

Lunar Exploration (3)
Lunar Missions planned (2A)

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LUNAR SCIENCE ENABLED BY A CISLUNAR OUTPOST ARCHITECTURE

Abstract

With the long term goal of human space exploration to land humans on the surface of Mars, precursor missions are needed that operate for long durations, far from Earth. This will allow astronauts to learn how to work in deep space for months at a time and address many of the risks associated with a Mars mission. A facility placed in an orbit in the vicinity of the Moon is an ideal place to gain experience operating in deep space. This facility can also be an international collaboration, with partnering nations contributing elements and major subsystems, based on their expertise. In addition to meeting human spaceflight objectives, the cislunar outpost missions can help meet exploration science objectives. Astronauts could operate a robotic rover, in near real-time, to collect geological samples from lunar farside and return them to the outpost using an ascent vehicle. Returning samples from the South Pole–Aitken Basin (SPA) on the far side of the Moon has been identified as a priority in planetary science Decadal Surveys because it would help scientists understand the early dynamics and impact history of the solar system. By using Orion as the reentry system, the robotic lander and ascent stage do not need to carry additional mass for a reentry system, increasing the amount of material that can be returned from the surface. Similar science operation concepts are also being developed for Mars missions, including Lockheed Martin’s Mars Base Camp crewed Mars orbital mission concept. A key part of Mars Base Camp concept is the demonstration in lunar orbit of the science operations. Particularly for early missions, the cislunar habitat will spend a portion of the year uncrewed. Lockheed Martin is investigating the types of systems required, including possibly robotics, to allow science to continue. As an example, the platform would provide a unique opportunity for long duration exposure to deep space radiation experiments. Human spaceflight missions could provide an opportunity for science payloads to be transported to the Moon at lower cost than a dedicated launch. The European Service Module of Orion includes a location for unpressurized cargo, including a connection to power and data systems. Orion can also fly and return internal payloads inside the pressurized volume of the Crew Module. There may also be an opportunity to deploy independent spacecraft from Orion.