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Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's (8-A5.4)

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THE JOURNEY TO MARS: NASA'S EXPLORATION PLANNING AND THE IMPORTANCE OF THE SPACE LAUNCH SYSTEM

Abstract

NASA's exploration planning is guided by the goal of human missions to the surface of Mars. Our goal, working together with our international partners, is to enable sustainable human exploration of Mars, leading to new knowledge, driving innovation and extending human presence in the solar system for the benefit of all mankind. As articulated by President Obama "our goal is the capacity for people to work and learn, and operate, and live safely beyond Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite." NASA's investments in human space exploration focus on the foundational capabilities and technologies which start down the path of pioneering space and enabling exciting missions as part of a step-wise path to Mars. The first steps have already been taken through science and technology research aboard the International Space Station and through robotic orbiters, landers, and rovers currently exploring Mars. We are taking the next steps with the development of the Space Launch System, the Orion crew capsule, and advanced solar electric propulsion systems. These capabilities open the door to missions beyond low Earth orbit for the first time since Apollo. The next step is into cis-lunar space, which is a proving ground for the capabilities, technologies and techniques which will enable sustainable human missions beyond the Earth-Moon system. Going beyond the Earth-Moon system will require reliability, robustness and recycling approaches which are Earth independent – we can't rely on a supply chain from Earth, challenges must be overcome by the crew with resources at hand. The next foundational capability is a deep space habitat, built together with international partners and deployed in a stable orbit around the Moon. The habitat enables a series of missions to incrementally advance capabilities and demonstrate Earth independence. Another exciting mission in cis-lunar space is the Asteroid Redirect Mission. This mission demonstrates how human exploration capabilities can be used to advance a range of exploration objectives. A key element of making such a long term endeavor sustainable is the availability of heavy lift launcher capability, embodied in the evolvable design of the Space Launch System. The Space Launch System plays a critical role in realizing the vision of pioneering space, from the first steps into cis-lunar space to the eventual landing of humans on Mars. This paper will describe NASA's exploration planning and the central role and criticality of the Space Launch System. The journey to Mars is a driving focus of human space exploration planning. The journey is a multi-decade endeavor that requires capabilities such as the SLS, creating the possibility to apply these capabilities to global challenges facing humankind today or that may arise in the future.