



NASA STTR 2016 Phase I Solicitation

T12.03 Increasing Predictability of Softgoods Material Behavior for Inflatable Space Structures

Lead Center: LaRC

Participating Center(s): JSC

This subtopic is seeking innovative design and fabrication methodologies that increase the predictability and repeatability of the mechanical behavior of softgoods material architectures, including broadcloth, webbing and cordage that are used in expandable space habitats. To date, high-strength softgoods materials used in deployable habitats have been manufactured to industrial or Mil-Spec standards that only require meeting a minimum strength requirement for acceptance. NASA is seeking high-strength softgoods material architectures and processes that significantly improve pristine repeatability on strength and stiffness, and provide improved predictability of mechanical properties when loaded over time. In addition, these materials may be packaged in an unloaded state for long periods of time prior to deployment, thus methods for maintaining predictability after a period of relaxation are being sought.

Integration of indicator fibers or yarns into these materials during manufacture is also of interest, to identify damaged or stressed areas of the softgoods during and after fabrication, and to provide a measure of the softgoods structural integrity over time. Post-fabrication integration of advanced health monitoring sensors, such as for strain and load, are covered under a separate subtopic.

NASA is also interested in modeling and simulation approaches that can model the effects and impact of the space environment (thermal, radiation, vacuum) on these materials over time to maintain structural margins. These modeling techniques in combination with materials built for higher predictability and integrated health monitoring should allow prediction of residual strength and remaining safe life for missions of several years.

In summary NASA seeks innovations in:

- Designing and fabricating high-strength softgoods material architectures with highly predictable strength and stiffness in the pristine state, with improved predictability of long-term behavior after extended packaged or inflated conditions in a space environment.
- Integrating specialized indicator fibers or yarns into these materials during fabrication, to enable evaluation of structural integrity.
- Advanced modeling and simulation methodologies to predict mechanical behavior of these materials after long-term exposure to the space environment.

Contractors should prove the feasibility of proposed innovations using suitable analyses and small scale tests in Phase I. In Phase II, significant testing / fabrication or software capabilities should be developed and demonstrated. A Technology Readiness Level (TRL) at the end of Phase II of 4 is desired.

