



# FIBER-FED PULSED PLASMA THRUSTER (FPPT) SYSTEM

## SOLID INERT POLYMER PROPELLANT

### JULY 2019

The CU Aerospace (CUA) Fiber-fed Pulsed Plasma Thruster (FPPT) system is a pulsed plasma thruster that uses PTFE fiber as propellant. This approach enables CUA to provide competitive  $\Delta V$  to CubeSat and small satellite customers at a substantially lower cost and risk profile than traditional liquid or gaseous propulsion systems that use valves and pressure vessels. In a 1U form factor, FPPT provides a peak total impulse of 5,500 N-s, a peak continuous thrust of 0.38 mN at 48 W to the power processing unit (PPU), or a peak maximum specific impulse of 2,400 seconds. The design incorporates 16 J capacitor bank energy storage unit (ESU) modules to trade propellant volume for performance. Presently, FPPT is in the later stages of development on a NASA Phase II SBIR program.

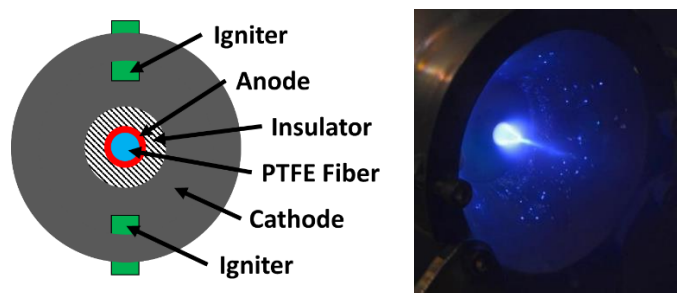
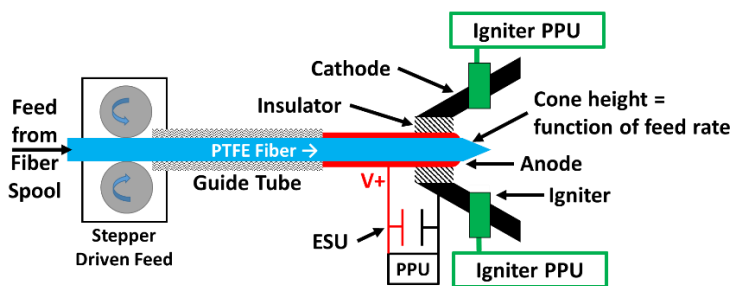
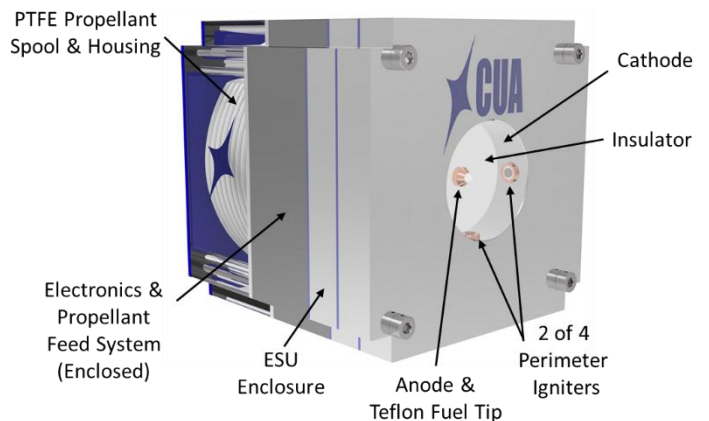
System Information		
System lifetime	> 10 <sup>8</sup> pulses	
System temperature range [°C]	- 50 to +75	
Nominal mass flow rate [mg/s]	0.014 – 0.040	
Nominal Power to PPU [W]	48	
Propulsion system volume	1U	1.5U
Nominal Pulse Energy [J]	16	32
Propellant Mass [g]	330	870
Specific Impulse [s]	1,000 – 1,700	1,600 – 2,400
Nominal Thrust [mN]	0.28 – 0.33	0.27 – 0.35
Impulse Bit (thrust stand) [μN-s]	90 – 120	180 – 240
Total impulse [N-s]	3,260 – 5,640	13,500 – 20,700
Total propulsion wet mass [kg]	1.51	2.75
Wet mass + 4 kg s/c $\Delta V$ [m/s]	610 – 1,060	2,150 – 3,290
Technology Readiness Level	TRL 5	

### TYPICAL OPERATION AND INTERFACE

FPPT starts immediately without warmup and mechanically feeds PTFE propellant fiber from a non-rotating spool through the anode where it is subjected to a pulsed discharge and electromagnetically accelerated to provide thrust. Varied power, thrust, mass flow rate, and resultant specific impulse levels are user-selectable by adjusting propellant feed rate, pulse rate, and optionally adjustable bank voltage.

Developmental 1U FPPT system interface:

- Unregulated bus battery voltage to PPU
- I<sup>2</sup>C communication protocol (other options available on request) for all thruster control and feedback
- Mounting interface designed for typical CubeSat structure via external enclosure adaptable to customer requirements



CUA | 3001 NEWMARK DRIVE | CHAMPAIGN, IL 61822

T: (217) 239-1701 | INFO@CUA.SPACE | WWW.CUA.SPACE

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