NASA STTR 2007 Phase I Solicitation

T1.02 Space Radiation Dosimetry and Countermeasures

Lead Center: ARC

As NASA embarks on its exploration agenda, the study of space radiation environments and associated health risks to astronauts will continue to guide radiation detection technology development and mitigation strategies. The development of suitable radiation detection technologies (both physical and biological) is vital to the success of long-term manned spaceflight. As NASA returns to the Moon and then on to Mars, a series of small, unmanned missions are anticipated followed by manned missions, including long-term (6 months) stays on the surface of the Moon. It is anticipated that the unmanned missions (e.g., small satellites that may even land on the Moon) will provide test beds for new and emerging miniaturized technologies that can be further evaluated on manned missions including on the lunar base. Prior to testing in space, the technologies must be tested using simulated space radiations available at the National Space Radiation Laboratory (NSRL), a NASA funded facility at the Brookhaven National Laboratory in New York. The NSRL is capable of generating high-energy particle radiation from protons to 56Fe nuclei. NASA also supports a facility at Loma Linda University Medical Center capable of generating energetic protons. These facilities enable research studies and technology development in support of NASA funded research. NASA is seeking innovative technologies in the areas described below.

Radiation Measurement Technologies for Small Spacecraft

NASA Ames is interested in flying small spacecraft payloads that measure radiation levels alone as well as in combination with biological payloads. In support of this objective, NASA Ames is seeking:

- Small radiation detectors that measure total dose equivalent;
- Miniaturized, radiation-hardened electronics;
- Technologies for combined radiation and biology payloads.

These technologies must minimize the use of power, volume, and mass, and provide what is needed to interface to a spacecraft bus. In the case of biological payloads, a pressurized environment, and environmental control including consideration of gas, thermal control, and humidity needed to support the biology experiment, must be

provided. Biological experiments ranging from cells to small organisms are of interest.

Radiation Health Monitoring Techniques

Technologies are needed to monitor the adverse effects of spaceflight radiation on human health. The following are of interest:

- Methods that are minimally invasive to the crew and provide monitoring of the biological effects of radiation;
- Application of high throughput analyses and genomic, proteomic, and metabolomic approaches used for other biological problems to space radiation effects;
- Concept and technology development of miniaturized spaceflight devices from existing laboratory-based devices to support the analyses described above.