

**The Lunar Mobility Vehicle as a Key Enabler in the Cislunar Economy.** R. M. Rickards, Lockheed Martin Space, 12257 S Wadsworth Blvd, Littleton, CO 80127. (Contact: Ross.M.Rickards@lmco.com)



*Figure 1: The Lunar Mobility Vehicle*

**Introduction:** On Earth, explorers of ages past could not conquer the vast expanse of the world's oceans without investment and development in vessels to ferry them over great distances. Similarly, the settlement of the western United States and the ensuing gold rush was first enabled by primitive roads and covered wagons and then the vast network of railways strewn across the country. Innovation, speed, and mobility are hallmarks of any successful exploration campaign. This is especially true where goods and services ultimately flow back to the source of investment. The Moon is no different requiring early investment in transportation to enable all things yet to come both on the lunar surface and in cislunar space. Lockheed Martin in partnership with General Motors is investing in mobility solutions capable of meeting the need for comprehensive exploration of the lunar surface and transportation of everything from surface samples to habitation modules.

**Capabilities:** The Lunar Mobility Vehicle (LMV) is the most capable rover designed to-date for use on another planetary body. Capable of speeds up to 20 kph and travelling for periods in excess of 8 hours on a single charge, this vehicle will go further and faster than any of its predecessors. The vehicle supports telerobotic and autonomous driving, allowing it to traverse the lunar surface safely and efficiently without on-board crew.

LMV can carry two human passengers in xEMU suits as well as their tools and instruments, or it can carry a comparable amount of scientific payloads for resource characterization and cataloging. LMV will survive the lunar night while providing power and data services to enable payloads to do the same. LMV has a robotic arm capable of collecting samples or adding and re-moving payloads from the payload bed. With LMV's understanding of its precise location and its suite of on-board cameras, a robust set of mapping data with layers of information will be captured and telemetered back to

Earth for commercial use. This can be done direct-to-Earth or via the Parsec communications relay.

Additionally, the chassis and core functionality are scalable and extensible allowing LMV to support a wide array of future mission needs such as surface preparation, transportation or assembly of key infrastructure projects, or providing mobility to habitation modules. Some of the mission kits envisioned include a blade attached to the front of the vehicle for grading the lunar surface and a printing head attached to the robotic arm to bind lunar regolith for roads or landing pads. Lastly, the team has been developing universal interfaces to connect with other external systems on the lunar surface and developing frequency and bandwidth allocations for cislunar communications traffic in collaboration with Parsec.

**Progress to-date:** The LMV Team has begun development with the intention of arriving on the lunar surface in time to support Artemis III and other scientific and commercial missions. One of the great enablers of progress has been the collaboration between several partners that are industry leaders in their respective areas of expertise. Goodyear, for example, is responsible for developing the vehicle's tires, and has made great strides in developing a modern design and material suitable for our targeted environment and operational life. MDA is developing the robotic manipulator and is taking advantage of their space heritage to inform the development of an arm with the right reach, packaging, and capabilities to support the mission use cases. General Motors, leveraging deep automotive and electric vehicle experience is responsible for core mobility functionality, key aspects of the electrical system, and autonomous driving. Lockheed Martin, the overall system integrator, brings to bear cutting edge human and robotic space capabilities from Orion and multiple successful deep space planetary missions.

Lockheed Martin is committed to building the infrastructure required to realize a cis-lunar economy that will relieve burdens on Earth, inspire future generations, and enable the human leap to a multi-planetary species. The LMV coupled with Lockheed Martin's Parsec lunar communication and navigation services enable customer opportunities never before realizable.