Revolutionary advances in radiation shielding technology are needed to protect humans from the hazards of space-radiation during NASA missions. All space-radiation environments in which humans may travel in the foreseeable future are considered, including low-Earth orbit, geosynchronous orbit, Moon, Mars, etc. All radiations are considered, including particulate radiation (electrons; protons; neutrons; alpha; light-to-heavy ions, with particular emphasis on ions up to iron; mesons; etc.) and including electromagnetic radiation (ultraviolet, x-rays, gamma rays, etc.). Technologies of specific interest include, but are not limited to, the following:

- Advanced computer codes are needed to model and predict the transport of radiation through materials.

- Advanced computer codes are needed to model and predict the effects of radiation on the physiological performance, health, and well-being of humans in space radiation environments.

- Innovative lightweight radiation shielding materials are needed to shield humans in aerospace transportation vehicles, large space structures such as space stations, orbiters, landers, rovers, habitats, space suits, etc. The materials emphasis should be on non-parasitic radiation shielding materials, or multifunctional materials, where one of the functions is radiation shielding.

- Non-materials and "out-of-the-box" radiation shielding technologies are also of interest.

- Laboratory and space flight data are needed to validate the accuracy of radiation transport codes.

- Laboratory and space flight data are needed to validate the effectiveness of radiation-shielding materials and non-materials solutions.

- Comprehensive radiation-shielding databases and design tools are also sought to enable designers to incorporate and optimize radiation shielding into space systems during the initial design phases.

- Accurate and reliable theoretical and phenomenological models are needed for the collision of radiation ions to generate the input database for transport phenomena. The models that give comprehensive results in a fast manner for broader (preferably whole) ranges of colliding ions, for ion energies from a few mega-electron volts to a few giga-electron volts are desirable. The information needed is as follows:
- Total, elastic, absorption, and fragmentation cross sections
- Spectral and angular distributions of producing particles
- Multiparticle fragmentations
- Cluster effects
- Meson production