



NASA SBIR 2011 Phase I Solicitation

X11 Radiation Protection

The SBIR topic area of Radiation Protection focuses on the development and testing of mitigation concepts to protect astronaut crews and exploration vehicles from the harmful effects of space radiation, both in Low Earth Orbit (LEO) and while conducting long-duration missions beyond LEO. Advances are needed in mitigation schema for the next generation of exploration vehicles inclusive of radiation shielding materials and structures technologies to protect humans from the hazards of space radiation during NASA missions. As NASA continues to form plans for long duration exploration, it has also become increasingly clear that the ability to mitigate the risks posed to both crews and vehicle systems by the space weather environment are also of central importance. This Radiation Protection Topic will have two sub-topics consisting of:

- Radiation Shielding.
- Alert and Warning Systems.

This first area of interest for the 2011 solicitation is radiation shielding materials systems for long-duration Galactic Cosmic Ray (GCR) and Solar Particle Event (SPE) protection capable of providing structural integrity for architectural element design, while also providing sufficient radiation protection. These material systems should likely possess other multi-functional properties such as thermal and/or MMOD protection, etc., therefore negating the need for the addition of parasitic shield mass. Neutron protection and high-energy electron protection are also of interest. Research should be conducted to demonstrate technical feasibility during Phase I and to show a path forward to Phase II technology demonstration. Physical, mechanical, structural, and/or other relevant characterization data to validate and qualify multifunctional radiation shielding materials and structures should be demonstrated. Advances are needed in:

- Innovative tailored materials for lightweight radiation shielding of humans and electronics for NASA missions.
- Innovative, multifunctional, integrated, or multipurpose structures (primary or secondary structure) for lightweight radiation shielding of humans and electronics for NASA missions.

Applications are expected to include space exploration vehicles including launch vehicles, crewed vehicles, and surface and habitat systems. Another area of interest in which SBIR-developed technologies can contribute to NASA's overall mission requirements are advances in the understanding and predictability of space weather science. Current operational space weather support utilizes both inter- and extra-agency assets to maintain situational awareness and mitigate radiation risks associated with agency missions. Operational space weather support consists in the most basic terms of maintaining situational awareness of both the state of the Sun as a physical system and the radiation environment and its dynamics within the Heliosphere, and altering in real-time, a mission in order to minimize their effects. Therefore, advances are needed in the development of scientific research products for real-time operational forecasting tools to mitigate mission risk. Research under this topic should be conducted to demonstrate technical feasibility during Phase I and show a path forward to Phase II hardware demonstration, and when possible, deliver a full-scale demonstration unit for functional and environmental testing at the completion of the Phase II contract.

Subtopics

X11.01 Radiation Shielding Materials Systems

Lead Center: LaRC

Participating Center(s): MSFC

Advances in radiation shielding materials technologies and systems are needed to protect humans from the hazards of space radiation during NASA missions. The primary areas of interest for this 2011 solicitation are radiation shielding materials systems for long-duration galactic cosmic radiation (GCR) and solar energetic particles (SEP) protection. Neutron protection and high-energy electron protection are also of interest. Research should be conducted to demonstrate technical feasibility during Phase I and to show a path toward a Phase II technology demonstration.

Physical, mechanical, structural, and/or other relevant characterization data to validate and qualify multifunctional radiation shielding materials should be demonstrated. Specific areas in which SBIR-developed technologies can contribute to NASA's overall mission requirements include the following:

- Innovative tailored materials for lightweight radiation shielding of humans.
- Innovative, multifunctional, integrated, or multipurpose structures (primary or secondary structures) for lightweight radiation shielding of humans.
- Innovative processes for developing radiation shielding materials.
- Smart, or sensing, radiation shielding materials.
- Radiation shielding materials demonstration experiments for MISSE (Materials International Space Station Experiment) or other ISS experiments.

X11.02 Integrated Advanced Alert/Warning Systems for Solar Proton Events

Lead Center: JSC

Advances are needed in alerts/warnings and risk assessment models that give mission planners, flight control teams and crews sufficient advanced warning of impending Solar Proton Event impact. Research and development should be targeted which leverages modeling techniques used throughout terrestrial weather for extreme event assessment. There is particular interest in development of models capable of delivering the probability of no SPE occurrence in a 24-hour time period, i.e., an "All-Clear" forecast.

Forecast techniques should utilize the historical record of archived SPEs to characterize model forecast validity in terms accepted metrics, i.e., skill score, false alarm rates, etc. Specific areas in which SBIR-developed technologies can contribute to NASA's overall mission requirements include the following:

Innovative forecasting solutions that leverage model development in other areas such as ensemble forecasting of hurricane tracks, flooding, financial market behavior, and earthquake prediction.

Innovative methods that integrate historical trending, real-time data, and fundamental physics-based models into advance warning and detection systems.