Special Issue

THE OBSERVER

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Artemis II Ready to Go to the Moon

The SLS rocket with the Orion spacecraft, in white at the top, being transported to launch pad 39-B at the Kennedy Space Center on January 17, 2026. If all goes well, it may be launched as early as February 8.

The Artemis II crew L-R-Commander Reid Wiseman, Pilot Victor Glover, Mission Specialist Christina Koch, Mission Specialist Jeremy Hansen(Canada)

There will certainly be no lack of pioneers when we have mastered the art of flight…Let us create vessels and sails adjusted to the heavenly ether and there will be plenty of people unafraid of the empty wastes…

Kepler, in a letter to Galileo, April 1610

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Central Valley Astronomers

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Number of exoplanets found as of January 2026

6,080*

How many more are out there?

Tens of thousands? Hundreds of thousands?

Maybe millions?

***From NASA's Exoplanet Exploration Site**

The Artemis II mission patch

The Artemis Program patch. The program motto "Et Luna Ad Martem" is Latin for "And the Moon to Mars"

The Artemis II Flight Path

The Artemis II mission will last 10 days. After launch, the spacecraft will go into Earth orbit, which, over the course of 2 days will extend further and further out from our planet. Then the Orion will fire its main engine to break free of Earth's gravity and head in a figure-8 circumlunar trajectory. On day 7, it will pass almost 7,000 miles beyond the Moon, the most distant any humans have ever gone beyond Earth. It will then loop around the Moon and head back to Earth. On day 10, it will reenter the Earth's atmosphere in a "skip-glide"reentry, and land in the Pacific Ocean near Hawaii.

Inside the Orion Spacecraft

During launch, the Orion spacecraft with its crew will be inside a protective aeroshell at the apex of the SLS, with an escape rocket to carry them away in the event of an emergency. The interior of the Orion can comfortably hold four people. They will actually be on two levels during launch and reentry; their seats will be folded away during most of the mission, allowing for more space. While in Earth orbit and on the way to and return from the moon, the crew will perform several science, engineering, and biomedical experiments, which will be of help to future moon-bound crews

The Road to Artemis II(The Short Version)

Over twenty years has passed since what is now known as the Artemius Program began, and it's been a long and complicated history. Here's a kind of abridged version of how it came to be what it is today.

In 2003, following the Columbia tragedy, President George W. Bush established a commission to make recommendations for the future of NASA's human spaceflight program. Although NASA's plans were for the Space Shuttle to fly until at least 2020, many in the agency and the aerospace community at large felt it was too uncertain and too full of flaws to continue for much longer. As it was, in 2004, the commission recommended the Shuttle program be ended no later than 2012, and a new human-rated spacecraft similar to the Apollo of the late 1960s and 70s be built to replace it. This led to the Constellation Program, which was officially established in 2005. It proposed the building of the new crewed capsule, to be known as Orion, but also an entire family of booster rockets, known as Aeres. The Aeres-Orion rockets would have several variations: the Aeres I would be used to fly astronauts to and from the International Space Station; the Aeres V, based on the Saturn 5, would be an uncrewed cargo heavy-lift booster as well as a rocket that would take the crewed Orion to the moon and eventually to Mars as well, both of which were part of NASA's long-term goals. The Constellation Program set a date for landing on the Moon no later than 2014.

This all sounded good on paper, but once the Constellation Program got going, it quickly became bogged down in both a lack of funding and NASA bureaucracy. The days of a lean, trim, "Can-Do" space agency were long gone, and by the early 2000s, mostly due to the Challenger and Columbia disasters, NASA had evolved into a huge bloated bureaucracy, with innumerable committees and review panels, all of which had to approve every detail of every program, especially those related to human spaceflight. So, from 2005 to 2009, the Constellation Program dragged on, with barely enough funding to survive, and being constantly modified by one committee after another. By 2009, when Bush Jr. left office and Barrak Obama entered it, the program had not gone much beyond the mockup stage.

When Obama took over the White House, he ordered a complete review of the Constellation Program. In 2010, based on recommendations from his space committee, he announced that the Constellation Program would be cancelled and a new program, called SLS, for Space Launch System, would take its place(This was not just a technical decision; according to Washington, D.C. insiders, politics was also involved. Obama, like most Democrats at the time, felt the Bush II Administration was illegitimate due to the Florida electoral vote controversy in 2000, and wanted to erase its programs and achievements from the history books). The SLS would replace the Aeres rockets; it would be a huge heavy-lift booster incorporating both Space Shuttle and Saturn V technology. At the same time, the Orion capsule would be downgraded from being able to carry seven people to four, and would be called the MPCV, for Multi-Purpose Crew Vehicle. The goal to land astronauts on the moon was reset at 2018. At the same time, NASA, belatedly realizing the Orion would never be finished by the now 2011 ending date for the Shuttle Program, instituted the Commercial Crew Spacecraft Program and invited a number of private aerospace companies to submit design proposals for crewed spacecraft to carry astronauts to and from the space station. This would lead to NASA relying on Russia's Soyuz spacecraft for over eight years until Space-X's Crew Dragon was developed and became operational in 2020.

As before, the SLS rocket and the Orion spacecraft became bogged down in NASA's bureaucracy and quickly fell behind schedule. Boeing was the prime contractor for the SLS and Lockheed for the Orion/

MPCV, but it was not until 2012 that work on both actually started. While Lockheed kept up with the Orion, Boeing's space systems dithered with the giant SLS booster, causing delays and huge cost overruns(This was due to NASA's "cost +" contract system; since so much of what NASA asked its builders to do was cutting edge technology and naturally expensive, any overruns were covered by the space agency. This also meant that the company had no incentive to hold down costs or stick to a schedule).

The SLS program originally planned to have the first launch of the SLS-Orion in 2016, but by then, it was at least three years behind schedule and several billion dollars over budget. Not only that, but due to Boeing's assembly and parts supply system, when it did finally fly, it could do so only once every two years. This caused the costs to rise even more and lead to more delays as well. At the same time, Lockheed was having problems with the Orion spacecraft; the electrical systems, the heat shield, and several other areas. Again, besides lack of funding, much of this was due to the bureaucracy insisting that everything be 100% safe and secure. That, of course, was almost impossible with a craft as complex as the Orion. As one engineer said about the space shuttle, "we could make it 99.99% safe and there'd still be 6,000 things that could go wrong."(another NASA veteran commented that if NASA's current crewed spacecraft safety standards were applied to the Apollo missions, none would have ever gotten off the ground).

In the late 20-teens and into 2020, even more problems arose, not just with costs, but quality control as well. Boeing was severely criticized in several Inspector General's reports for shoddy and substandard work. It's now known that the SLS program and Boeing in general suffered from chronic mismanagement, which would plague the company for many years(and cause major problems with its Starliner commercial crew spacecraft as well). In addition, an IG report in 2022 estimated that each SLS launch would cost $4-5 billion, a price that was considered "unsustainable." By the time Artemis II is launched, the SLS program will have cost NASA almost $18 billion, over twice its original $8 billion estimate.

Finally, in December 2022, Artemis I, an uncrewed ten day circumlunar mission, was launched from launch pad 39-B at the Kennedy Space Center(LC-39-A was, and still is, being used by Space-X for its uncrewed and crewed Falcon-Dragon launches), almost six years past schedule. After the IG's scathing report on mismanagement and quality control, Boeing did get its act together, and the SLS performed well. Overall, the mission was considered a success, but when the engineers inspected the Orion spacecraft, the heat shield was found to be more damaged than expected. Although it was within safety parameters, concern arose over it, and NASA undertook a complete review of the shield qualities which delayed the Artemis II mission, which was scheduled for mid-2024, by almost two years. Finally, in September 2024, NASA concluded that the heat shield was viable, but several engineers and management people claimed it was unsafe and threatened to go to Congress and the news media, claiming the space agency was putting publicity and saving money over safety. They demanded that the heat shield be completely redesigned and retested in another uncrewed mission, which would have delayed the program at least two more years, and cost at least $2-3 billion more dollars. It was, however, during the 2024 presidential election and their allegations were lost in the political din.

In January 2023, NASA announced that eighteen members of its astronaut corps had been chosen for the initial Artemis missions, and on April 3, 2023, announced the crew of Artemis II, the first crewed mission. They were Reid Wiseman, Victor Glover, Christina Koch, and Canadian Jeremy Hansen. They immediately began training for a mid-late 2024 mission. That, of course, did not happen, but finally, in the summer of 2025, NASA announced that the SLS and Orion were ready for their first crewed flight and it would take place as early as February 2026, almost eight years behind schedule.

And this is where we are now.

The Deep Space Network-How NASA Stays in touch with Moon-bound Spacecraft

People have often asked: how does NASA stay in touch with all its satellites outside Earth orbit? The answer is the Deep Space Network, a series of radio antennas in California, Australia, and Spain, that allows the space agency to maintain contact with its Mars rovers and orbiters, its lunar missions, and even the Voyager spacecraft, which are now well beyond the solar system.

The Deep Space Network began in 1958, when the U.S. Army contracted the Jet Propulsion Laboratory in Pasadena to set up a series of radio communications stations in Nigeria, Singapore, and California to keep track of the newly launched Explorer satellites. In late1958, with the establishment of NASA, the space agency took over all the military's space systems facilities and equipment, and by 1960, decided to incorporate them all into a single unified network, based at JPL, to monitor and track all deep space vehicles. NASA was already thinking ahead, not only to the then on-paper-only Apollo Moon Program, but also planetary missions to Venus, Mercury, and Mars, and eventually, the outer planets. It started building a permanent facility at JPL, as well as locating and establishing sites at three major areas around the Earth to provide continuous 24-hour coverage of all deep space activities. By 1964, it had settled on and was building facilities near Canberra, Australia, and Madrid, Spain, as well as Goldstone, California, about 40 miles north of Barstow in the Mojave Desert. Each site was built with a 70 meter primary radio antenna, as well as smaller antennas and research, data transmission and retrieval, and office facilities. The entire complex was finished in time for the Apollo moon landing program and has been used since then for all deep space missions. Above right-the DSN at Canberra, Australia; below left– the DSN near Madrid, Spain

Today, NASA still runs the DSN in partnership with the host nations; in Australia, the land and facilities are owned by the Australian government and managed by the Australian Astronomy and Space Science Division, and most of the employees are Australian, while NASA owns the actual antenna equipment and has the final decision over how it is used. The same with Spain; the land and facilities are owned by the National Aerospace Institute, a part of the Spanish Defense Department, and most of the engineers, technicians, and scientists at the site are Spanish. In addition, NASA has linked-in agreements with networks other countries, including the Russian Deep Space Network, The Japanese Deep Space Network, and the Chinese Deep Space Network. It also has agreements with several radio telescope facilities in the U.S. and overseas, to use their equipment if and when necessary.

In recent years, NASA has been updating all three facilities, due to aging, and also in preparation for the return to the Moon and advanced deep space missions. The 70 meter antennas have been modernized and smaller 34 meter antennas have been built and tied in to supplement their capabilities. So, when the astronauts land on the moon by the end of this decade, they'll not only have the best equipment from Earth, but also the best communication from Earth as well.

Right -the DSN facility at Goldstone, California

Space Age Archeology

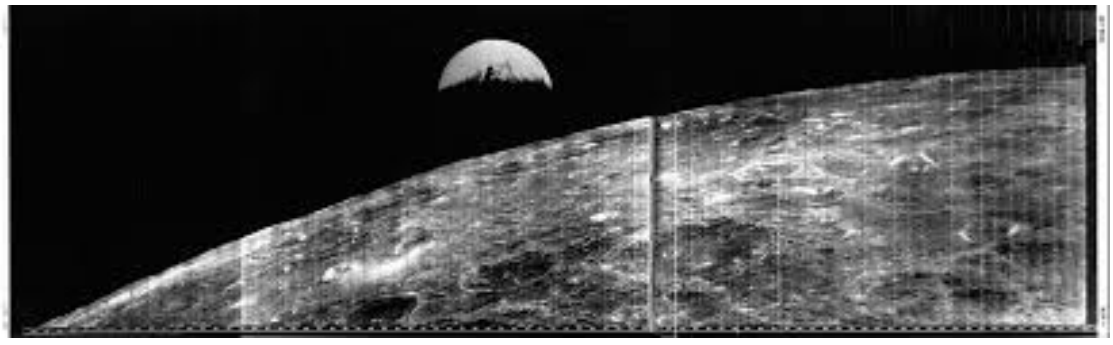
Lunar Orbiter

With the impending launch of Artemis II, it's important to remember its pathfinders, not just the Apollo missions of the 1960s and early 70s, but also the uncrewed spacecraft which paved the way for Apollo by gathering data and imagery that made the original Moon landings possible. Among the most important of these is the Lunar Orbiter spacecraft, of which there were five. They are all but forgotten today, but their successes made it possible for America to go to the moon.

The Lunar Orbiter program was a joint venture by Boeing and Eastman Kodak and was announced by NASA in late 1963. One of NASA's main concerns was to have highly detailed maps of the lunar surface to determine landing sites for the Apollo crews(at one point, NASA considered using a modified version of the Air Force's classified KH-7 spy satellite, but the feeling was that the highly detailed imagery would give away too many of the KH's secrets. In the end, Eastman Kodak assured NASA that it could design cameras that would suit its imagery needs). While Kodak worked on the imaging cameras, Boeing designed and built the spacecraft's platform and main bus. The bus, holding the cameras and other scientific equipment, was 5.5 feet tall and 4.9 feet at the base. With four foldable solar cell panels added, the width of the spacecraft was 12.2 feet. The spacecraft weighed 850 Earth pounds at launch. The launch vehicle for all five spacecraft was the Atlas-Agena-D rocket.

The first Lunar Orbiter was launched on August 10, 1966. Its primary goal was to image potential Apollo Landing sites, which it did from August 18 to 29. It crashed onto the moon on October 29, 1996. Lunar Orbiter 2 was launched on November 6, 1966, and operated until November 25, 1966. It, too, crashed on the moon on October 11, 1967. The third Lunar Orbiter was launched on February 5, 1967, operated until February 23, 1967, and crashed on the moon on October 9, 1967. The first three Lunar Orbiters were specifically designed to scout for potential Apollo landing sites. Lunar Orbiters 4 and 5 performed high resolution lunar mapping programs, imaging 99% of the Moon's surface, including the mysterious far side, which had never been mapped before. Lunar Orbiter 4 was launched on May 4, 1967, and operated until May 26, 1967. Lunar Orbiter 5 was launched on August 1, 1967, and operated until August 16 of that year.

When the last Lunar Orbiter ended its program and crashed into the moon, NASA employees hung up a banner in the main control room which read "Five for Five," a testament to the success of the program. Although it is barely remembered today, it was a key element in the ultimate success of the Apollo program.



Right-the first ever Image of the Earth And the Moon, taken by Lunar Orbiter I in August 1966

Artemis Terminology

Amidst all the publicity about the Artemis II mission, different stories and articles are throwing around all kinds of words and phrases describing the mission, some of which seem to contradict each other. Here is a short lexicon to clarify what everything means.

1. Artemis-This is the official name of NASA's crewed Moon exploration and landing program. The name was established by then-NASA chief administrator Jim Bridenstein in 2019. It refers to Artemis, who in Greek mythology was the goddess of the moon(she was also a master archer and the stag was her symbol) and the twin sister of Apollo. According to NASA, ten Artemis missions are planned; Artemis I was an uncrewed circumlunar flight in 2022, Artemis II will take place as early as February, and Artemis III will be a lunar landing mission near the Moon's south pole as early as September 2027. Artemises IV through X will also be crewed lunar landing missions lasting through 2033, all in the area of the moon's south pole, preparatory to a permanent lunar base nearby

2. Orion-This is the official name of the capsule that will carry Artemis crews to and from the moon. It is a cone-shaped design, based on the Apollo capsule of the 1960s and 70s, but half again as large, and was nicknamed "Apollo on steroids." The capsule itself was designed by NASA and built by Lockheed; the service module, with its solar panels extended out, was designed and built by the European Space Agency. It was originally designed to carry up to seven crewmembers, but when the Obama Administration revamped the Moon landing program in 2010, its crew capacity was cut back to four. At the same time, it was also given the term the MPCV, for Multi-purpose Crew Vehicle, to emphasize that its planned uses will not just be to go to the moon, but also eventual trips to Mars, and possibly to commercial space stations in low Earth orbit. NASA plans to use it as its primary deep space crewed vehicle into the 2040s and even 2050s(if this sounds like it'll be obsolete by then, remember that Russia has been using the Soyuz crewed spacecraft since 1967, almost 60 years now-and it was first designed in 1963. For that matter, Orion was originally designed in 2004, so it's actually over twenty years old).

3. The SLS-this is the Space Launch System, abbreviated SLS, the heavy lift booster that will take Orion-Artemis crews to the moon and back. It is loosely based on the Saturn 5 rocket of the 1960s and 70s but is much larger and has half again more thrust, almost 10 million pounds, compared to the Saturn's 7.5 million pounds. The SLS replaced the proposed Ares 5 heavy lift rocket in 2010, when the Obama Administration revamped the entire moon landing program, citing excessive costs. Ironically, the SLS is far over budget and several years behind schedule; an Inspector General's report a few years ago concluded that each SLS launch will cost $4-5 billion, a figure it called "unsustainable." NASA is now looking at abandoning the SLS, possibly as soon as Artemis V, and using much less expensive commercial heavy lift rockets such as Space-X's Starship or Blue Origin's New Glenn.

Right-The SLS(in the middle) compared the Space Shuttle, Space-X's Falcon Heavy, the Saturn V, and Space-X's Starship