



## NASA SBIR 2011 Phase I Solicitation

### X16 Space Radiation

The goal of the NASA Space Radiation Research Program is to assure that we can safely live and work in the space radiation environment, anywhere, any time. Space radiation is different from forms of radiation encountered on Earth. Radiation in space consists of high-energy protons, heavy ions and secondary products created when the protons and heavy ions interact with matter such as a spacecraft, surface of a planet, moon, asteroid, or even the astronauts themselves. NASA requires instruments that can reliably measure these radiations. NASA has a need for compact active radiation detection systems that can meet stringent size, power, and performance requirements. These include real-time personal monitors and area monitors that can be used on the International Space Station (ISS) as well as on future missions beyond low-Earth orbit (LEO). Ending the Space Shuttle program will increase the need to replace the current passive monitoring technologies on the ISS with active ones to reduce up and down mass. Also, as missions extend beyond LEO there will be further premium on reduced size, mass, and power for radiation detection technologies. To achieve such reductions, there will be an increasing need for reliable miniaturized components such as sensors, photomultipliers, data processors, power supplies, and the like that can be used to enhance radiation detection technologies as they develop. Advanced technologies up to technology readiness level (TRL) 4 are requested in these and related areas.

## Subtopics

### X16.01 Radiation Measurement Technologies

Lead Center: ARC

NASA has a need for compact active radiation detection systems that can meet stringent size, power, and performance requirements. These include real-time personal monitors and area monitors that can be used on the ISS as well as on future missions beyond LEO. Ending the Space Shuttle program will increase the need to replace the current passive monitoring technologies on the ISS with active ones to reduce up and down mass. Also, as missions extend beyond LEO there will be further premium on reduced size, mass, and power for radiation detection technologies. To achieve such reductions, there will be an increasing need for reliable miniaturized components such as sensors, photomultipliers, data processors, power supplies, and the like that can be used to enhance radiation detection technologies as they develop. Advanced technologies up to technology readiness level (TRL) 4 are requested in these and related areas useful to NASA. Also, such advances would likely have potential customers outside NASA and in the commercial sector.

Metric and desired performance range:

---

## **Personal Monitors**

Sensitive to charged particles with LET of 0.2 to 500 keV/Å $\mu$ m and detect charged particles (including protons) with energies 30 MeV/n to 1000 MeV/n. Design goals for mass should be 0.25 kg and for volume, 250 cm<sup>3</sup>. The monitor should be able to measure dose rate and dose-equivalent rate at both ambient conditions in space (0.01 mGy/hr) and during a large solar particle event (100 mGy/hr). Total power requirement should be in the 1 W range. Monitors shall perform data reduction internally and display dosimetry data in real time.

## **Area Monitors**

Same as Personal Monitors but extend LET to 1000 keV/Å $\mu$ m and must also detect neutrons between 0.5 MeV and 150 MeV. Design goals for mass should be 1 kg and for volume should be 1000 cm<sup>3</sup>. Total power requirement should be less than 2 W. Monitors shall perform data reduction internally and display dosimetry data in real time.

## **Components**

These may include but are not limited to compact sensors with excellent response to space radiation (e.g., novel scintillation crystals, organic semiconductors, photodiodes), compact low-noise solid state photomultipliers that require less than 0.5 W of power, data processors not to exceed 0.2 W that can perform multi-channel analysis, low noise power supplies that require less than 0.3 W of power.

Phase I Deliverables: Proof of concept of the technologies requested.

Phase II Deliverables: Prototypes or components of the monitoring technologies meeting the requirements indicated.