National Aeronautics and Space Administration

Commercial Lunar Payload Services

IM-2 (Intuitive Machines-2) Lunar Mission

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QUICK FACTS

Through NASA's Commercial Lunar Payload Services (CLPS) initiative, NASA is working with American companies to deliver science and technology, enabling industry growth and supporting long-term lunar exploration.

The CLPS model offers a unique opportunity to test and refine technologies and integrate systems that will provide insight for future crewed missions to Moon as part of NASA's Artemis campaign.

NASA currently has a pool of 13 eligible American providers on contract under CLPS, including a portfolio of 11 lunar deliveries by five vendors sending more than 50 individual science and technology instruments to lunar orbit and the surface of the Moon.

Intuitive Machines' IM-2 mission, carrying NASA science and technology will land on Mons Mouton, a lunar plateau within 6 degrees of the South Pole of the Moon, closer to the pole than any previous lunar mission.

CLPS landing sites are located on the near side, far side, and South Pole regions of the Moon where high-value, high-priority investigations and exploration are informed by each area's unique characteristics.

MISSION OVERVIEW

About Intuitive Machines' IM-2 Mission

Intuitive Machines is one of 13 American companies eligible to bid on contracts to deliver valuable science instruments and technology demonstrations to the Moon through NASA's Commercial Lunar Payloads Services (CLPS) initiative. Since the CLPS initiative's debut in 2018, Intuitive Machines has been awarded four contracts to deliver over 20 NASA payloads to the Moon over the next few years.

Intuitive Machines' second lunar mission, IM-2, is scheduled to launch no earlier than Feb. 26, 2025, and land approximately eight days later. Intuitive Machines' Nova-C lander, named Athena, will deliver three NASA payloads to the lunar South Pole region - the Polar Resources Ice Mining Experiment-1 (PRIME-1) suite and the Lunar Retroreflector Array (LRA). The lander will also carry two commercial technology demonstrations funded through NASA's Space Technology Mission Directorate Tipping Point initiative. Furthermore, IM-2 will share its ride to space with NASA's Lunar Trailblazer, a SmallSat which will deploy during transit and orbit the Moon.

Intuitive Machines' inaugural mission, IM-1, launched and landed in February 2024, carrying six NASA instruments to Malapert A, a lunar feature in the Moon's South Pole region. The lander operated on the lunar surface for approximately seven Earth days becoming the first CLPS flight to land on the

Artistic rendering of Intuitive Machines' Nova-C lander with a depiction of NASA's Polar Resources Ice-Mining Experiment-1 attached to the spacecraft on the surface of the Moon.
Credit: Intuitive Machines

CLPS: IM-2 Mission

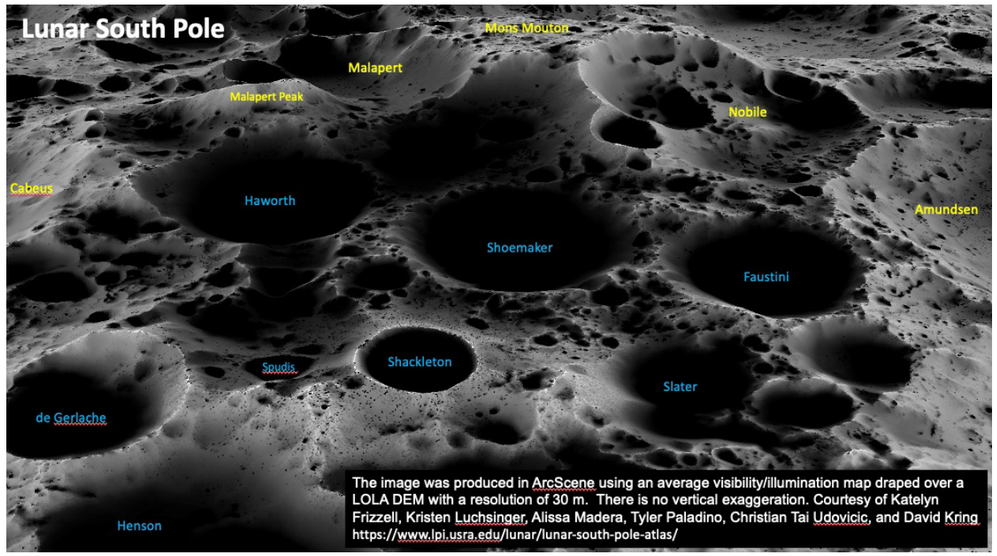
Moon and the United States' first return to the Moon since Apollo 17 in 1972.

IM-2 Landing Site

Intuitive Machines' Nova-C lander will land at Mons Mouton, a lunar plateau near the Moon's South Pole. The wide, relatively flat-topped mountain, about the size of the state of Delaware, was created over billions of years by lunar impacts, which sculpted it out of its surroundings. As a result, Mons Mouton stands as tall as Mount McKinley – the tallest mountain in North America – approximately 20,000 feet higher than its neighboring features on the Moon's South Pole. Because it is relatively untouched by bombardments, scientists believe Mons Mouton is much more ancient – possibly billions of years older than its surroundings. A ring of huge craters - evidence of its pulverizing past - lie around its base; some with cliff-like edges, descending into areas of permanent darkness. Its rolling hilltop is peppered with smaller rocks and pebbles as well as lots of enticing craters that are frequently blanketed in freezing, shifting shadows.

About NASA'S CLPS Initiative

Through the **Commercial Lunar Payload Services** (CLPS) initiative, NASA is purchasing lunar delivery services from American companies to carry science investigations and technology demonstrations to the Moon. The CLPS initiative aims to conduct science on the Moon for the benefit of all, improving our understanding of the lunar environment and surface characteristics, in advance of future crewed missions to the Moon as part of the agency's broader **Artemis** campaign.

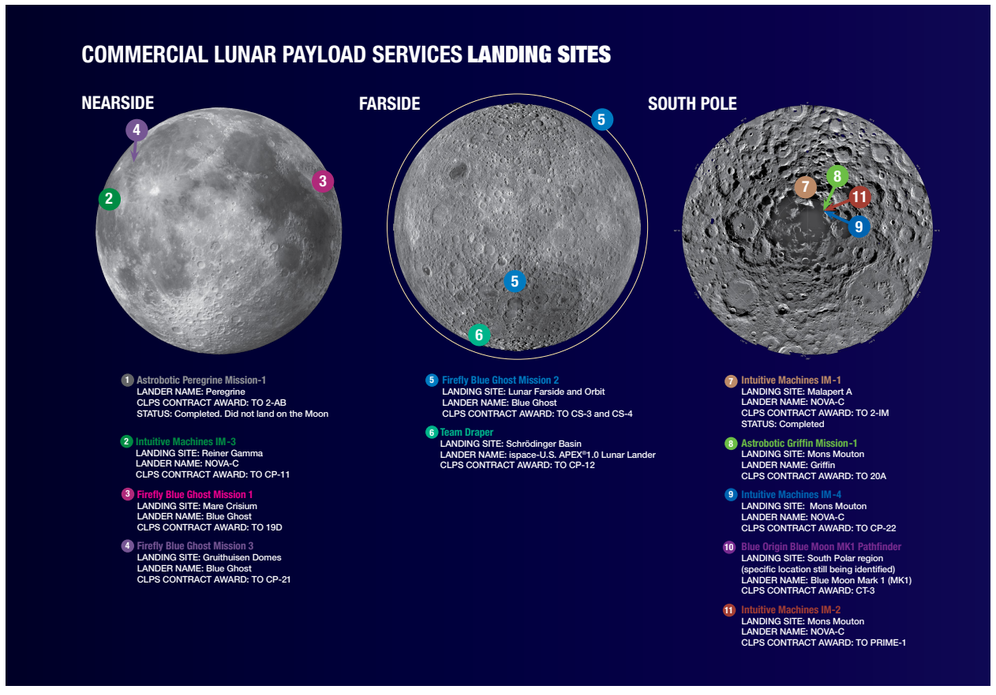


The Mons Mouton region is seen at the top of this image of the Moon's South Pole.
Credit: Lunar and Planetary Institute

Under this innovative model, NASA is one of many customers, along with commercial companies, universities, and international organizations, all sending payloads to the Moon. Through CLPS, NASA is embracing a higher risk tolerance by leveraging commercial solutions to send rapid, low-cost deliveries to the Moon, fostering a growing lunar economy and enabling a long-term presence on the lunar surface.

CLPS contracts are indefinite delivery, indefinite quantity contracts with a combined maximum contract value of $2.6 billion through November 2028. Individual CLPS contract awards cover end-to-end commercial payload delivery services, including payload integration, mission operations, launch from Earth, and landing on the surface of the Moon. Some CLPS payloads are also selected through the call for Payloads and Research Investigations on the Surface of the Moon (PRISM) proposals. The decision to fly non-NASA payloads is at the discretion of each CLPS vendor.

To date, there have been three CLPS launches: one collected data in transit but an anomaly prevented it from reaching the Moon, one landed and operated on the lunar surface, and one is currently enroute and scheduled to land in early March 2025. Additional CLPS deliveries are planned through 2028 at a cadence of around two per year.



This graphic illustrates the planned landing sites for Commercial Lunar Payload Services (CLPS) deliveries on the near side, far side, and South Pole of the Moon, taken from Lunar Reconnaissance Orbiter Camera (LROC) wide-angle camera base maps. *Credit: NASA/GSFC/Arizona State University*

CLPS: IM-2 Mission

Current Timeline of all CLPS Deliveries

2024

- **Astrobotic's Peregrine Mission One** – Following a successful launch, the spacecraft experienced an anomaly preventing it from landing on the Moon.
- **Intuitive Machines' IM-1 Mission** – Completed, delivered six NASA payloads to **Malapert A** in the South Pole region of the Moon.

2025

- **Firefly's Blue Ghost Mission 1** will deliver 10 payloads to Mare Crisium, a basin on the Moon's near side.
- **Intuitive Machines' IM-2 mission** will deliver the **PRIME-1** (Polar Resources Ice Mining Experiment-1) instrument suite and a Laser Retroreflector Array (LRA) to Mons Mouton near the Moon's South Pole.
- Blue Origin's Blue Moon Mark 1 lander will deliver **one** payload to the Moon's South Pole.
- Astrobotic's Griffin Mission One will deliver its lunar lander to the Moon's South Pole region.

2026

- **Intuitive Machines' IM-3 mission** will deliver four payloads to Reiner Gamma on the western edge of the Moon's near side.
- **Firefly's Blue Ghost Mission 2** will deliver two NASA payloads to the far side of the Moon and deliver a communications and data relay satellite into lunar orbit, which is a European Space Agency collaboration with NASA. As part of this mission, Firefly will also provide a radio frequency calibration service to a radio transmitter payload from lunar orbit.
- **Draper's first mission** will carry six NASA payloads to the lunar South Pole.

2027

- **Intuitive Machines' IM-4 mission** will carry six NASA payloads to Mons Mouton near the Moon's South Pole.

2028

- **Firefly's Blue Ghost Mission 3** will deliver six NASA payloads to Gruithuisen Domes on the near side of the Moon.

WHAT'S ON BOARD

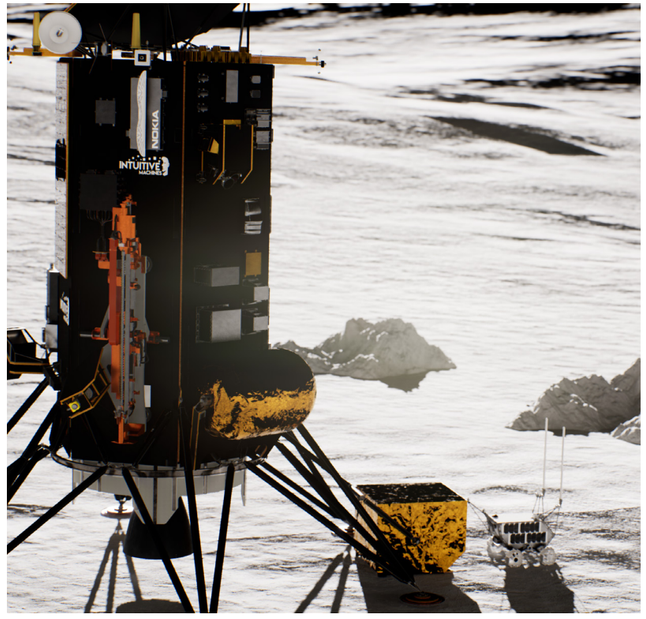
NASA Payloads on Board

Among the payloads on the Nova-C lander, the IM-2 mission will deliver one of the first in-situ (i.e., on-site), demonstrations of resource utilization on the Moon, using a drill and a mass spectrometer to measure the volatiles (gases that easily evaporate) content of subsurface materials. In addition, a passive Laser Retroreflector Array mounted on the top deck of the lander will reflect or bounce any laser light striking it back to the source (i.e., an orbiting or incoming spacecraft) to precisely determine the location of the lander, as a fiducial marker, and the distance to that point on the lunar surface with respect to the orbiter. Other technology instruments on this delivery will demonstrate a robust surface communications system and deploy a propulsive drone that can hop across the lunar surface into permanently shadowed regions.

Launching as a rideshare alongside the IM-2 delivery NASA's Lunar Trailblazer spacecraft also will begin its journey to lunar orbit, where it will map the distribution of the different forms of water on the Moon.

Polar Resources Ice Mining Experiment (PRIME-1)

NASA's Polar Resources Ice Mining Experiment, known as PRIME-1, is a suite of two instruments, the TRIDENT drill (The Regolith Ice Drill for Exploring New Terrain) and MSOLO (Mass Spectrometer Observing Lunar Operations), which will work together to extricate lunar soil samples, known as regolith, from the subsurface and analyze their composition to further understand the lunar environment and gain insight on potential resources that can be extracted for future examination.



Artistic rendering of Intuitive Machines' Nova-C lander with a depiction of NASA's Polar Resources Ice-Mining Experiment-1 suite and Laser Retroreflector Array (LRA) attached to the spacecraft on the surface of the Moon. *Credit: Intuitive Machines*

CLPS: IM-2 Mission

The Regolith Ice Drill for Exploring New Terrain (TRIDENT)

The meter-long TRIDENT drill is designed to extract lunar soil, or regolith, up to about three feet below the surface, measuring soil temperature at varying depths below the surface, which will help to verify existing lunar thermal models that are used for ice stability calculations and resource mapping. By drilling into the lunar regolith, information is gathered to help answer questions about the lunar regolith geotechnical properties, such as soil strength, both at the surface and in the subsurface that will help inform Artemis infrastructure objectives. This data is extremely beneficial for designing future in-situ resource utilization systems that will use local resources to create everything from landing pads to rocket fuel.

Lead Development Organization: Honeybee Robotics, a Blue Origin Company.

MSOLO (Mass Spectrometer Observing Lunar Operations)

MSOLO is a mass spectrometer capable of identifying and quantifying volatiles (or gasses that easily evaporate) found at or beneath the lunar surface, including potentialwater and oxygen, brought to the surface by the TRIDENT drill. This instrument can also detect any gases that emanate from the lander, drilling process, and other payloads conducting operations on the surface. Using MSOLO to study the volatile gases found on the Moon can help us understand how the lander's presence might alter the local environment. This is important because changes to the lunar environment could impact future scientific measurements – especially those that rely on precise direction or sensitive measurements. By characterizing these changes, scientists can better predict how long the lander's influence might affect measurements and be able to adjust future approaches to exploration.

Lead Development Organization: INFICON of Syracuse, New York, in partnership with NASA's Kennedy Space Center in Florida.

Laser Retroreflector Array (LRA)

NASA's Laser Retroreflector Array (LRA) is a collection of eight retroreflectors that enable precision laser ranging, which is a measurement of the distance between the orbiting or landing spacecraft to the reflector on the lander. LRA is a passive optical instrument, which means it does not power on, and will function as a permanent location marker on the Moon for decades to come.

Lead Development Organization: NASA Goddard Space Flight Center

LRA will be mounted on Intuitive Machine's Nova-C lander deck and help provide precision measurements of distances between orbiting or landing spacecraft. *Credit: NASA*

Tipping Point Demonstrations

Two technology demonstrations aboard IM-2 were developed through NASA's Tipping Point opportunity. Tipping Points are collaborations between the agency's Space Technology Mission Directorate and industry that foster the development of commercial space capabilities and benefit future NASA missions.

- Intuitive Machines: One of the Tipping Point technologies on IM-2 is a small hopping robot developed by Intuitive Machines. The deployable hopper, named after computer scientist and mathematician Grace Hopper, will deploy as a secondary payload from the lander and enable high-resolution imaging and science surveying of the lunar surface. The hopper is designed to bypass obstacles such as steep inclines, boulders, craters and to cover a lot of terrain while moving quickly, which is a valuable capability to support future missions on the Moon and other planets, including Mars.
- Nokia: The second Tipping Point technology will test a Lunar Surface Communications System developed by Nokia. This system employs the same cellular technology used by billions of devices on Earth, reconceptualized by Nokia Bell Labs to meet the unique requirements of a lunar mission. This tipping point technology will demonstrate proximity communications between the lander, a Lunar Outpost rover, and the hopper.

Non-NASA Commercial Payloads

Nova-C will also carry additional payloads from other non-NASA customers, including scientific instruments and technologies from different companies, dozens of science teams, and individuals around the world.

CLPS: IM-2 Mission

MAJOR MISSION MILESTONES AND TIMELINE

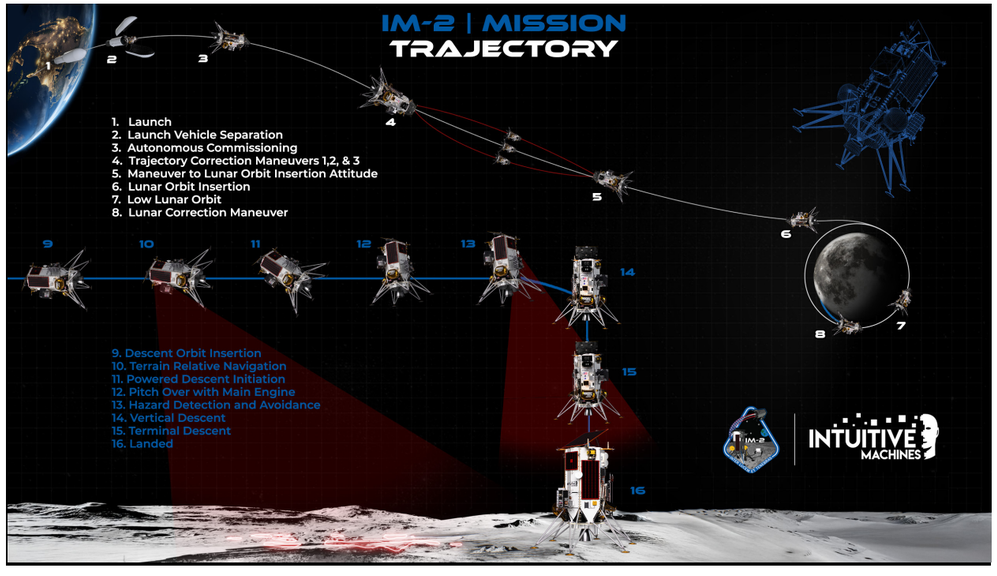
Launch Information

Intuitive Machines' IM-2 mission will launch on a SpaceX Falcon 9 rocket from Launch Complex 39A at NASA's Kennedy Space Center in Florida. The four-day launch window opens no earlier than Wednesday, Feb. 26, 2025. Intuitive Machines conducts all mission operations from its Nova Control Mission Operations Center, headquartered in Houston, Texas.

- Launch Site: **Cape Canaveral, Florida**
- Launch Date: **NET Feb. 26, 2025**
- Flight Duration: **Approximately 8 days**
- Surface Operations: **Approximately 10 days**
- Landing Site: **Mons Mouton near the lunar South Pole**
- Lander Name: **NOVA-C**
- Launch Vehicle: **SpaceX Falcon 9**

Nova-C Trajectory

After launch, the Nova-C lander will separate from the rocket and begin, depending on the launch day, a roughly 5 to 4 day cruise to the Moon's orbit. The lander will orbit the Moon for approximately 3 to 1.5 days, before beginning its powered descent to its landing site at Mons Mouton near the South Pole of the Moon.



This illustration depicts Nova-C's trajectory from launch to decent to the lunar surface.
Credit: Intuitive Machines

NOVA-C Descent Profile and Timeline

Intuitive Machines will use the propulsion capabilities of the lander to insert Nova-C into lunar orbit before final descent and landing. The navigation system that combines laser range finder data and optical cameras for visual cues and will be used to ensure Nova-C lands safely and accurately at the planned landing site.

Completed and Upcoming CLPS Milestones

2018

- November: **First nine CLPS vendors announced**

2019
First CLPS Contracts Awarded

- February: **NASA announces first payloads for early CLPS flights**
- May: **NASA selects Astrobotic, Orbit Beyond, and Intuitive Machines to deliver payloads to Moon**
- July: **NASA announces 12 new lunar investigations for CLPS flights**
- November: **NASA awards five more CLPS contracts**

2020

- October: **NASA selects Intuitive Machines to deliver PRIME-1**

2021

- November: **NASA awards Intuitive Machines to deliver four payloads**

2023

- May: **Intuitive Machines lunar landing site moves to south pole**

2024
First CLPS flights launched to the Moon

- January: **Astrobotic's Peregrine Mission One launched** Jan. 8, 2024
- February: **Intuitive Machines' IM-1 Mission launched** Feb. 15, 2024
- February: **IM-1 lander lands on the Moon's South Pole region** Feb. 22, 2024
- August: **NASA awards Intuitive Machines lunar south pole research delivery**
- December: **More NASA science, tech will fly to Moon aboard future Firefly flight**

2025

- January: Firefly's Blue Ghost Mission One launched Jan. 15, 2025
- Intuitive Machines' IM-2 Mission targeting launch on Feb. 26, 2025
- Intuitive Machines' IM-3 Mission targeting launch in 2025
- Astrobotic's Griffin Mission One targeting launch in 2025
- Blue Origin's Blue Moon Mark 1 targeting launch in 2025

CLPS: IM-2 Mission

WHAT'S COMING UP

Intuitive Machines third mission, IM-3, with a mission window that extends into early 2026, will deliver four NASA payloads to Reiner Gamma, located on the Moon's near side. Reiner Gamma is a feature commonly referred to as a lunar swirl. Lunar swirls are associated with magnetic anomalies in the lunar crust, but more data is needed to characterize them and understand their formation. This NASA delivery aims to study the properties of Reiner Gamma's swirl and its mini magnetosphere. This contract also includes a technology demonstration of swarm robotics technology with the deployment of four small autonomous rovers. Two international payloads will also fly on IM-3 including a radiation detector, developed by Korea Astronomy and Space Science Institute (KASI) and an actuated retroreflector provided by ESA (European Space Agency) that will enable high-resolution Earth-Moon distance measurements.

Intuitive Machines' fourth mission, IM-4, is scheduled for 2027 to land at the lunar South Pole, carrying six NASA payloads aimed at investigating the effects of radiation on biological processes, understanding the thermal properties and mineral composition of lunar rocks and dust, and studying engine plume-surface interactions, and identify volatiles, such as water and oxygen on the lunar surface.

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