



## **NASA SBIR 2017 Phase I Solicitation**

### **Z8.04 Small Spacecraft Structures, Mechanisms, and Manufacturing**

**Lead Center: ARC**

**Participating Center(s): GSFC, JPL, LaRC, MSFC**

**Technology Area: TA12 Materials, Structures, Mechanical Systems and Manufacturing**

Smallsats, including cubesats, are quickly maturing technologically towards advanced capabilities, which will result in significant contributions to the achievement of NASA's scientific and exploration missions. In fact, smallsats are seriously being considered for complex, long duration missions to deep space locations and for Earth observing constellations. However, while smallsats have the benefit of small size and mass making them generally easier and cheaper to launch, many space applications require larger physical sizes or alternate structural architectures. These applications can be realized through the innovative blending of structural elements with other functional elements; reconfigurable, reusable structures; reliable deployment mechanisms and aggregation techniques; and novel manufacturing techniques driving the utility of smallsats even further. Three main thrust areas are envisioned for this subtopic.

#### **Structures**

In the area of smallsat structures, NASA is interested in materials and structural systems that optimize component or instrument packaging. This includes techniques to integrate or combine structural elements with other subsystem elements (multi-functionality; i.e., spacecraft chassis with electrical power management, or internal spacecraft communications). See related discussion below on Manufacturing on embedded systems into structures.

Also of interest are technologies that can allow aggregation of smaller elements in space to create larger structures that cannot be launched as a single element, or that do not have to be designed to withstand launch loads. This implies integrative structural technologies that can share or distribute power, communications or thermal resources between the individual building blocks that can be arranged to perform a specific function in space. Further, these systems of building blocks can be reconfigured once launched to enable in space assembly architectures.

#### **Mechanisms**

This area focuses on the stowage (during launch) and deployment (during space operations) of various elements and subsystems. Included in this category are deployable solar cell arrays, radiators, antennas or other mission-enabling elements. These deployable mechanisms should be reliable in a wide variety of space environments (LEO and/or deep space) and be compatible with existing smallsat architectures. Ideally, deployable mechanisms should include methods to verify proper deployment (i.e., latch sensors, etc.) and should also employ robust technologies such as motorized actuators versus passive stored energy systems such as springs. Inflatable and on-orbit reconfigurable systems are also of interest.

#### **Manufacturing and Materials**

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NASA is interested in technologies that take advantages of manufacturing advances as they apply to small spacecraft. Examples include model-based additive manufacturing technologies that can create fluid manifolds, propellant tanks, small thrusters, or unique geometries not currently possible via traditional manufacturing techniques. A related dimension to this area is multiple (or mass) production technologies that can be applied for the manufacturing of large numbers of spacecraft such as swarms or constellations. Other concepts involve integrating electrical components and interconnects within structural elements, especially when such integration results not only in mass savings, but also decreased integration and test flow timelines and increased overall systems reliability through the use of built-in-test approaches.

Finally, NASA is interested in manufacturing technologies using novel materials that are low mass/density yet compatible with high radiation and extreme temperature deep space environments.