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DEVELOPMENT AND QUALIFICATION OF A 12-KW HALL THRUSTER FOR DEEP-SPACE MISSIONS

Abstract

NASA and Aerojet Rocketdyne are developing and qualifying a 12-kW Hall thruster for deep-space mission applications through the Advanced Electric Propulsion System (AEPS) program. The core technology of the thruster derives from the NASA-developed Hall Effect Rocket with Magnetic Shielding (HERMeS), which had a design lifetime of 50 kh at specific impulses up to 3000 s. AEPS is planned to be first used on Maxar's Power and Propulsion Element (PPE) spacecraft as part of NASA's Lunar Gateway under the Artemis project. The AEPS program consisted of a development phase, which concluded with Critical Design Review in March 2022, and is now entering qualification and flight hardware fabrication. The development phase included thruster and component testing that demonstrated the performance of the hardware to the required dynamic and thermal environments. Qualification hardware includes two thrusters, a hollow cathode, and several other thruster components that will undergo qualification testing. Thruster qualification will span performance, dynamic, thermal, and wear testing. The hollow cathode and other components will be subjected to thermal cycling tests. Physics-based plasma modeling is being used to establish the required margins for thruster life. Flight hardware fabrication of three thrusters is running in parallel to the qualification campaign.