MONOFILAMENT VAPORIZATION PROPULSION (MVP) SYSTEM
SOLID INERT POLYMER PROPELLANT
JUNE 2021

The CUA Monofilament Vaporization Propulsion (MVP) system is an electrothermal thruster that uses a space-rated plastic as propellant. This approach enables CUA to deliver competitive delta-V to CubeSat customers at a substantially lower cost and dramatically lower risk profile than traditional liquid or gaseous propulsion systems having pressure vessels. In a 0.9U form factor, MVP provides a total impulse of 280 N-s with a peak continuous thrust of 4.5 mN. A flight-like MVP passed environmental and subsystem qualification testing on a NASA Phase II SBIR program.

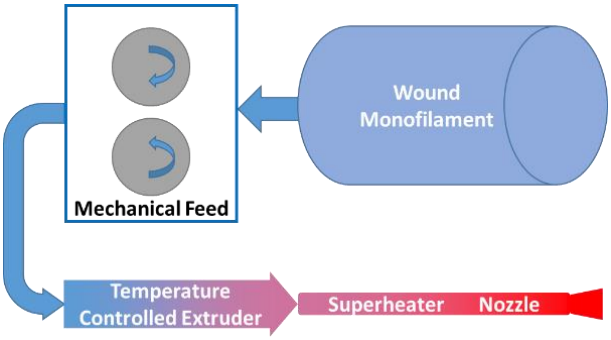
System Information	
Propulsion system volume	0.9U
Volume Envelope	9.0 x 9.0 x 11.6 cm^3
System lifetime	Not propellant limited
Spacecraft temperature range	Not propellant limited
Propellant	POM, gaseous MW = 30
Propellant Mass	433 g
Total propulsion wet mass	1.06 kg
Nominal mass flow rate	7.0 mg/s
Total thrust time	17 hr
Specific Impulse	66 s
Primary Thrust	4.5 mN
Total impulse	280 N-s
Spacecraft ΔV, M(initial) = 4 kg	74 m/s
Propulsion power when firing	45 W
Propulsion power (avg. duty cycled)	13.5 W
TRL	6

TYPICAL OPERATION AND INTERFACE

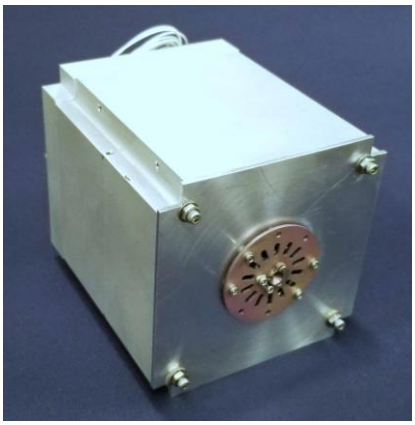
MVP draws from 3D printing technology to feed propellant. A preheat is required before firing (~3 minutes), but once warmed the "ready" state is maintained with minimal power draw and thermal loading. When firing, the system uses approximately 45 W (duty cycled average is only 13.5 W). Propellant fiber is mechanically drawn from a fixed spool into the extruder where it evaporates. Propellant metering is precise, but evaporation time results in "softer" starts and stops. As a consequence, minimum impulse bit is inherently much larger than gaseous propulsion systems with fast-actuating valves; this represents the largest trade-off for the reduced system cost, complexity, and risk.

0.9U MVP system interface:

- 12V power interface (Can modify on request)
- RS422 and TTL level RS232 communication protocol available for all thruster control and feedback
- Mounting interface designed for typical CubeSat structure via external enclosure adaptable to customer requirements



MVP Schematic



MVP-1 Flight-Like System (1.15U)

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