High-Power Hall Thruster Technology Evaluated for Primary Propulsion Applications

High-power electric propulsion systems have been shown to be enabling for a number of NASA concepts, including piloted missions to Mars and Earth-orbiting solar electric power generation for terrestrial use (refs. 1 and 2). These types of missions require moderate transfer times and sizable thrust levels, resulting in an optimized propulsion system with greater specific impulse than conventional chemical systems and greater thrust than ion thruster systems. Hall thruster technology will offer a favorable combination of performance, reliability, and lifetime for such applications if input power can be scaled by more than an order of magnitude from the kilowatt level of the current state-of-the-art systems. As a result, the NASA Glenn Research Center conducted strategic technology research and development into high-power Hall thruster technology.

During program year 2002, an in-house fabricated thruster, designated the NASA-457M, was experimentally evaluated at input powers up to 72 kW. These tests demonstrated the efficacy of scaling Hall thrusters to high power suitable for a range of future missions. Thrust up to nearly 3 N was measured. Discharge specific impulses ranged from 1750 to 3250 sec, with discharge efficiencies between 46 and 65 percent. This thruster is the highest power, highest thrust Hall thruster ever tested.

Glenn researcher Robert Jankovsky compares the NASA-457M Hall thruster, the largest ever built and tested, with a kilowatt-class Hall thruster.
Long description The NASA-457M has an annular discharge chamber with a 457-mm outside diameter. The kilowatt-class thruster has a outside diameter on the order of 100 mm.

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References

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2. Oleson, S.: Advanced Propulsion for Space Solar Power Satellites. AIAA Paper 99-2872, 1999.

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