Columbia* and began their return to Earth. Entering the Earth's atmosphere at over 24,000 miles (38,000 kilometers) per hour was potentially dangerous. The crew experienced a fireball outside and high "g" forces after days in low or zero gravity. But everything went perfectly. With the world watching, at 12:50 p.m. Eastern Time, July 24, 1969, *Columbia* splashed down in the Pacific Ocean. After a decade of striving, America had realized centuries of dreams. The Moon landing was a triumph of modern technology and personal courage—the most dramatic demonstration of what humanity could achieve.

AFTER APOLLO 11

Armstrong, Collins, and Aldrin secured the Cold War victory President Kennedy had wanted and received a hero's welcome around the world. The Apollo program continued until late 1972. In five more Moon landings out of six attempts, astronauts gathered a trove of lunar samples and scientific data that transformed our understanding of solar system history.

The flight of Apollo 11 electrified the world. In the decades since, no human achievement in space has had such a profound impact.

Today, robotic spacecraft explore the Moon and planets in our solar system, and even more exciting space travel is planned. Humans successfully reached the Moon, but the journey continues.



Race to the Moon

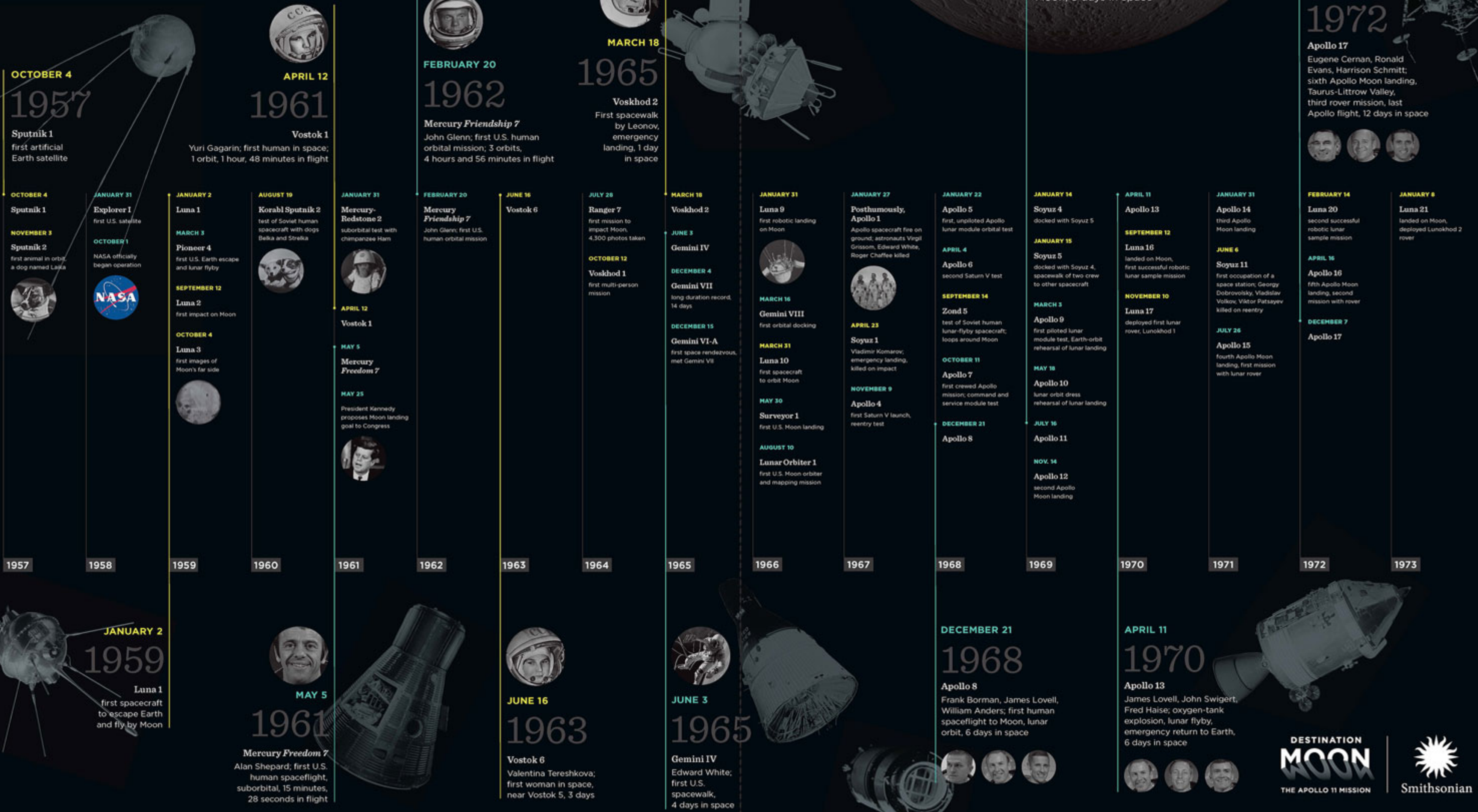
KEY MOMENTS IN HUMANITY'S JOURNEY TO REACH THE MOON

UNITED STATES

SOVIET UNION

Dates specified are launch dates. All images courtesy NASA unless otherwise indicated.

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OCTOBER 4

1957

Sputnik 1
first artificial Earth satellite

OCTOBER 4

Sputnik 1

NOVEMBER 3
first animal in orbit, a dog named Laika



JANUARY 31

Explorer I
first U.S. satellite

OCTOBER 1

NASA officially began operation



JANUARY 2

Luna 1

MARCH 3
first U.S. Earth escape and lunar flyby

SEPTEMBER 12

Luna 2
first impact on Moon

OCTOBER 4

Luna 3
first images of Moon's far side



1957

1958

1959

1960

1961

1962

1963

1964

1965

1966

1967

1968

1969

1970

1971

1972

1973

JANUARY 2

1959

Luna 1
first spacecraft to escape Earth and fly by Moon



MAY 5

1961

Mercury Freedom 7
Alan Shepard; first U.S. human spaceflight, suborbital, 15 minutes, 28 seconds in flight



FEBRUARY 20

1962

Mercury Friendship 7
John Glenn; first U.S. human orbital mission; 3 orbits, 4 hours and 56 minutes in flight

JANUARY 31

Mercury-Redstone 2
suborbital test with chimpanzee Ham



APRIL 12

Vostok 1

MAY 5

Mercury Freedom 7

MAY 25

President Kennedy proposes Moon landing goal to Congress



1961

FEBRUARY 20

Mercury Friendship 7

John Glenn; first U.S. human orbital mission



APRIL 12

Vostok 1

MAY 5

Mercury Freedom 7

MAY 25

President Kennedy proposes Moon landing goal to Congress



1962

JUNE 16

Vostok 6

first multi-person mission



OCTOBER 12

Vostok 1

first space rendezvous, met Gemini VII

DECEMBER 15

Gemini VI-A

first space rendezvous, met Gemini VII

AUGUST 10

Lunar Orbiter 1

first U.S. Moon orbiter and mapping mission

MAY 30

Surveyor 1

first U.S. Moon landing

MARCH 31

Luna 10

first spacecraft to orbit Moon

1964

JULY 28

Ranger 7

first mission to impact Moon, 4,300 photos taken



OCTOBER 12

Vostok 1

first multi-person mission

DECEMBER 15

Gemini VI-A

first space rendezvous, met Gemini VII

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Lunar Orbiter 1

first U.S. Moon orbiter and mapping mission

MAY 30

Surveyor 1

first U.S. Moon landing

MARCH 31

Luna 10

first spacecraft to orbit Moon

1964

MARCH 18

Voskhod 2

long duration record, 14 days



DECEMBER 4

Gemini VII

long duration record, 14 days

DECEMBER 15

Gemini VI-A

first space rendezvous, met Gemini VII

AUGUST 10

Lunar Orbiter 1

first U.S. Moon orbiter and mapping mission

MAY 30

Surveyor 1

first U.S. Moon landing

MARCH 31

Luna 10

first spacecraft to orbit Moon

1965

JANUARY 31

Luna 9

first robotic landing on Moon



MARCH 16

Gemini VIII

first orbital docking

MARCH 31

Luna 10

first spacecraft to orbit Moon

MAY 30

Surveyor 1

first U.S. Moon landing

AUGUST 10

Lunar Orbiter 1

first U.S. Moon orbiter and mapping mission

MARCH 31

Luna 10

first spacecraft to orbit Moon

1966

JANUARY 27

Posthumously, Apollo 1

Apollo spacecraft fire on ground, astronauts Virgil Grissom, Edward White, Roger Chaffee killed



APRIL 23

Soyuz 1

Vladimir Komarov; emergency landing, killed on impact

NOVEMBER 9

Apollo 4

first Saturn V launch, reentry test

DECEMBER 21

Apollo 8

first crewed Apollo mission; command and service module test

OCTOBER 11

Apollo 7

first crewed Apollo mission; command and service module test

SEPTEMBER 14

Zond 5

test of Soviet human lunar-flyby spacecraft; loops around Moon

APRIL 4

Apollo 6

second Saturn V test

JANUARY 14

Soyuz 4

docked with Soyuz 5

JANUARY 31

Apollo 14

third Apollo Moon landing

APRIL 11

Apollo 13

James Lovell, John Swigert, Fred Haise; oxygen-tank explosion, lunar flyby, emergency return to Earth, 6 days in space

DECEMBER 7

Apollo 17

Eugene Cernan, Ronald Evans, Harrison Schmitt; sixth Apollo Moon landing, Taurus-Littrow Valley, third rover mission, last Apollo flight, 12 days in space

JANUARY 6

Luna 21

landed on Moon, deployed Lunokhod 2 rover

JULY 16

1969



Apollo 11
Neil Armstrong, Michael Collins, Edwin Aldrin; first human landing on Moon, 8 days in space

DECEMBER 7

1972

Apollo 17
Eugene Cernan, Ronald Evans, Harrison Schmitt; sixth Apollo Moon landing, Taurus-Littrow Valley, third rover mission, last Apollo flight, 12 days in space



FEBRUARY 14

Luna 20

second successful robotic lunar sample mission



APRIL 15

Apollo 16

fifth Apollo Moon landing, second mission with rover

DECEMBER 7

Apollo 17

JULY 26

Apollo 15

fourth Apollo Moon landing, first mission with lunar rover

NOVEMBER 10

Luna 17

deployed first lunar rover, Lunokhod 1

SEPTEMBER 12

Luna 16

landed on Moon, first successful robotic lunar sample mission

JUNE 6

Soyuz 11

first occupation of a space station, Georgy Dobrovolsky, Vladislav Volkov, Viktor Patsayev killed on reentry

APRIL 11

Apollo 13

James Lovell, John Swigert, Fred Haise; oxygen-tank explosion, lunar flyby, emergency return to Earth, 6 days in space

JANUARY 31

Apollo 14

third Apollo Moon landing

JANUARY 2

Luna 1

first U.S. Earth escape and lunar flyby

MARCH 3

Pioneer 4

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OCTOBER 1

NASA officially began operation

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first animal in orbit, a dog named Laika

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