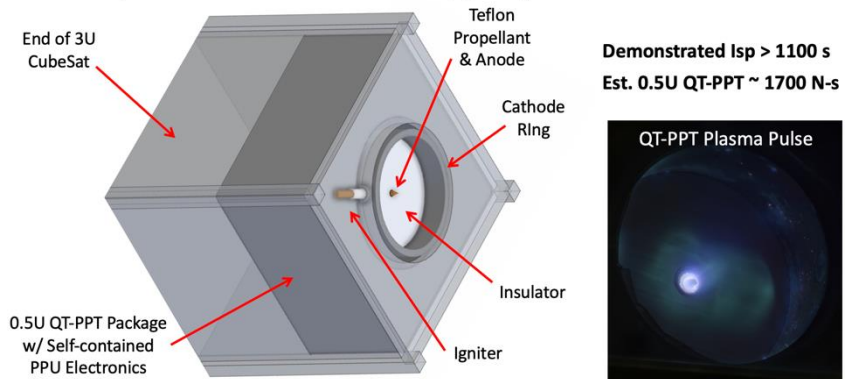The CU Aerospace (CUA) Quick Turn Pulsed Plasma Thruster (QT-PPT) self-contained system uses either a disk of PTFE or PTFE fiber as propellant. The entire system including the PPU is tightly integrated onto a stack of PCBs approximately 0.5U in size, which offloads most of the manufacturing and quality control to the specialized PCB manufacturer, and enables the "Quick Turn" PPT system integrated by CUA. CUA

Quick Turn Pulsed Plasma Thruster (QT-PPT): Solid Disk Version

Demonstrated Isp > 1100 s
Est. 0.5U QT-PPT ~ 1700 N-s

developed miniaturized electronics subsystems including life-tested high-density energy storage via MLCC capacitors, low-erosion discharge geometry, negligible-erosion regenerative carbon igniters, compact power electronics, and electromagnetic thrust vectoring. Recent FCC deorbit rule changes require deorbiting within 5 years of end of useful lifetime. QT-PPT with a fiber feed system can achieve a full 1300 km deorbit for a 6 kg spacecraft from a 0.7U thruster. The total impulse can be varied via fuel loading and capacitor energy selection, and thrust vectoring is also an option. For comparison, the smaller disk 0.5U configuration is estimated to have a specific impulse of 700 s and a total impulse of 1100 N-s, enough to lower a 4 kg CubeSat from 900 km to 400 km. CUA's long-term goal will be to establish the QT-PPT as a mature integrated system solution with standard lead times under 6 weeks.

OPERATION AND TYPICAL PERFORMANCE

FPPT fires on demand without warmup. The disk version passively ablates, and the fiber version is mechanically fed PTFE propellant from a non-rotating spool through the anode, utilizing a pulsed discharge to electromagnetically accelerate fuel to provide thrust. Power, thrust, mass flow rate, and resultant specific impulse levels are user-selectable by adjusting propellant feed rate, pulse rate, and bank voltage.


Fiber-fed Version
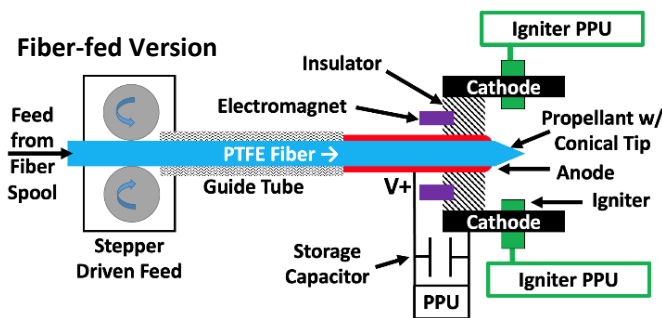
| System Information*		
System Temperature Range [°C]	– 35 to +75	
Pulse Rate, Steady State Max [Hz]	2	
Feed Type	Disk (Passive)	Fiber (Active)
Propulsion System Volume	0.55U	0.67U
Energy per Pulse [J]	7.4	7.4
Nominal Power to PPU @ 2 Hz [W]	20	20
Nominal Mass per Pulse [micro-g]	~10	2.3
System Lifetime, Pulses	> 4 x 10^6	> 34 x 10^6
Nominal Thrust/Power [microN/W]	7.1	3.6
Nominal Thrust @ 2 Hz [mN]	0.14	0.07
Specific Impulse [s]	~700	1575
Total Impulse [N-s]	1100	2700
Propellant Mass [kg]	0.16	0.17
Total propulsion wet mass [kg]	0.79	0.92
Spacecraft ΔV [m/s] (Init. S/C Mass)	280 (4 kg)	450 (6 kg)

* Note: values listed are estimates based upon TRL 5 system
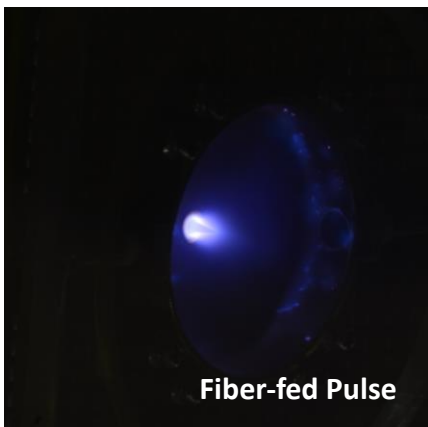
BASELINE QT-PPT SYSTEM INTERFACE

- 12V power interface (can modify on request)
- RS422 or TTL level RS232 communication protocols available
- Mounting interface
  - Designed w/ external enclosure for typical CubeSat structure
  - Adaptable to customer requirements
- Flight envelope
  - Disk: $9.0 \times 9.0 \times 5.5$ cm^3
  - Disk w/ "Tuna Can": $9.0 \times 9.0 \times 6.7$ cm^3
  - Fiber: $9.0 \times 9.0 \times 6.6$ cm^3
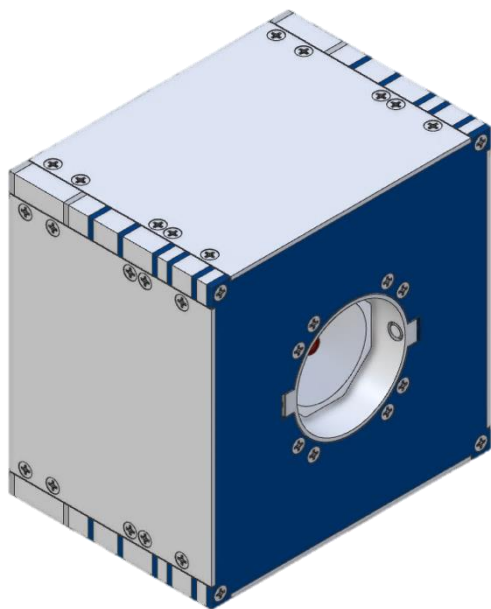
Fiber-fed Variant
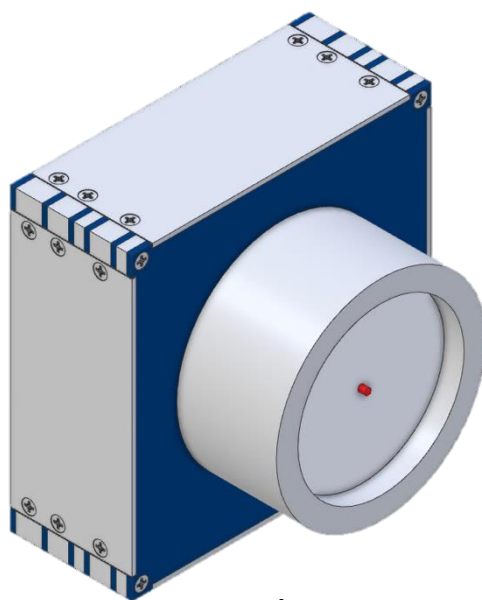
Disk w/ "Tuna Can"

Fiber-fed Pulse

Disk Pulse