NASA SBIR 2018 Phase I Solicitation

Z7.03 Deployable Aerodynamic Decelerator Technology

Lead Center: LaRC

Participating Center(s): ARC, GRC, JSC, MSFC

Technology Area: TA9 Entry, Descent and Landing Systems

Background: NASA is developing deployable aerodynamic decelerators to enhance, and enable, robotic and human missions to destinations such as Mars, Venus, and Titan, as well as returning payloads to Earth from Low Earth Orbit (LEO).Â The biggest challenge facing Entry, Descent and Landing systems is the delivery of human class missions to the surface of Mars.Â One benefit of deployable decelerators is that a relatively large atmospheric entry vehicle can be packed into, and deployed from, a comparatively small space transit vehicle. Eliminating these entry vehicle size constraints imposed by the launch system enables delivery of very large (20 metric tons or more) of usable payload required to support Mars human exploration. For reference, it is estimated that safely landing 20 metric tons may need a deployable diameter as large as 20 meters.Â The technology also allows for the return of payloads from LEO and recovery of launch assets that will reduce the cost of space access. This subtopic area solicits innovative technology solutions applicable to deployable entry vehicles. Specific technology development areas include:Â

- Advancements in woven and non-woven textile technologies that can be used in the design and production of mass efficient flexible thermal protection systems (TPS) such as durable, high-temperature fibrous insulators capable of efficiently suppressing both radiation and convective heat transfer at temperatures above 1200Â° C. TPS concepts must be flexible to allow compact stowage.Â They can be passive approaches that do not rely on decomposition to manage heat loads, or active systems, such as phase change approaches, that enhance thermal management capability. Reusable concepts and/or materials, capable of surviving multiple atmospheric entries, are of particular interest. Focus of Phase I development can be subscale manufacturing demonstrations that lead to Phase II manufacturing scale up that is relevant to Mars human exploration.
- Concepts that augment the drag of rigid or deployable hypersonic aerodynamic decelerators subsequent to the hypersonic entry phase. Envisioned secondary decelerator systems would be activated after the entry heat pulse during the earliest stages of the supersonic regime.Â Devices can be either deployable or rigid design concepts, but must be suitable for, and scalable to, a Mars human exploration architecture. Inflatable structural designs and deployment methods for a secondary decelerator that augment drag over the primary decelerator by a factor or 2 to 4 are to be considered. Phase I proof of concept and preliminary design requirements that will lead to a demonstration under a Phase II effort are of interest.
- Inflatable structural concepts with non-axisymmetric geometries, or features, that provide lift for flight control during atmospheric entry.Â Envisioned concepts can be deployed or adjusted to provide active flight control to improve landing accuracy. Concepts that provide lift-to-drag ratios of 0.1 to 0.2 during hypersonic flight conditions appear to be sufficient for human exploration of Mars. Lift-to-drag ratios of 0.8 or more may provide benefit, or may be enabling, for other destinations with atmospheres. Innovations can include

morphing concepts, drag modulators, or center of gravity offset approaches. Thermal management and response time should be addressed. Phase I proof of concept and preliminary design requirements that will lead to a demonstration under a Phase II effort are of interest.