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SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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HIGH POWER SOLAR ELECTRIC PROPULSION SPACECRAFT FOR SPACE EXPLORATION

Abstract

Lockheed Martin has developed conceptual designs for a SEP spacecraft, building on the heritage of flight proven hardware. The AEHF program experience is used for the operational expertise of the first-ever orbit SEP GTO to GEO transfer. The Commercial modernized A2100 spacecraft line is used for the solar arrays and some spacecraft hardware elements. Our planetary spacecraft heritage is used for the unique elements which enable operations at a large range of solar and earth distances, in particular for the fault protection and telecommunications subsystems.

The SEP system required for the ARRM, or for significant cargo capacity, will use higher power in the thruster system than required for GEO communication satellites. Proven spacecraft structural design techniques are scaled up to accommodate a propellant load of ten metric tons of Xenon, and provision is made for larger Xenon loads with only minor additional structural modification. The Multi-Mission Modular Solar Arrays (MMSA), which is based on ISS heritage, has been refined under internal development for the LM commercial spacecraft programs. The MMSA generates high power at low mass, enabling efficient transfer of large masses through the solar system.

The Asteroid Redirect Mission is the first application of LM's 50kw SEP spacecraft, and design can accommodate either a full asteroid capture (so-called option A) or the retrieval of a boulder from a 500m class asteroid (option B). Planetary spacecraft features demonstrated on Mars, Jupiter, and Small Bodies Discovery missions enable the bus design to be flexible to late mission design choices. Design choices have been made which allows the spacecraft to be flexible in its application, so that it can be used for missions such as cargo delivery to a lunar distant retrograde orbit. Additionally, features have been included which allow scaling up power or propellant load so that the design can be applied to future Mars cargo delivery needs.

The LM high power SEP spacecraft design is an enabling element for both NASA's Proving Ground missions and the Evolvable Mars Campaign. The design can enable large cargo mass transfer on either the SLS or EELV vehicles. A yearly launch manifest is developed which shows its use is a series of potential NASA Asteroid and cargo missions. The LM High Power Solar Electric Propulsion spacecraft is an enabling element of NASA's future Human Exploration Architecture.