NASA SBIR 2007 Phase I Solicitation

X9.04  Launch Vehicle Propulsion and Pyrotechnic Technologies

Lead Center: MSFC

Participating Center(s): GRC

The goal of this subtopic is the development of innovative components, manufacturing techniques, health management systems, and design and analysis tools for launch vehicle propulsion and pyrotechnic systems. Performance, reliability, and cost of operations improvements to existing and planned Constellation launch vehicle propulsion and pyrotechnic systems are needed. Technologies that would contribute to decreased sensitivity to manufacturing and handling effects, that will lead to reduction in development and qualification testing, and that will lead to reduction in touch labor during ground operations and vehicle turnaround are particularly welcomed. Also solicited are proposals that would reduce the time, cost, and complexity associated with designing and analyzing launch vehicle propulsion and pyrotechnic systems. While solid or hybrid rocket propulsion is specifically emphasized, compelling proposals related to liquid engine boost propulsion are also invited.

Specific areas of interest include:

- Concepts for solid or hybrid propulsion systems and related components that would lead to increased payload mass fraction over current solid rocket motors.
- Concepts for solid or hybrid auxiliary propulsion systems that can be throttled to provide enhanced vehicle maneuverability; technology that supports applicability of these systems for in-space primary propulsion is also of interest.
- Health management technologies, including embedded sensors and modeling methodologies, that would improve the ability to monitor the reliability of solid or hybrid rockets during manufacturing, handling, and flight.
- Manufacturing techniques improvements that allow for reductions in the cost and schedule required to fabricate and test solid or hybrid rockets.
- New propellant ingredients or formulations that would increase the propellant specific impulse while
maintaining a Department of Transportation Class 1.3 hazard classification; proposals that would experimentally synthesize and characterize new ingredients, or formulate and demonstrate new propellants are encouraged.

- Retrofitable technologies to existing boost liquid engines that address the goals of performance enhancement and/or lower operations cost.

- Improvements in explosive bolt technology, both for traction as well as ejector bolts, to improve handling safety and increasing robustness of installation.

- Improvement to detonators to reduce the required initiation power, or to provide integrated safe-and-arm functions within detonator.

- Wireless or optical approaches for initiation of explosive bolts and frangible nuts for reduced system weight and improved safety.

- Improvements to explosive cutters, cutting chords, and specialty cutting charges to reduce installation labor, check-out labor, and sensitivity to environmental, handling, and ageing effects without reducing reliability.

- Analysis tools that support development and operation of launch vehicle propulsion systems (liquid, solid, or hybrid) by allowing for a more accurate definition of the environment internal to the propulsion system. Test data that provides for validation of existing design and analysis tools is also sought.

- Improvement to the design and analysis tools that support pyrotechnic devices development and integration into the launch vehicle system, especially those tools that define the induced environments created during and immediately after the action time of the pyrotechnic device; Test data to validate and quantify uncertainty in launch vehicle pyrotechnic devices design and induced environments.

Proposals that address more than one of these items are highly encouraged.