

High-Efficiency Hall Thruster Discharge Power Converter

For use in high-voltage Hall accelerator thrusters and other electric propulsion devices

Busek Company, Inc., is designing, building, and testing a new printed circuit board converter. The new converter consists of two series or parallel boards (slices) intended to power a high-voltage Hall accelerator (HiVHAC) thruster or other similarly sized electric propulsion devices. The converter accepts 80- to 160-V input and generates 200- to 700-V isolated output while delivering continually adjustable 300-W to 3.5-kW power. Busek built and demonstrated one board that achieved nearly 94 percent efficiency the first time it was turned on, with projected efficiency exceeding 97 percent following timing software optimization. The board has a projected specific mass of 1.2 kg/kW, achieved through high-frequency switching.

In Phase II, Busek optimized to exceed 97 percent efficiency and built a second prototype in a form factor more appropriate for flight. This converter then was integrated with a set of upgraded existing boards for powering magnets and the cathode. The program culminated with integrating the entire power processing unit and testing it on a Busek thruster and on NASA's HiVHAC thruster.

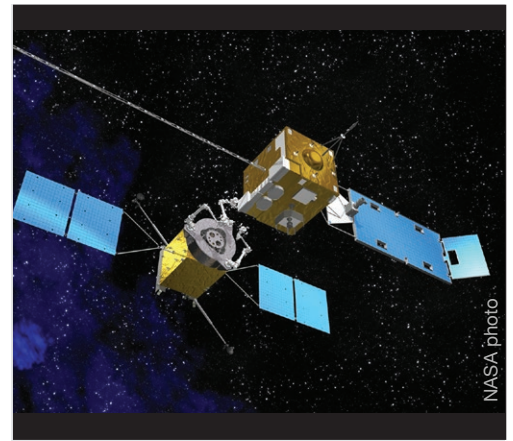
Applications

NASA

- ▶ Lunar and Mars exploration
- ▶ Vesta–Ceres rendezvous (Dawn Mission)
- ▶ Comet 22P/Koppf rendezvous
- ▶ Asteroid 4660 Nereus sample return mission

Commercial

- ▶ Department of Defense space assets
- ▶ Defense Advanced Research Projects Agency Fast Access Spacecraft Testbed Program:
 - All-electric, high-power space tug and geosynchronous Earth orbit servicing vehicle
- ▶ Commercial satellite manufacturers:
 - Satellite servicing
 - Orbit maintenance
 - Orbit raising and lowering
 - Inclination changes
 - Repositioning



Phase II Objectives

- ▶ Demonstrate very high efficiency, low mass modular power processing unit (PPU) with input and output voltages appropriate for deep-space missions and NASA's HiVHAC thruster
- ▶ Integrate new with existing converters operating at different input voltages
- ▶ Complete existing breadboard and build next version with the correct form factor
- ▶ Convert existing boards for magnets, cathode, etc.
- ▶ Integrate new and existing boards
- ▶ Test PPU on BHT-1500 thruster at Busek and on HiVHAC thruster at NASA Glenn

Benefits

- ▶ High efficiency Hall thruster
- ▶ Low mass

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