SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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HIGH-POWER HALL PROPULSION SYSTEM DEVELOPMENT AT NASA GLENN RESEARCH CENTER

Abstract

NASA Glenn Research Center (GRC) has a long history of researching and developing high power Hall effect thrusters (HETs). NASA GRC's high-power HET research and development efforts started in 1997 with the testing of the TRW T-220 10 kW HET. In 2000, the In-Space Transportation Program funded the development of the NASA-457Mv1 which was tested to power levels up to 72 kW. In addition to the ISPT Program, NASA's project Prometheus was initiated in 2003 with the goal of developing nuclear power and propulsion technologies that will enable the exploration of the universe in search of life and resources. In support of Prometheus, NASA GRC designed, built, and successfully tested a 40 kW HET designated the NASA-400M. National interest in high power electric propulsion systems was renewed. In 2010, NASA's Human Exploration Framework Team concluded that the use of a high power (300 kW) solar electric propulsion (SEP) system could significantly reduce the number of heavy lift launch vehicles required for a human mission to a near earth object.

NASA's Office of Chief Technologist In-Space Propulsion Project is focused on developing and maturing high power propulsion technologies needed to enhance the agency's capabilities to explore and move large payloads in space. The project content includes performing foundational research and testing of high power Hall system components, and advancing candidate designs to a system TRL 6. These developments are to support deep-space human exploration and to reduce travel time between Earth's orbit and future destinations. This new capability could enable cost effective missions within Earth orbit, to NEOs, and deep space robotic science missions.

NASA GRC's high power Hall development activities include testing of existing high power thrusters that were developed by past NASA programs and by the Air Force, designing and testing of high current cathodes, performing detailed plasma diagnostics, performing physics based plasma simulations to predict HET lifetime, developing tools and roadmaps that guide the design of highly efficient HET power processing units, and performing testing of HET systems.

This paper summarizes the technology current state-of-the-art and addresses the key technical challenges for further development. It also describes recent and current activities at NASA GRC in support the development of Hall propulsion systems for future space science and human exploration missions.