

# Low-Cost, High-Performance Hall Thruster Support System

## *Power processing unit (PPU) for Hall thrusters*

Colorado Power Electronics (CPE) has built an innovative modular PPU for Hall thrusters, including discharge, magnet, heater and keeper supplies, and an interface module. This high-performance PPU offers resonant circuit topologies, magnetics design, modularity, and a stable and sustained operation during severe Hall effect thruster current oscillations. Laboratory testing has demonstrated discharge module efficiency of 96 percent, which is considerably higher than current state of the art.

The Phase II project developed an engineering model high-voltage Hall accelerator (HiVHAC) PPU that includes a digital control interface unit (DCIU). This will position CPE to manufacture a qualification model PPU as a Phase III project. The prototype digitally controlled flow controller with a PC interface developed in Phase I served as the foundation for a combination DCIU-flow module added to the PPU in Phase II. Thermal and vibration finite element analysis was performed on the reduced-mass chassis, and then a test brassboard PPU was built and tested. Additionally, the control loops of the PPU were analyzed and a stress analysis performed. The team designed and built an engineering model flight-like PPU that includes flight-like wire harnessing schemes, electromagnetic interference filtering, enhanced modularity, and the new DCIU-flow module.

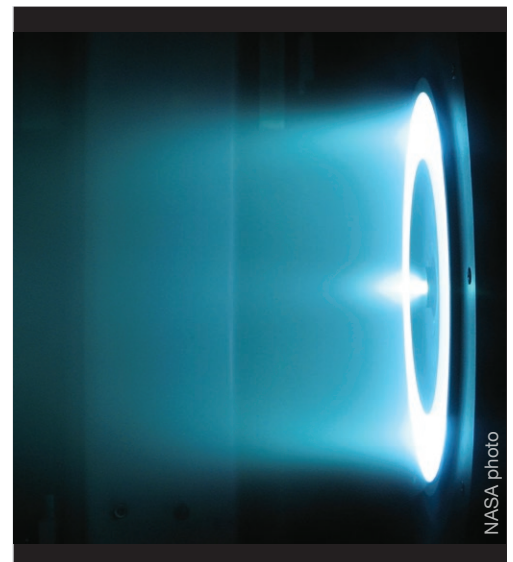
### Applications

#### NASA

- ▶ PPU for Hall thrusters
- ▶ PPU for ion thrusters

#### Commercial

- ▶ Space-rated piezoelectric driver
- ▶ Resonant converters for high-power Hall thrusters



NASA photo

### Phase II Objectives

- ▶ Develop an engineering model flight-like HiVHAC PPU
- ▶ Develop and integrate a DCIU that controls the PPU and xenon feed system
- ▶ Refine electrical and mechanical PPU design
- ▶ Improve manufacturability
- ▶ Develop electrical, thermal, and structural models

### Benefits

- ▶ Offers discharge module efficiency of 96 percent
- ▶ Provides sustained operation during severe Hall effect thruster current oscillations
- ▶ Can operate a Hall thruster at a wide range of voltages

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