# BIT-3
# RF Ion Thruster

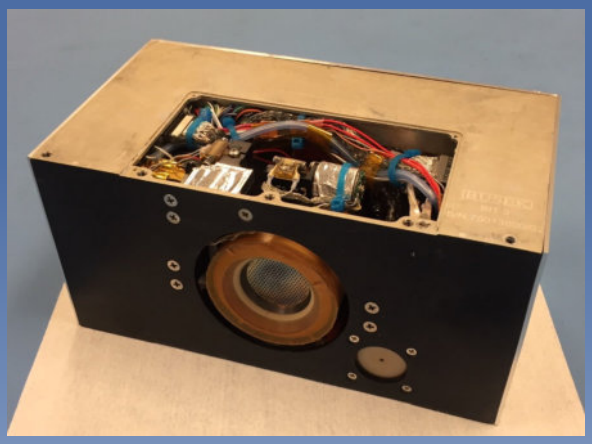
BUSEK
Space Propulsion and Systems

***The world's first iodine gridded ion thruster featuring high performance and unprecedented efficiency for its size.***

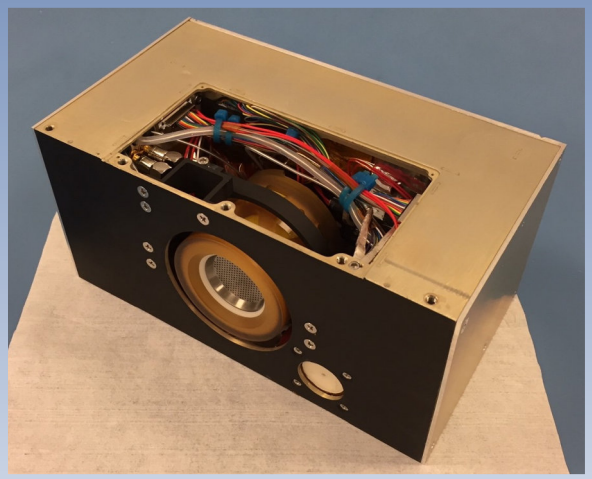
Busek's BIT-3 RF ion thruster is a mission-enabling, iodine-fueled ion propulsion system scheduled for launch on two deep-space CubeSat missions aboard NASA's Space Launch System rocket in 2020. The 56-80W input propulsion system utilizes a 2.5cm diameter grid RF ion thruster (BIT-3) and a micro RF cathode (BRFC-1) as the neutralizer. The thruster's unprecedented performance produces thrust up to 1.25mN and specific impulse up to 2,300 seconds. Performance results were verified with xenon and iodine propellant using a highly-accurate torsional thrust stand. As an optional add-on, Busek has developed an innovative thruster gimbal capable of desaturating reaction wheels as part of the Attitude Control System (ACS).

The BIT-3 uses an inductively-coupled plasma (ICP) discharge to eliminate the need for an internal hot cathode and increase overall lifetime. Thruster life is dominated by grid erosion, which by simulation exceeds 20,000 hours. The most unique feature of BIT-3 is its compatibility with iodine propellant, a demonstrated drop-in replacement for xenon in terms of thrust and Isp performance. Iodine stores as a dense solid (>2x storage density than xenon) and eliminates the need for high-pressure tanks.

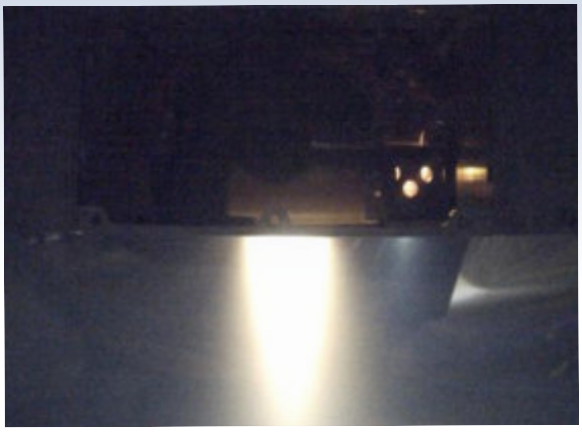
Advances in the BIT-3 thruster and BRFC-1 neutralizer are complemented by major breakthroughs in the flight electronics. The BIT-3 power processing unit (PPU) features a ~90% efficient RF power supply with radiation-tolerant components. The state-of-the-art electronics package is highly efficient and compact.



**BIT-3 System, Gimbaled**



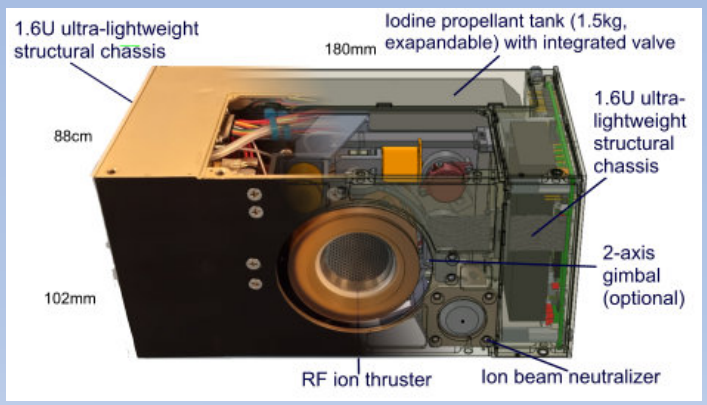
**BIT-3 System, Non-Gimbaled**



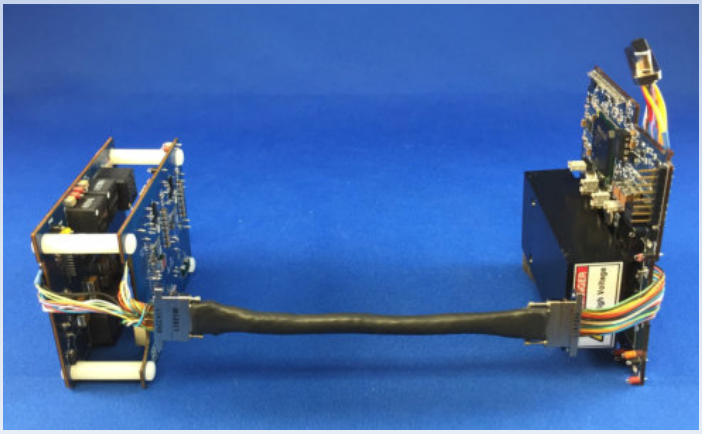
**BIT-3 Flight Model Firing with Iodine Propellant**

# *BIT-3 CubeSat Flight System*
# *Technical Specifications*

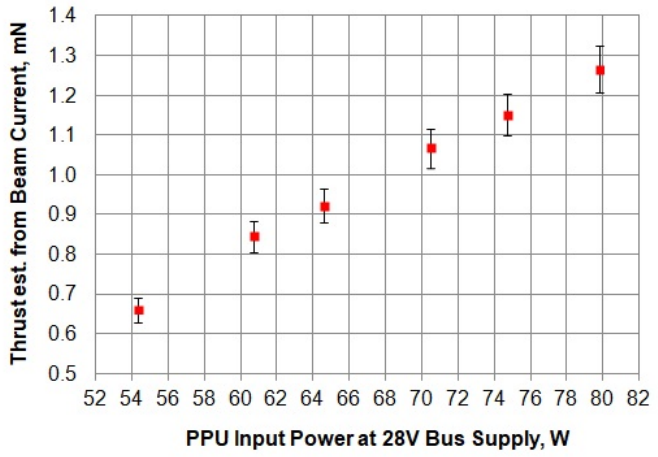
| | |
|---|---|
| **Propellant** | Iodine, solid storage |
| **Envelope** | 180 x 88 x 102 mm |
| **Dry Mass** | 1.28 kg w/o gimbal<br>1.40 kg w/ gimbal |
| **Propellant Loads** | 1.50 kg max |
| **System Power** | 56 - 80 W |
| **Input Voltage**<br>(Regulated) | 28 VDC<br>(assumes ambient temp.) |
| **Ion Beam Current** | 9 - 17 mA |
| **Propellant Mass Flow**<br>(Nominal, cathode included) | 48 µg/sec |
| **Thrust** | Up to 1.25 mN |
| **Specific Impulse** | Up to 2,300 s |
| **Delta-V** | Up to 2.5 km/s<br>(14 kg CubeSat) |
| **Integrated Gimbal**<br>(Optional) | 2-axis, ±10°<br>(capable of desaturating reaction wheels) |
| **Communication** | RS-485 |
| **Thermal Dissipation Load** | ~30 W max |
| **Operating Temperature Range** | -10 to +45°C |




**BIT-3 System Layout, Gimbaled**



**BIT-3 Rad-Tolerant PPU**




**Actual Performance of Iodine BIT-3 Flight System**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