



MICRO AEROSPACE SOLUTIONS, INC.

- ▲ Propulsion System Engineering
- ▲ Small Spacecraft Engineering
- ▲ Computer Data Systems
- ▲ Aerospace Software

Micro Aerospace Solutions' Nanosatellite Propulsion System Development

Micro Aerospace Solutions, Inc. (MAS) of Melbourne, Florida is developing propulsion system technology for nanosatellite applications. Thrusters developed in this effort can be used for attitude control for nanosatellites or for very fine pointing control for slightly larger spacecraft. The higher end (1 N) thruster could also be used for nanosatellite main propulsion.

A thruster module comprised of a microthruster producing 0.050 N (50 milli-Newtons) thrust, an elastomeric-diaphragm tank, micro-solenoid valves, filters and tubing has been built and tested. The unit tested thus far is designed for hydrogen peroxide monopropellant usage but a hydrazine system is in development. Table 1 summarizes some of the thrusters. Potential future development could include a HAN (hydroxyl ammonium nitrate)-based propellant system. Other thrusters in the range from 0.005 N to 1 N are also in development.

The catalyst is a vital part of a monopropellant thruster and MAS has designed a unique catalyst for these thrusters. In most monopropellant systems a bed of catalytic pellets is supported by screens. That arrangement has a tendency to degrade in performance over time and the pellets will often crack and blow through the retaining screen and is too big for a microthruster. We use an innovative metal gauze catalyst design which offers increased system performance and lifetime. Other microthrusters have had difficulty maintaining proper decomposition of the propellant in the chamber, but our system has operated for over 100,000 pulses with proper decomposition.

MAS is also developing a gel-propellant system to boost a microspacecraft from Low-Earth Orbit to a higher orbit. A gel propellant system offers a microspacecraft propulsion module with lower mass and volume yet the same performance as a solid motor (Isp currently of a solid is approximately 290 seconds). It is also safer since it is not susceptible to electrostatic discharge or leakage.

Hydrogen Peroxide Monopropellant Thrusters

	M005HP	M010HP	M050HP	M100HP
Thrust (N)	0.005	0.1	0.5	1.0
Isp (sec.)	100	110	120	120
Inlet Pressure (Pa)	350000	350000	350000	350000
Minimum Impulse bit (N-sec.)	1.2×10^{-4}	9×10^{-4}	4×10^{-3}	8.5×10^{-3}
Weight (grams)	10	11	15	20
Exit Diameter (mm)	3.81	5	6.35	7.6
Pulse life	>100,000	>100,000	>100,000	>100,000
Power Steady (W)	0.5	0.5	1.0	2.0



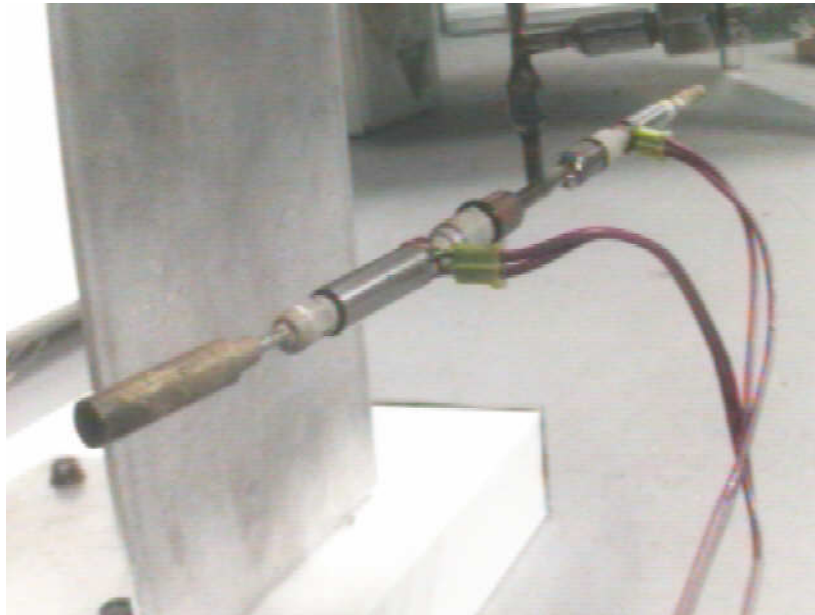
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Micro Aerospace Solutions' Microthruster System



Thruster Module with 2-inch Tank, micro-solenoid valves and thrusters



50 milli-Newton Thrusters with Valves