Revolutionary advances in radiation shielding materials and structures technologies are needed to protect humans from the hazards of space radiation during NASA missions. All particulate radiation species are considered, including electrons, protons, neutrons, alpha particles, light ions, heavy ions, etc. All space radiation environments in which humans may travel in the near future are considered, including low-Earth orbit, geosynchronous orbit, Moon, etc. The primary area of interest for this 2007 solicitation is radiation shielding materials systems for long duration lunar surface protection for humans. Lightweight radiation shielding materials systems for short-term in-space operations for humans are also of interest. The materials emphasis is on multifunctional materials, where two of the functions are, but not exclusively, radiation shielding efficiency and structural integrity. Radiation shielding design software to optimize multifunctional materials usage in specific designs is also of interest. Radiation shielding augmentation materials are part of this solicitation, along with associated software tools to minimize augmentation requirements. Research should be conducted to demonstrate technical feasibility during Phase 1 and to show a path toward a Phase 2 technology demonstration. Specific areas in which SBIR-developed technologies can contribute to NASA's overall mission requirements for advanced radiation shielding materials and structures include, but are not limited to, the following:

- Innovative lightweight radiation shielding materials and structures to shield humans in crew exploration vehicles, large space structures such as space stations, orbiters, landers, rovers, rigid habitats, inflatable habitats, spacesuits, etc.;

- Radiation laboratory and spaceflight data to validate the shielding effectiveness of radiation shielding materials and structures;

- Physical, mechanical, structural, and other relevant characterization data to validate and qualify multifunctional radiation shielding materials and structures;

- Comprehensive radiation shielding databases to enable designers to incorporate and optimize radiation shielding structural materials into space systems during all phases of the design process;

- Radiation shielding software, compatible with Multi-Disciplinary Optimization (MDO) analysis, for optimization of specific vehicle designs;

- Innovative processing methods to produce quality-controlled advanced radiation shielding materials of all forms - resins, fibers, fabrics, foams, microcomposites and nanocomposites, fiber-reinforced composites,
light alloys, and hybrid materials;

- Innovative fabrication techniques to fabricate advanced radiation shielding materials into useful products and structural components;

- Innovative manufacturing techniques to produce quality-controlled advanced radiation shielding products and structural components, including innovative scale-up methods for producing quality-controlled viable quantities of advanced radiation shielding materials and structures;

- Innovative commercialization strategies to introduce advanced radiation shielding materials and structures into the marketplace to enable availability of the technologies for use by NASA and the space exploration community;

- Innovative concepts to reuse, recycle, and reprocess materials and structures in space for use as radiation shielding materials and structures.