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LUNAR SURFACE MOBILITY: ROBOTIC AND CREWED SYSTEM CONCEPTS

Abstract

Lockheed Martin has a longstanding history of designing, building, and operating spacecraft for deep space applications. This includes 15 successful interplanetary missions, ranging from the first successful Mars lander mission, Viking I, in 1976 to the most recent Mars lander, InSight. Lockheed Martin is also the prime contractor for Orion, providing NASA with the capability for deep space human exploration. The Lockheed Martin McCandless Lunar Lander, a Commercial Lunar Payload Services (CLPS) Lunar transportation service, is ready to deliver Lunar science and commercial payloads to the Moon. Under contract to NASA, Lockheed Martin is developing concepts for the Gateway, the Gateway Habitat design, and technologies for the Human Landing System (HLS). Lockheed Martin has independently studied aerospace architectures for Moon and Mars exploration, such as Mars Base Camp, a single stage Lunar lander, and early Lunar exploration campaigns. NASA is planning to land the first woman and the next man on the Moon by 2024 in order to enable human expansion across the solar system and bring back to Earth new knowledge and opportunities. The exploration and scientific discovery of the Moon can be enhanced using technology that aids capabilities of astronauts on the Lunar surface. In addition to the key objective of Lunar science, these supporting systems will demonstrate technology and operations that feed forward to the human exploration of Mars. Mobility systems are essential to the exploration of both the Moon and Mars and can transport scientific instruments, humans, or cargo extended distances, supporting both scientific discovery and exploration objectives. NASA has expressed interest in working with international partners, and surface infrastructure or mobility solutions are a good candidate for this collaboration. Lockheed Martin has conducted trade studies to determine the balance between robotic and human-driven Lunar mobility options, the benefits of each, the correlation between number of mobile systems and increased science return, requirements that drive the level of autonomy, and how mobility options may be operated to achieve the highest science return for the Artemis program objectives. The trades also examine the balance of purely robotic rovers, unpressurized rovers, pressurized rovers, and stationary habitats. Concepts have been developed for pressurized and unpressurized Lunar rovers based on the results of these trades. This paper will discuss the results of these trades and review the rover concepts developed.