

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Space Transportation Solutions for Deep Space Missions (8-A5.4)

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## NEAR-TERM SLS-ORION MISSIONS LEADING TO HUMANS ON MARS

**Abstract**

The exploration goal of the international space community has long been a human mission to Mars. NASA has been chartered by Congress to support this goal by developing deep space missions that eventually lead to placing humans on Mars. To achieve this goal, NASA is developing the Orion crew capsule and Space Launch System (SLS) as key elements in the eventual architecture for sending humans to Mars. This aggressive goal is complicated by the constraint of NASA having to work within the limited, flat budget profile allocated by Congress for human exploration activities. Defining and prioritizing the technology and hardware needed is important to achieving the goal of landing humans on Mars. We have chosen to prioritize hardware development into three phases: Earth Gravity Well, In-Space Elements, and Mars Gravity Well. Orion and SLS are already in development to provide transportation from Earth to space and back. The next elements that need to be developed are deep space transit habitats and solar electric propulsion (SEP) tugs, which enable astronauts to live for long periods in space and move between the Earth-Moon system and Mars. Eventually Mars landers and ascent vehicles will need to be developed in the 2020's. Therefore we will need to concentrate on near term missions that develop and mature concepts for habitats and in-space propulsion that will enable the eventual Mars mission. This paper will discuss near term missions that leverage the Orion and SLS already in development and also mature habitat and SEP concepts. A unique feature that has been developed to enable exciting near term missions is to co-manifest payloads in conjunction with the Orion spacecraft on SLS launches. Doing so provides new flexibility in achieving human exploration, operations, and science objectives on any given mission. Utilizing this co-manifest capability, a number of potential near term missions have been identified that will mature the near term elements needed for eventual Mars mission, develop mission operations techniques necessary for the long term Mars mission, refine life support systems, and conduct interesting science. Taking advantage of this important new SLS co-manifesting capability, this paper will discuss key aspects of the missions that could be conducted over the next decade to place humans on the path to Mars.