The applications of advances in Nanotechnology are anticipated to have a profound impact on NASA’s future missions by offering significant advantages in terms of cost affordability and reliability from multifunctional materials. Nanotechnology enables systems performance beyond those expected from conventional materials. While many fundamental findings are reported in the literature, there is a strong need to focus efforts on the demonstration of real benefits provided by nanostructured material systems.

It is especially interesting to meet exploration challenges with the development of high strength-to-weight and multifunctionality possible from the unique combinations of desirable properties of the nano-structured materials. The promise of high strength-to-weight, multi-functional, nano-structured materials has led to intense interest in developing them for near-term applications for human spaceflight and exploration.

Nano-structured materials of interest include, but are not limited to, the utilization of single wall, carbon, nanotube-based composites, ceramic nanofibers, and bio/nano-inspired materials and composites.

Due to the size scale and fundamental physical properties of the structures involved, a successful proposal for applications development should demonstrate a mature understanding of nano-material synthesis and material quality, as well as incorporate the development and use of new characterization methodologies to fully assess the impact of the nano-structured materials upon a given matrix or system.

The specific focus of this subtopic will include, but not be limited to:

- New materials for structures and components offering significant mass reduction and increased strength with improved thermal conductivity, low permeability, low density, and improved damage tolerance through self-repairing mechanisms;
- Application of nano-structured materials to self-healing and self-repair materials and concepts;
- Nano-structured materials offering enhanced radiation protection;
- Development of nano-material systems that are resistant to large thermal fluctuations, radiation, electrostatic charging, abrasion, and micrometeoroid debris damage;
- Nano-materials for energy generation, storage, and distribution.