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MARS BASE CAMP UPDATES AND NEW CONCEPTS

Abstract

Orion, the Multi-Purpose Crew Vehicle, is a key piece of the NASA human exploration architecture for beyond earth orbit. Lockheed Martin was awarded the contract for the design, development, test, and production for Orion up through Exploration Mission 2 (EM-2). Lockheed Martin is also working on defining the cislunar 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. In 2016, Lockheed Martin presented a proposal for achieving crewed exploration of Martian space as early as the 2028 launch opportunity. Known as Mars Base Camp, this proposal involved establishing a crewed vehicle in Martian orbit from which astronauts could perform excursions to Deimos and Phobos, and could also perform telerobotic exploration of the Martian surface, including sample return. This concept presented a novel, practical, and affordable path to enable human exploration of the Martian system in the next decade. This paper will detail additional development for the Mars Base Camp concept, including the production of propellant from water, additional details for the cislunar proving ground missions, and a Mars lander concept. The orbiting base camp could generate oxygen and hydrogen from water via solar-powered electrolysis. Water may be provided directly from the Earth system or via in-situ resource production in the lunar, Martian, or other systems. The primary and secondary objectives of the cislunar proving ground missions will be discussed, including element demonstrations, scientific mission possibilities, and one year shakedown cruise options. The lander is envisioned as a fully reusable, lifting body that uses supersonic retropropulsion to descend and land on the surface. Initial crewed missions using the lander, which would follow on later missions than the initial mission, are outlined as relatively short-duration, science-focused exploration missions. Multiple areas of the Martian surface would be explored with the objective to gather scientific data from a wide variety of sites of interest, and more fully characterize possible sites for future permanent settlements. Once a surface mission is completed, the lander returns to Mars Base Camp as a single stage to orbit launch vehicle to be refueled. With these additional developments, the Mars Base Camp concept can be seen as a core system that pivots humanity into a viable, sustainable long-term Mars exploration program.