

Nontoxic Hydroxylammonium Nitrate (HAN) Monopropellant Propulsion

To replace hydrazine with a green monopropellant

Nontoxic monopropellants have been developed that provide better performance than toxic hydrazine. Formulations based on HAN have superior performance as compared to hydrazine with enhanced specific impulse (Isp), higher density and volumetric impulse, lower melting point, and much lower toxicity. However, HAN-based monopropellants require higher chamber temperatures (2,083 K vs. 883 K) to combust. Current hydrazine-based combustion chamber technology (Inconel® or niobium C103 and silicide coating) and catalyst (Shell 405) are inadequate. In Phase I, state-of-the-art iridium-lined rhenium chambers and innovative new foam catalysts were demonstrated in pulse and 10-second firings. Phase II developed and tested a flight-weight thruster for an environmentally green monopropellant.

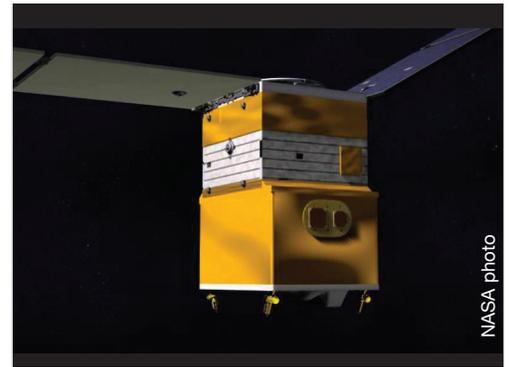
Applications

NASA

- ▶ Mars Ascent Vehicle
- ▶ Lunar landers
- ▶ Reaction control systems
- ▶ In-space propulsion:
 - Attitude control
 - Orbit maintenance
 - Repositioning of satellites/spacecraft
 - Descent/Ascent engines
- ▶ Nuclear power/propulsion
- ▶ Microgravity containment crucibles and cartridges

Commercial

- ▶ Rocket nozzles for satellites and military
- ▶ Crucibles, heat pipes, propulsion subcomponents, X-ray targets, sputtering targets, turbines, rotors, furnaces, power generation, jet engine restarters, catalysts, etc.



NASA photo

Phase II Objectives

- ▶ Develop a nontoxic HAN-based monopropellant thruster to replace hydrazine
- ▶ Pursue improvements to Phase I foam catalyst and injector
- ▶ Demonstrate ignition of nontoxic AF-M315E with Phase II design
- ▶ Test life and response time of the thrust chamber assembly
- ▶ Analyze posttest thruster and catalyst
- ▶ Fabricate multiple thrust chambers for commercial partners
- ▶ Commercialize green thruster

Benefits

- ▶ Enhanced Isp of 261 seconds (12 percent greater than hydrazine)
- ▶ Higher density and volumetric impulse (60 percent greater density impulse than hydrazine)
- ▶ Lower melting point than hydrazine
- ▶ Low toxicity (no self-contained breathing apparatus required)

Firm Contact

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Proposal Number: 10-2 X2.02-9554