NASA SBIR 2005 Phase I Solicitation

X2.02 Structures and Habitats

Lead Center: LaRC

Participating Center(s): AFRC, JSC, MSFC

This subtopic solicits innovative structural concepts, materials, and assembly techniques that support the development of modular space systems. Also needed is a criteria to judge the different concepts in terms of impact on the overall performance and weight. Structural concepts can include inflatable, erectable, deployable, or easily connected modules to create large space structures utilizing membranes, composites, or other material concepts. Modular units can provide reconfigurable structures, such as multiple-energy configurations using cables and linkages, compliant structures or mechanisms that adapt to varying surfaces, or multi-purpose integrated structures, such as load-bearing modular power distribution, thermal management, or radiation protection systems. Additionally, this subtopic includes research related to novel rotating devices, actuators, tribology, and seals. It further includes intelligent structural, electrical, and fluid interfaces to enable the assembly (or ‘self-assembly’) of modular systems.

Of particular interest are inflatable structures and habitats to minimize launch volume and costs. Large inflatable structures can be folded into compact packages for launch, pressurized for deployment once in space, and rigidized after deployment so that internal pressure is not required to maintain structural stiffness and shape.

New concepts, materials, and methods for in-space structures and habitats to enable humans to safely and effectively live and work in space are needed. Specifically, structures or habitats with integral radiation shielding, impact shielding, thermal management, and integral diagnostics/health monitoring capabilities are of interest as well as high strength-to-weight materials (e.g., foamed materials), structural elements, and beams that can be deployed or fabricated in situ. Development of smart and multifunctional modular structures, including the use of embedded sensors and actuators, is encouraged.

Also solicited are assembly technologies such as innovative connectors for joining and/or bonding techniques, module positioning and alignment concepts, component deployment or erection concepts, and component/module inspection and verification techniques. Structures and materials that support reconfigurable modular architectures are also solicited.

Modeling and structural testing techniques and analyses that support the design of modular structural concepts or their assembly are of interest. Two areas are of particular interest: one is controls-structures interaction (CSI).
techniques and the second one is hybrid-test and physics based-modeling approaches. Application of advanced
controls-structures interaction (CSI) techniques for measuring and controlling structural dynamics and geometry are
important. Solutions for incorporation of CSI techniques for controlling such inflatable structures are also highly
desirable. On hybrid modeling, ways to integrate test and physics-based models for cases where the physics-
based models are not sufficient is also desirable.