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INTEGRATED MODULAR POWER UNIT FOR LIGHTWEIGHT AND SCALABLE ELECTRIC PROPULSION (IMPULSE)

Abstract

The Integrated Modular Power Unit for Lightweight and Scalable Electric Propulsion (IMPULSE) system represents a groundbreaking effort to address the critical need for innovative power solutions in space infrastructure, combining the development of a versatile modular power converter with intensive electric propulsion system research. Spearheaded by a collaboration involving several research and commercial institutions, this initiative has led to significant advancements in the efficiency and adaptability of space operations. Initial results from testing several hall effect thrusters in vacuum conditions have demonstrated the robustness and flexibility of the proposed power solutions. The project investigates the use of a single power supply for electric propulsion, integrating cutting-edge technologies such as a heaterless hollow cathode to address ignition and steady operation challenges. Comprehensive analyses including far-field plume studies, alongside thrust, flowrate, and power measurements, have underscored the operational efficiency and necessary adaptations for a simplified power supply approach. This has led to innovations in voltage adjustment for coil protection during ignition and the exploration of material magnetic properties to enhance electrical efficiency. The holistic approach of the IMPULSE system not only paves the way for improved spacecraft electric propulsion systems but also sets the stage for the future of extraterrestrial exploration and infrastructure development.