# NASA STTR 2017 Phase I Solicitation

## T12.01 Advanced Structural Health Monitoring

**Lead Center: LaRC**

**Participating Center(s): ARC, GSFC, JSC, KSC**

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

Future manned space missions will require spacecraft and launch vehicles that are capable of monitoring the structural health of the vehicle and diagnosing and reporting any degradation in vehicle capability. This subtopic seeks new and innovative technologies in structural health monitoring (SHM) and integrated vehicle health management (IVHM) automated systems and analysis tools. Techniques sought include modular/low mass-volume systems, low power, low maintenance systems, and complete systems that reduce or eliminate wiring, as well as smart-sensor systems that provide processed data as close to the sensor and systems that are flexible in their applicability. Examples of possible automated sensor systems are: Surface Acoustic Wave (SAW)-based sensors, passive wireless sensor-tags, flexible sensors for highly curved surfaces, flexible strain and load sensors for softgoods products (broadcloth, webbing or cordage), direct-write film sensors, and others. Damage detection modes include leak detection, ammonia detection, micrometeoroid impact and others. Reduction in the complexity of standard wires and connectors and enabling sensing functions in locations not normally accessible is also desirable. Proposed techniques should be capable of long term service with little or no intervention. Sensor systems should be capable of identifying material state awareness and distinguish aging related phenomena and damage conditions in complex composite and metallic materials. Techniques and analysis methods related to quantifying material properties, density, microcrack formation, fiber buckling and breakage, etc. in complex composite, metallic and softgoods material systems, adhesively bonded/built-up and/or polymer-matrix composite sandwich structures are of particular interest. Some consideration will be given to the IVHM /SHM ability to survive in on-orbit and deep space conditions, allow for changes late in the development process and enable on orbit modifications. System should allow NASA to gain insight into performance and safety of NASA vehicles as well as commercial launchers, vehicles, inflatable structures and payloads supporting NASA missions. Inclusion of a plan for detailed technical operation and deployment is highly favored.

### State of the Art

Current tools for SHM are rudimentary and or need development for future space missions. Current data analysis methods are frequently non-ideal for the large scales of data needed for SHM analysis and/or require expert involvement in interpretation of data.

This technology enables:

- Monitoring of advanced structures/vehicles.
- Cost-effective methods for optimizing SHM techniques.
- Feasible methods for validating structural health monitoring systems.

Once developed this technology can be infused in any program requiring advanced structures/vehicles Aerospace companies are very interested in this enabling technology.

STMD/NASA/NARP/National - Directly aligns with NASA space technology roadmaps and Strategic Space Technology Investment plan.