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IMPROVED PERFORMANCE ESTIMATES FOR THE SOLAR WIND ION FOCUSING THRUSTER

Abstract

At the 65th International Astronautical Congress (IAC) we introduced the Solar Wind Ion Focusing Thruster or SWIFT concept for in-space propulsion. The main component of a SWIFT would be a net of wires arranged as a cone with its large open end facing the sun. The wires are highly positively charged by connection to an electron gun and their electric field acts to focus solar wind ions into the base of the cone. This higher density plasma is collected by the main part of the spacecraft to which the SWIFT cone is attached and can be efficiently manipulated into a particle beam. This beam can then be accelerated to velocities much higher than the solar wind drift velocity, resulting in a net thrust for the spacecraft that can be directed anywhere. The SWIFT system combines several of the benefits of passive propellantless concepts (e.g. solar and electric sails) with those of solar electric propulsion systems.

In papers presented at the 67th IAC, we examined the performance of a SWIFT with reference to other propulsion systems using generalized models. In this work, we compare the SWIFT to new classes of high performance electric thrusters currently under development, specifically the NASA Evolutionary Xenon Thruster (NEXT) and the NASA Annular Engine. Both of these concepts have been under development for several years as the newest high-power, high-performance electric propulsion systems. The missions used for comparing these systems are taken from the proposed missions for the NASA New Frontiers program, including a comet sample return, rendezvous with multiple Trojan asteroids, and delivery of a Venus probe.

For this evaluation, the systems are compared on the basis of available power. To cover the range of power systems that may be available from the very near term to within the next decades, power systems from 100 kW to 100 MW are considered and the performance of the SWIFT is compared to the other systems parametrically. This allows us to give a good overview of how valuable the SWIFT would be to develop further as a serious consideration for these types of missions.