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Author: Mr. Jeffrey Honse  
Aerojet Rocketdyne, United States, jeffrey.honse@rocket.com

Mr. Robert Masse  
United States, robert.masse@rocket.com

Mr. Steven Overton  
Aerojet Rocketdyne, United States, steven.overton@rocket.com

ADVANCEMENTS IN HIGH-PERFORMANCE GREEN SMALLSAT/CUBESAT PROPULSION

**Abstract**

Enabled by the NASA Science, Technology, and Mission Directorate's public-private partnerships to advance "Tipping Point" technologies, a high-performance green/AF-M315E SmallSat/CubeSat propulsion system is under development for potential first flight demonstration in early 2018. Based on a high-impulse-density architecture originally developed for a similar hydrazine system, the 1U module combines a single piston tank serving as the primary structure with high-performance AF-M315E advanced green monopropellant thrusters to provide both  $\Delta V$  thrust as well as attitude control. While the higher density-Isp of the green propellant alone yields a 50% gain in total impulse compared to hydrazine (and >10X that of similarly-packaged cold gas), the earlier system's more conventional blow-down GN2 pressurization scheme has been replaced by an innovative temperature-regulated high-expansion-ratio condensable pressurization system to realize a 30% further increase in system propellant tank volume. The novel pressurization approach also facilitates lower stored-energy in the pressurant tank for greater inherent handling safety during ground operations, as well as a simplified and more power-efficient means of post-launch system activation where initially-isolated pressurant may be introduced into the propellant tank without need for mechanically or pyrotechnically actuated devices. By design the system manufacturing approach emphasizes strategies where costs and logistics scale favorably with the higher production rates associated with larger numbers of smaller, simpler spacecraft while supporting short delivery cycles. Advanced additive manufacturing technologies factor significantly, as well as a purpose-developed next-generation low-cost miniature AF-M315E thruster enabling three-axis control using a four thruster configuration.