

## Abstract for ESA-3AF Space Propulsion 2014

Title: Enabling Dedicated, Affordable Space Access through Aggressive Technology Maturation

Author(s): Jonathan Jones, Tim Kibbey, Pat Lampton, and Thomas Brown

Organization: National Aeronautics & Space Administration, Marshall Space Flight Center

Address: George C. Marshall Space Flight Center, Propulsion Systems

Department/ER01, Marshall Space Flight Center, Alabama 35812

Phone: (256) 544-0559

Fax: (256) 544-1630

A recent explosion in nano-sat, small-sat, and university class payloads has been driven by low cost electronics and sensors, wide component availability, as well as low cost, miniature computational capability and open source code. Increasing numbers of these very small spacecraft are being launched as secondary payloads, dramatically decreasing costs, and allowing greater access to operations and experimentation using actual space flight systems. While manifesting as a secondary payload provides inexpensive rides to orbit, these arrangements also have certain limitations. Small, secondary payloads are typically included with very limited payload accommodations, supported on a non interference basis (to the prime payload), and are delivered to orbital conditions driven by the primary launch customer. Integration of propulsion systems or other hazardous capabilities will further complicate secondary launch arrangements, and accommodation requirements.

The National Aeronautics and Space Administration's Marshall Space Flight Center has begun work on the development of small, low cost launch system concepts that could provide dedicated, affordable launch alternatives to small, risk tolerant university type payloads and spacecraft. These efforts include development of small propulsion systems and highly optimized structural efficiency, utilizing modern advanced manufacturing techniques. This paper outlines the plans and accomplishments of these efforts and investigates opportunities for truly revolutionary reductions in launch and operations costs. Both evolution of existing sounding rocket systems to orbital delivery, and the development of clean sheet, optimized small launch systems are addressed.

A launch vehicle at the scale and price point which allows developers to take reasonable risks with new propulsion and avionics hardware solutions does not exist today. Establishing this service provides a ride through the proverbial "valley of death" that lies between demonstration in laboratory and flight environments. This effort will provide the framework to mature both on-orbit and earth-to-orbit avionics and propulsion technologies while also providing dedicated, affordable access to LEO for cubesat class payloads.