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MARTIAN MOON HUMAN EXPLORATION ARCHITECTURE

Abstract

Orion, the Multi-Purpose Crew Vehicle, is a key piece of the NASA human exploration architecture for beyond earth orbit (BEO). Lockheed Martin was awarded the contracts for the design, development, test, and production for Orion up through the Exploration Mission 2 (EM-2). Lockheed Martin is also working on defining the cis-lunar Proving Ground mission architecture, in partnership with NASA. In addition, Lockheed Martin is exploring the definition of Mars missions as the horizon goal to provide input to the plans for human exploration of the solar system. This paper describes an architecture to determine the feasibility of a Mars Base Camp architecture within about a decade. This architecture would involve human exploration of both Martian moons, and provide an opportunity for the crew to interact with pre-staged robotic assets on Mars. This study is a high-level assessment to identify architecture drivers and science opportunities. There are some key tenets for this architecture. For this first human interplanetary mission, system redundancy and a self-rescue capability is required. The number of system developments is minimized, and the use of the already developed systems like the Space Launch System and Orion is maximized. To minimize the number of events that could lead to the loss of the whole crew, the architecture does not require rendezvous and docking of pre-staged elements necessary for crew survival during the mission. This paper will describe the different enabling technologies required. The trajectory assumptions will be described, including the results of studies performed for the transit to Mars and return to Earth, in addition to mission design trades for the exploration of the Martian system. The transfer vehicle module design concept will be detailed. Possible science activities will be described. Study results for propulsion technology, assembly methods, and the mission campaign will also be addressed. The results of this architecture study will show that a near term Mars mission is compelling and feasible, and will highlight the required key systems.