



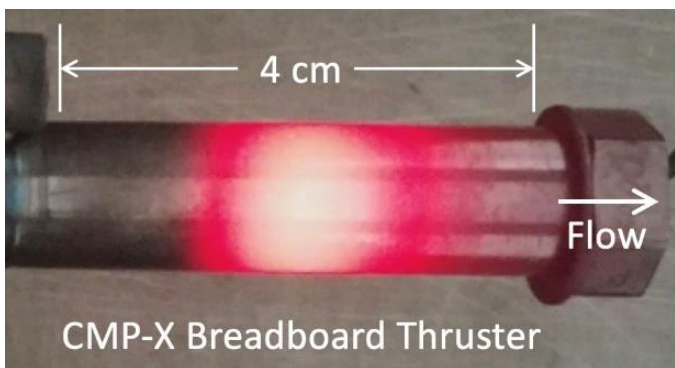
MONOPROPELLANT PROPULSION UNIT FOR CUBESATS (MPUC) SYSTEM

LOW FLAME TEMPERATURE GREEN MONOPROPELLANT

JULY 2020

The CU Aerospace (CUA) Monopropellant Propulsion Unit for Cubesats (MPUC) system, is a compact monopropellant thruster using a high performance, non-detonable, low-toxicity (“green”) chemical monopropellant [CUA Monopropellant, formulation 10 (CMP-X)] MPUC has benign storage characteristics, uses an in-house CUA Catalyst, formulation 9, (CC-9) catalyst bed, and uses non-refractory construction materials thanks to a ~950°C flame temp. Propellant is driven by gaseous helium pressurant, providing constant fuel flow and thrust over the system lifetime. The system is readily adapted for a two-phase pressurant (self-pressurizing liquid) that can both provide constant primary fuel flow and also feed a four-nozzle cold gas ACS. High “volumetric impulse” (N-s/liter) performance levels of >1000 N-s/liter for the anticipated system and ~180 s specific impulse for the optimized thruster head will provide significant orbital maneuverability (a 6U 12 kg satellite with a 2U-sized MPUC system would see a total $\Delta V > 210$ m/s) and also enable end of mission de-orbiting. The average power

PARAMETER / PROPULSION SYSTEM	MPUC (1.5U)	MPUC (2U)
Thruster System Package Volume [cm ³]	1,500	2,000
Available Tank Volume [cm ³]	770	1,220
Propulsion Technology	Monopropellant	
Propellant	H ₂ O ₂ -Ethanol	
Nominal Power Draw [W]	3	
Specific impulse [s]	180	
Mass Flow Rate [mg/s]	100	
Thrust [mN]	160	
Total impulse [N-s]	1,550	2,460
Vol. Impulse (total impulse / system volume) [N-s / liter]	1,030	1,230
Propellant Mass [g]	862	1,366
Dry Mass [g]	1,600	1,850
Propulsion System Wet Mass [g]	2,462	3,116
Delta-V capability (Propulsion Wet Mass + 10 kg) [s]	159	259
TRL	4 (est. 6 by May 2022)	



requirement is projected to be a moderate ~3 W based on previously-developed hardware. CMP-X thrusters have demonstrated 180 s specific impulse at 174 mN thrust during thrust stand testing and continuous firing times > 10 min.

An MPUC system equipped with CMT technology is an exceptionally compact, moderate thrust, lightweight system with very high volumetric impulse. This system offers affordable access to CubeSat propulsion and is easily scalable to larger sizes depending on mission requirements to meet needs of differing users in DOD, industry, and academia.



CC-9 in tray



CC-9 w/ 50% H₂O₂



MnO₂ w/ CMP-X



CC-9 w/ CMP-X