SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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SOLAR ELECTRIC CARGO TRANSPORTATION FOR HUMAN EXPLORATION BEYOND LOW EARTH ORBIT

Abstract

As the international partnership of nations contemplates what next to do in space after the completion of the International Space Station, one fact is clear: exploration of deep space will require an efficient system for transporting material to any destination. Current plans call for expanding human presence into cis-lunar space and evolving capabilities required for longer and longer crew stays. Beyond that, human exploration may pursue lunar landings or explore asteroids. Eventually, by the mid-2030's humans will travel to Mars. Under any scenario, large amounts of consumables, equipment, and even the habitats themselves will need to be transported from Earth orbit to the increasingly more distant destinations. The current paradigm of launching large chemical stages to perform the in-space transportation is flawed because it results in most of the mass launched being propellant. Solar-electric propulsion (SEP) modules can cut the mass of propellant required by more than half, providing a tremendous savings in launch costs and overall affordability of the human exploration campaign. This paper will describe a Solar Electric Propulsion Module (SEPM) design that can fulfill the requirements of human exploration beyond LEO and is also capable of performing a variety of other missions for a wide set of customers. The modular design and broad mission applicability will make the SEPM more affordable for all potential users. Aerojet Rocketdyne is applying its experience in flying Electric Propulsion (EP) and integrating large space power systems (such as the ISS) to the design of the SEPM. The goal is to produce a fundamental building block that can be used to fulfill a growing set of missions throughout cis-lunar space and on to Mars, enabling higher production rates and lower costs. High level requirements and design challenges of the modular approach will be described, as well as some of the salient features of the proposed SEPM. Mission analysis results for some notional missions will be provided to illustrate the broad range of application for this versatile in-space transportation system.