

IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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ELECTRIC PROPULSION RESEARCH AND DEVELOPMENT AT NASA

Abstract

Electric propulsion (EP) is an extremely important technology for NASA, and has played a major role on several missions. As a result of these successes, solar electric propulsion (SEP) is now broadly recognized as an important technology for future exploration endeavors. NASA currently has many projects focused on research and development of EP for a range of applications. All three of NASA's mission directorates that deal directly with space exploration are actively engaged in supporting work in this area.

NASA's Science Mission Directorate (SMD), which conducts a wide range of robotic planetary science missions, continues to support EP technology development for future applications. SMD's primary focus is on the flight development of NASA's Evolutionary Xenon Thruster - Commercial (NEXT-C). This project is developing and flight qualifying two ion thruster/power processing unit (PPU) strings, based on the NEXT technology development work completed in 2012. NEXT-C hardware is being considered for multiple science missions including the the Double Asteroid and Redirection Test (DART) mission led by the Applied Physics Laboratory (APL).

NASA's Human Exploration and Operations Mission Directorate (HEOMD) has several EP technology development projects underway under its Advanced Exploration Systems (AES) program. The NextSTEP project is supporting work on three high power EP technologies, which could ultimately be used for large cargo transport to Mars and even crewed spacecraft. These include: Aerojet Rocketdyne's XR-100 Nested Hall Thruster; Ad Astra's Variable Specific Impulse Magnetoplasma Rocket (VASIMR); and MSNW's Electrodeless Lorentz Force (ELF) Thruster.

Most of NASA's EP projects are being conducted by programs within NASA's Space Technology Mission Directorate (STMD). The largest of these is the Advanced EP System (AEPS), which is developing and flight qualifying four 13.3-kW Hall thruster/PPU strings. These will serve as the main propulsion system for the Power and Propulsion Element (PPE), the initial building block of NASA's Gateway spacecraft/station and cislunar-based exploration architecture. Under STMD's Game Changing Program, the Advanced In-space Propulsion (AISP) Iodine project is systematically advancing iodine EP technology across a wide range of components and subsystems toward risk reduction for future iodine missions.

STMD's Small Spacecraft Technology Program is also funding work on several EP technologies. These include efforts in electrospray propulsion and small Iodine Hall EP systems.

This paper describes these projects in more detail, including the specific technical activities being conducted at NASA's main centers for EP technology and development, namely Glenn Research Center (GRC) and the Jet Propulsion Laboratory (JPL).