NASA SBIR 2014 Phase I Solicitation

H2.02 In-Space Chemical Propulsion

Lead Center: GRC

Participating Center(s): JSC, MSFC

This solicitation intends to examine a range of key technology options associated with non-toxic storable liquid propulsion systems for use in future exploration missions. Efficient propulsive performance and long duration storage attributes have made the use of hydrazine widespread across the aerospace community. However, hydrazine is highly corrosive and toxic, creating a need for non-toxic, high performance propellants for NASA, other government agencies, academia, and the commercial space industry.

Non-toxic engine liquid mono- and bi-propellants technologies are desired for use in lieu of the currently operational hydrazine based engine technologies. Handling and safety concerns with the current toxic chemical propellants can lead to more costly propulsion systems. The use of new non-toxic propellants has the potential to reduce the cost of access to space by lowering overall life cycle costs.

Demonstrations of a hydrazine alternative in a storable liquid mono- or bi-propellant chemical propulsion system implementation relevant to at least one of the following applications are desired: in-space reaction control propulsion, in-space primary propulsion, and launch vehicle reaction control propulsion. Non-toxic technologies could range from pump fed or pressure fed thruster systems from 1 to 1000 lbf.

Specific technologies of interest to meet proposed engine requirements include:

- Non-toxic mono- and bi-propellants that meet performance targets (as indicated by high specific impulse and high specific impulse density) while improving safety and reducing handling operations as compared to current state-of-the-art storable propellants.
- Alternate catalysts, ignition technologies to ignite advanced monopropellants.
- Advanced materials capable of withstanding hot and corrosive combustion environment of advanced mono- and bi-propellants.
- Techniques that lower the cost of manufacturing complex components such as injectors, catalysts, and combustion chambers. Examples include, but are not limited to, development and demonstration of rapid prototype techniques for metallic parts, powder metallurgy techniques, and application of nano-technology for near net shape manufacturing.

Note to Proposer: Subtopic S3.02 under the Science Mission Directorate also addresses in-space propulsion. Proposals more aligned with science mission requirements should be proposed in S3.02.

For all above technologies, research should be conducted to demonstrate technical feasibility during Phase I and show a path toward Phase II demonstration, and delivering a demonstration package for NASA testing at the completion of the Phase II contract.

Phase I Deliverables - Research to identify and evaluate candidate technology applications to demonstrate the technical feasibility and show a path towards a demonstration. Bench or lab-level demonstrations are desirable. The technology concept at the end of Phase I should be at a TRL range of 3-4.

Phase II Deliverables - Emphasis should be placed on developing and demonstrating the technology under simulated mission conditions. The proposal shall outline a path showing how the technology could be developed into mission-worthy systems. The contract should deliver a demonstration unit for functional and environmental testing at the completion of the Phase II contract. The technology concept at the end of Phase II should be at a TRL range of 4-6.