

INTUITIVE MACHINES: ENABLING COMMERCIAL INTERNATIONAL LUNAR SCIENTIFIC EXPLORATION. D. B. J Bussey¹, M. S. Robinson¹, T. D. Martin¹ & the IM Team, ¹Intuitive Machines, 13467 Columbia Shuttle St., Houston, TX 77059, USA, bbussey@intuitivemachines.com.

Introduction: Intuitive Machines (IM) is a lunar services company providing access to lunar orbit and the surface for science and exploration. Our lunar access capabilities consist of several components.

1. Fixed lunar surface services
2. Lunar rover services,
3. Lunar hopper services,
4. Satellite delivery services.
5. Lunar communication & PNT services

Fixed Lunar Surface Services: IM is a participant in the NASA Commercial Lunar Payload Services (CLPS) initiative. As of January 2025, NASA has awarded ten CLPS contracts to deliver payloads to the lunar surface. IM has won four of those contracts. All four deliveries use the IM-designed Nova-C lander. Nova-C uses one VR-900 bipropellant engine to deliver over 130 kg of payload anywhere on the Moon. It can land on slopes up to 10° and uses a hazard detection and avoidance system to ensure a safe landing. Multiple payload mounting points are available on the Nova-C, which provides power and communications to the payloads for the mission duration. IM can also deliver up to 2500 kg of payload to the lunar surface with the Nova-D lander.



Figure 1: The finished IM-1 Nova C, called Odysseus, just prior to shipping to KSC for launch.

IM-1: The IM-1 mission (February 2024) successfully landed near Malapert-A crater ([80.13°S, 1.44°E](#)) in the lunar south polar region. The Odysseus Nova-C spacecraft landed in an off nominal surface orientation due to a cabling issue with the laser altimeter. However, the vehicle operated for over six Earth days, returning more than 500 Megabytes of engineering and image data, demonstrating the robust system design. The vehicle carried NASA CLPS payloads as well as several commercial payloads.



Figure 2: Odysseus during lunar orbit insertion.



Figure 3. Odysseus on the lunar surface.

Lunar Mobility Services: IM has formed a strategic partnership with multiple rover providers (Lunar Outpost and Space Applications Services) to offer rover mobility solutions to customers. These companies have a portfolio of rovers with different capabilities depending on payload needs.

Lunar Hopper Services: The IM-developed hopper mobility platform, called μ Nova [1,2], enables regional exploration deploying from a Nova-C or Nova-D. The μ Nova enables access to terrain not accessible to a rover, such as lunar pits, or quick access to the floor of large impact craters, including permanently shadowed regions. The μ Nova is a fully independent spacecraft with propulsion, power, and communication systems. It can carry 8 kg of payload a distance of several kilometres. Flight profiles are tailored to mission needs, including parabolas and flying a constant altitude traverse.



Figure 2: IM hopper. Approximately 70 cm tall, and capable of flying 8 kg of payload several kilometres.

Satellite Delivery Services: In parallel to conducting a lunar surface delivery, IM can deliver satellites into various lunar orbits. These range from deploying up to 1000 kg into a 185 km x 380 000 km translunar injection orbit to deploying a 375 kg satellite into a 100 km circular lunar orbit.

Additional Services: In addition to the four core services described above, IM offers ancillary capabilities to enhance data return from the Moon. A

key one is our communications infrastructure. IM has developed the first private, secure, interoperable lunar distance communication network. We have agreements with ground stations located worldwide, which, combined with our communication relay spacecraft, provide a complete lunar communications and navigation solution. The first communication relay spacecraft, LDNS-1, will be delivered into lunar orbit in late 2025.

Upcoming Lunar Missions IM-2 is scheduled to launch in late February 2025. The Nova-C lander, called Athena, will deliver the NASA PRIME-1 instrument that consists of the same Trident drill and M-SOLO mass spectrometer that are manifested to fly on NASA's VIPER rover. IM-2 also carries the IM μ Nova hopper, two rovers and other payloads, including a Nokia LTE communication demonstration.

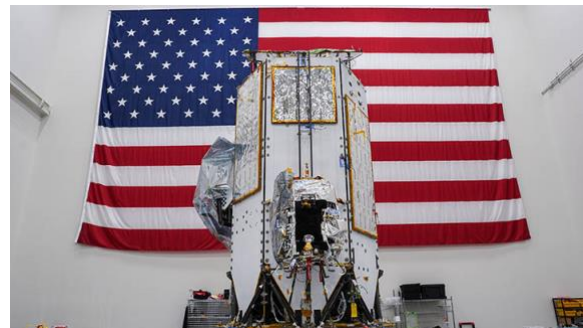


Figure 4: The IM-2 lander, "Athena". Note the attached μ Nova hopper

IM-3, scheduled for flight in late 2025, will land on the Reiner Gamma formation, and will carry the CLPS payload Lunar Vertex as well as instruments from Korea, and the European Space Agency. IM-4, scheduled for launch in late 2027, will carry an ESA payload to the lunar south polar region.

We aim to fly at least one lunar lander mission every year. This regular lunar access cadence provides the lunar science community the maximum flexibility when planning lunar exploration.

References:

- [1] Atwell M. et al. (2022) *LEAG* Abs #5037. [2] Martin T. et al. (2025) *LPSC LVI*