

## **The First Commercial Lunar Services Program and Jeff Koons**

### ***Jeff Koons' Moon Phases***

*The first NFT (non-fungible token) project by Jeff Koons is titled, 'Jeff Koons: Moon Phases'. The project comprises 125 Moon Phase artworks, each consisting of three components: a stainless steel sculpture that will remain on the Earth, a miniature Moon sculpture that will be installed and displayed on the Moon in perpetuity, and 125 NFTs that will contain the images of the Moon Phases artwork on the Moon and Earth. The exhibition box containing the 125 miniature sculptures were launched from Florida on Thursday, February 15, 2024. [1]*

### ***Commercial Lunar Payload Services Program (CLPS)***

Commercial Lunar Payload Services (CLPS) is a NASA program to hire companies to send small robotic landers and rovers to the Moon's south-polar region, mostly with the goals of scouting for lunar resources, testing in situ resource utilization (ISRU) concepts, and performing lunar science to support the Artemis lunar program. CLPS is intended to buy end-to-end payload services between Earth and the lunar surface using fixed-price contracts.

The program was extended to add support for large payloads starting after 2025.

The eligible companies bid on delivering payloads for NASA. This includes everything from payload integration and operations, to launching and landing on the surface of the Moon.

CLPS contracts are indefinite delivery, indefinite quantity contracts with a cumulative maximum contract value of \$2.6 billion through 2028.

The list of eligible contractors is as of February 2024: [Astrobotic Technology](#), [Deep Space Systems](#); [Draper Laboratory](#), [Firefly Aerospace](#), [Intuitive Machines](#), [Lockheed Martin Space](#), [Masten Space](#), [Moon Express Systems](#), [OrbitBeyond](#), [Blue Origin](#), [Ceres Robotics](#), [Sierra Nevada Corporation](#), [SpaceX](#), [Tyvak Nano-Satellite Systems](#). [2]

### ***The Intuitive Machines IM-1 Mission***

The first commercial lunar payload services mission (CLPS) is the IM-1 mission, designed and executed by Intuitive Machines company (Houston), launched on a Space-X Falcon 9 from Launch Complex 39A at NASA's Kennedy Space Center in Florida at 1:05 a.m. EST, Thursday, February 15, 2024.

The IM-1 lander carries the following six NASA experiments and five commercial experiments to the Moon's surface.

### ***NASA Experiments [3]***

#### **• Lunar Node 1 Navigation Demonstrator (LN-1)**

A small, CubeSat-sized flight hardware experiment that integrates navigation and communication functionality for autonomous navigation to support future surface and orbital operations. Principal investigator: Dr. Evan Anzalone, NASA's Marshall Space Flight Center.

#### **• Laser Retroreflector Array (LRA)**

A collection of eight retroreflectors that enable precision laser ranging, which is a measurement of the distance between an orbiting or landing spacecraft to the reflector on the lander. LRA is a passive optical instrument and will function as a permanent location marker on the Moon for decades to come. Principal investigator: Dr. Xiaoli Sun, NASA's Goddard Space Flight Center.

#### **• Navigation Doppler Lidar for Precise Velocity and Range Sensing (NDL)**

A Lidar-based (Light Detection and Ranging) descent and landing sensor. This instrument operates on the same principles of radar but uses pulses from a laser emitted through three optical telescopes. NDL will measure vehicle velocity (speed and direction) and altitude (distance to surface) with high precision during descent to touchdown. Principal investigator: Dr. Farzin Amzajerdian, NASA's Langley Research Center.

#### **• Radio Frequency Mass Gauge (RFMG)**

A rocket propellant gauge used to measure the amount of spacecraft propellant in a low-gravity space environment. Using sensor technology, RFMG will measure the amount, or mass, of cryogenic

propellants in IM-1's tanks, providing data that can help predict propellant usage on future missions. Principal investigator: Dr. Greg Zimmerli, NASA's Glenn Research Center.

- **Radio-wave Observations at the Lunar Surface of the Photoelectron Sheath (ROLSSES)**

Four antennas and a low-frequency radio receiver system designed to study the dynamic radio energy environment near the lunar surface and determine how natural and human-generated activity near the surface interacts with science investigations. It will also detect radio emissions from the Sun, Jupiter, and Earth, as well as dust impacting the surface of the Moon. Principal investigator: Dr. Nat Gopalswamy, NASA Goddard.

- **Stereo Cameras for Lunar Plume-Surface Studies (SCALPSS)**

A suite of four cameras to capture stereo and still images of the dust plume created by the lander's engine as it begins its descent to the lunar surface until after the engine shuts off. Principal investigator: Michelle Munk, NASA Langley

### ***Commercial Payloads [1]***

#### **Columbia Sportswear**

In partnership with Intuitive Machines, Columbia is testing the limits of its innovations by sending Omni-Heat Infinity to the Moon. Originally inspired by space blankets on Apollo missions, the same OmniHeat Infinity technology found in jackets on Earth will help protect the IM-1 lunar lander from the extreme temperatures of outer space

#### **Embry-Riddle Eagle Cam**

Eaglecam is designed to deploy off of IM-1 approximately 100ft (30m) above the lunar surface and capture images as the spacecraft touches down on the Moon

#### **Jeff Koons: Moon Phases**

This is Koons's most ambitious work to date and brings together leaders in the scientific and creative fields. Koons's project was initiated by Patrick Colangelo of NFMoon and Chantelle Baier of 4Space, and is presented by Pace Verso. Intuitive Machines carries Koons's sculptures to the Moon as part of the historic IM-1 mission, marking the first authorized artworks to be placed on the surface of the Moon

#### **International Lunar Observatory Association: ILO-X Camera**

This mission will be the first Hawai'i-based organization's cameras on the Moon. Hawai'i is a place that honors science, discovery and mindful exploration. The ILO-X narrow-field camera was given the name Ka 'Imi (The Search) after a Hawai'i student naming contest.

#### **Galactic Legacy Labs: Lunaprise**

**Mission Objective:** To establish a secure lunar repository called the Lunaprise in support of Arch Missions Foundation's billion-year archive, preserving human knowledge for eternity. These messages are called Lunagrams and can be submitted online as text, an image, or both. Music and video files are also accepted. An archive from the nonprofit Arch Mission Foundation, including the English Wikipedia, The Rosetta Project, Long Now Foundation content, Project Gutenberg content, and other cultural archive datasets are also included in this payload

#### **Lonestar Data Holdings Inc.**

Lonestar's mission is working to send increasingly capable data centers to the Moon to meet the needs of its customers for secure premium data storage and edge processing. Lonestar's *Independence* payload represents a key technology demonstration of the company's Disaster Recovery as a Service (DRaaS) utilizing the unique operational properties offered from the Moon. Lonestar is storing digital data on board the IM-1 lander for its customers and transmitting the first documents off Earth for data storage to the Moon while in turn transmitting the first documents back from the Moon. Think of the ultimate in digital refresh and restore on a planetary scale from its most secure backup location. This first small step is in preparation for Lonestar's larger data center payload, *Freedom*, scheduled to fly with Intuitive Machines on their second scheduled lunar mission.



Jeff Koons: Moon Phases

*Rendering of Moon Phase example 'Leonardo da Vinci' Earth component of the NFT. Mock-ups of exhibition box mounted on IM-1 (see image below) and the 125 Moon Phases images © Jeff Koons*



*IM-1 lander with Jeff Koons 125 miniature Moon Phases exhibition box. "Global aspiration beyond Earth into the universe" (Jeff Koons)[4]*

#### References

- [1] Press kit <https://www.intuitivemachines.com/im-1?lightbox=dataItem-ls22wsqs2>
- [2] Wikipedia CLPS [https://en.wikipedia.org/wiki/Commercial\\_Lunar\\_Payload\\_Services](https://en.wikipedia.org/wiki/Commercial_Lunar_Payload_Services)
- [3] NASA CLPS: <https://www.nasa.gov/commercial-lunar-payload-services/>
- [4] <https://www.pacegallery.com/journal/jeff-koons-moon-phases/>

February 2024, Joachim J. Kehr, Editor Journal of Space Operations & Communicator (<https://opsjournal.org>)