Next-Generation Ion Propulsion Being Developed

Left: Deep Space 1 thruster. Right: 40-cm engine.

The NASA Glenn Research Center ion-propulsion program addresses the need for high-specific-impulse systems and technology across a broad range of mission applications and power levels. One activity is the development of the next-generation ion-propulsion system as a follow-on to the successful Deep Space 1 system. The system is envisioned to incorporate a lightweight ion engine that can operate over 1 to 10 kW, with a 550-kg propellant throughput capacity. The engine concept under development has a 40-cm beam diameter, twice the effective area of the Deep Space 1 engine. It incorporates mechanical features and operating conditions to maximize the design heritage established by the Deep Space 1 engine, while incorporating new technology where warranted to extend the power and throughput capability. Prototype versions of the engine have been fabricated and are under test at NASA, with an engineering model version in manufacturing. Preliminary performance data for the prototype engine have been documented over 1.1- to 7.3-kW input power. At 7.3 kW, the engine efficiency is 0.68, at 3615-sec specific impulse. Critical component temperatures, including those of the discharge cathode assembly and magnets, have been documented and are within established limits, with significant margins relative to the Deep Space 1 engine.

The 1- to 10-kW ion thruster approach described here was found to provide the needed power and performance improvement to enable important NASA missions. The Integrated In-Space Transportation Planning (IISTP) studies compared many potential technologies for various NASA, Government, and commercial missions. These studies indicated that a high-power ion propulsion system is the most important technology for development because of its outstanding performance versus perceived development and recurring costs for interplanetary solar electric propulsion missions. One of the best applications of a high-power electric propulsion system was as an integral part of a solar electric propulsion (SEP) stage to send a payload to outer planet targets. The IISTP studies showed that

either trip time or launch vehicle class could be significantly reduced when compared with state-of-the-art systems.

Find out more about this research http://www.grc.nasa.gov/WWW/ion/.

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Programs/Projects: Missions of interest include Titan Explorer, Neptune Orbiter, other interplanetary missions, and SEP.