



*Figure 1: The Lunar Mobility Vehicle in various configurations*

**Introduction:** In a lunar exploration campaign characterized by uncertainty and new challenges, mobility—and the speed, durability, and flexibility it provides—is a critical enabler for missions and success in multiple domains. Mobility is instrumental to the success of a lunar campaign and to the identification, acquisition, distribution, and use of lunar resources. Great strides in technology have been made in the decades since the last human-landing on the Moon. By leveraging these advances for expanded mobility options, the potential value of exploration missions grows substantially. Previously untenable mission concepts, coupled with a more robust lunar economy, could become reality in the nearer term. The Lunar Mobility Vehicle (LMV) (Figure 1), developed by Lockheed Martin in partnership with General Motors, MDA, and others enables this future.

**Capabilities:** The LMV is the most capable rover designed to-date for use on another planetary body. To go further and faster than its predecessors, the rover is capable of teleoperated speeds of up to 8 kph and traveling distances over 1000 km per standard lunar day. The vehicle supports both crewed and teleoperated driving modes, allowing it to traverse the lunar surface safely and efficiently without on-board personnel. Further, it can spend multiple consecutive Earth days in a Permanently Shadowed Region (PSR) for advanced mission operations.

The LMV can carry two fully suited passengers with tools and instruments or comparable payload mass over long surface traverses. The rover can accommodate scientific and industry-driven payloads for resource characterization in multiple large, standardized payload slots for various missions scenarios. The rover has a robotic arm with a reach of 2.5m and peak load of 70kg, which can collect samples and transfer modular payloads between lunar surface systems. The LMV will survive the 355-hour lunar night while still

providing power and data services to payloads to enable their survival & longevity.

Onboard, the native sensor suite of HD & 4K cameras, radar, LiDAR, and a neutron spectrometer enables the LMV to capture a robust set of mapping data that can be remotely shared for government, international, and commercial use and scientific discovery. Additionally, the chassis and core functionality are scalable and extensible, allowing the LMV to support a wide array of enhanced mission needs, including surface preparation, transportation, and assembly of key infrastructure elements. Further capabilities in development include universal interfaces to connect with external systems for towing, data, and power transfer, as well as bandwidth allocations for cislunar communications handled by Lockheed Martin's Parsec constellation.

**Enabled Operations:** The LMV enables commercial applications and pushes the boundaries of possibility both for comprehensive lunar exploration and for the discovery, extraction, transportation, and use of lunar resources. One key aspect of this is enabling missions to go farther and last longer within PSRs while still operating on-board research and science payloads. Extended operation time and greater payload capacities enable the LMV to carry and deploy the heavier equipment needed to develop key infrastructure for some of the lunar economy's highest-impact domains, including and especially resource utilization.

In addition to the LMV's roles as a science platform and hardware testbed, several other mission operations capitalize on this enhanced mobility capability. Options leverage the large carrying capacity to haul raw or processed resources, crew- and robotically collected samples, high-fidelity geological instrumentation, and other payloads in support of space resource science and industry. Other concepts include attaching earthmoving implements like a plow to the front of the vehicle for lunar surface preparation, grading, building roads, or additive manufacturing and construction using an attachable printing head for regolith binding.

Lockheed Martin's innovative LMV design enables cislunar exploration and economic development, increasing the potential capabilities for lunar resource research and utilization. The LMV's high performance in travel distance, speed, mission duration, night survival, and payload capacity help make possible a range of new lunar exploration activities and missions.