NASA SBIR 2004 Phase I Solicitation

X2.07 Space Environmental Effects

Lead Center: KSC

Participating Center(s): ARC, GSFC

This subtopic is soliciting proposals for space environmental effects with emphasis on the development of materials and equipment for spacecraft and space habitats either robotic or human. Space Environmental Effects encompasses all effects of the Space Environment on spacecraft design, performance, launch, and operation. Among the environments considered are meteoroids and debris, ionizing radiation, spacecraft charging and plasma interactions, material interactions, dusty planetary surfaces, and Low Earth Orbit (LEO) specific environments (such as atomic oxygen and atmospheric drag), as well as the synergistic effects of the different environments. We are looking for radiation protection to 200 krad total dose and operation in environments ranging from $1 \times 10^{-12}$ torr to 7-torr dusty CO$_2$ atmospheres with dust particle sizes in the 1–10 μm range and particle velocities reaching 30 m/s. We are interested in materials and equipment that are able to withstand temperatures ranging from -193°C to 130°C, collisions with micrometer-to-millimeter size micrometeorites and fragmented space debris moving at velocities from 5–70 km/s. Full sun effects are expected to last for 17 day and night cycles.

We are interested in theoretical models, tools, ground-based environmental simulations, and space flight experiments to determine the effects of space environments on spacecraft flying through them. From these models, we should be able to derive effects on semiconductors, material degradation, and shielding effectiveness. We are looking for proposals that will develop proof-of-concept demonstrations of mitigation techniques of the deleterious effects of the space environment, such as special coatings, processes, designs, or materials hardened-by-design.

We are looking for proposals to develop screening, shielding concepts, component selection techniques, and/or manufacturing processes that will make it possible to cope with the radiation effects in the space environment.

We are looking for proposals for the development of clear antistatic coatings that can withstand exposure to the rigors of the space environment as well as for the development of adhesives which would allow the application of these coatings to flexible and rigid materials used in space suits, planetary landers and rovers, and in the instrumentation on board these craft.

We are looking for proposals that will develop techniques to modify the electrostatic properties of several polymers used in space applications that have long charge decay times. The modifications should result in charge dissipation times short enough to enable the reclassification of these polymers as statically dissipative instead of electrically...
insulating. These modifications should not change the physical and chemical properties that make these polymers usable for space applications. Proposals for the development of instrumentation or techniques to monitor electrostatic fields remotely are also needed. These instruments should operate inside spacecraft and space habitats at distances ranging from a few centimeters to several meters and work at relative humidities ranging from 0%–70%. Similar instruments that operate outside closed environments on planetary surfaces, at larger distances (in the meter to kilometer range) are desired.

We are looking for proposals that will develop techniques to prevent the accumulation of dust on surfaces of structures, spacesuits, landers, rovers, and habitats exposed to the dusty environments of Mars and the Moon. These techniques should require low power and be lightweight.