NASA SBIR 2007 Phase I Solicitation

X8.03 Nuclear Surface Power

Lead Center: GRC

Participating Center(s): MSFC

NASA is interested in the development of highly advanced systems, subsystems and components for use with fission and isotopic power systems for future lunar and Mars robotic and manned missions. Proposals are sought for critical technologies for fission and isotopic power systems to meet the following anticipated missions and applications.

The current Vision for Space Exploration identifies the first human lunar landing in 2017 with subsequent longer duration stays of approximately 6 months in 2021. Fission-based systems are anticipated to enable the long duration stay over the lunar night and for "global access" Mars missions. Initial planetary outpost power levels are anticipated to be between 30-50 kWe with anticipated growth to 100's kWe, accommodating resource production and advanced life support habitation, which require additional power.

Planetary surface human base applications include: habitats, propellant production/liquefaction/maintenance, surface mobility for both robotic and piloted rovers, excavating and mining equipment and science applications such as: deep drilling, resource production demos, weather stations, etc. Isotopic technologies are needed for unique space environments that improve the utilization of a limited fuel supply and have extensibility to fission systems.

Specific technology topics of interest are:

- Advanced, high efficiency, high temperature power conversion less than 20%;
- Electrical power management, control and distribution (1000-5000 V);
- High temperature, low mass thermal management/heat rejection less than 6kg/m²;
- Deployment systems/mechanisms for large radiators, surface mobility systems for remote emplacement of power systems, innovative methodology for use of indigenous shielding materials;
• High temperature materials or coatings compatibility with local soil and atmospheric environments;

• Systems/technologies to mitigate planetary surface environments. Dust accumulation, wind, planetary atmospheres, (CO₂, corrosive soils, etc.); 

• Power system design considerations for long life (greater than 10 years), autonomous control and operation, including sensor and control technologies;

• Radiation tolerant systems and materials enabling robust, long life operation;

• Innovative methodologies and approaches to accelerated life testing.

In addition to reducing overall system mass, volume and cost, increased safety and reliability are of extreme importance. It is envisioned that these technologies will be used on robotic and human missions and it is to NASA’s advantage to develop those technologies that satisfy both robotic and human mission requirements.