IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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ELECTRIC PROPULSION MISSIONS TO URANUS, NEPTUNE AND BEYOND

Abstract

We explore the capability of a VASIMR® solar slingshot concept to send a 4000+ kg spacecraft to Uranus, Neptune and beyond. The VASIMR® performs a slingshot pass close to the Sun and uses the high level of available solar energy to produce a sustained burst of high thrust. Enough kinetic energy is provided to the probe to reach Jupiter orbit while still within 0.7-1. AU. This study identifies the important parameters in the propulsion system operation (power level, propellant mass, payload release point, distance of closest approach to the Sun), and scan these parameters to understand and optimize the capabilities of the proposed system. The VASIMR® engine's power rating must match the peak power available when the spacecraft is closest to the Sun. The solar array is assumed to be a planar array rather than a concentrator since it will have to operate near the Sun, where a concentrator would overheat photovoltaic cells. The feasibility of using the VASIMR® to provide thrust along the transfer orbit until the transfer orbit reaches $\geq$ 5 AU will also be examined. Spacecraft speed in excess of 60 kps is achieved within Earth's orbit. In order to stop at Saturn, the VASIMR® must retrofire from 1 AU to 5 AU. So far, the best-case Saturn model assumes 30 mT in LEO, and a 5 kps Earth departure velocity from the chemical launch system. The simulation arrives at 1.1x10^6 km from Saturn with a velocity of 3.3 kps. Using chemical SOI, the simulated system delivers an 8.5 mT payload in 4.44 years transit time. We will also discuss Uranus, Neptune and thousand AU simulation results.