NASA SBIR 2007 Phase I Solicitation

S3.03 Power Generation and Storage

Lead Center: GRC

Participating Center(s): GSFC, JPL, JSC

Future NASA science missions will employ Earth orbiting spacecraft, planetary spacecraft, balloons, aircraft, surface assets, and marine craft as observation platforms. Proposals are solicited to develop advanced power conversion, energy storage, and power electronics to enable or enhance the capabilities of future science missions. The requirements for the power systems for these missions are varied and include long life capability, high reliability, significantly lower mass and volume, higher mass specific power, and improved efficiency over the state of practice (SOP) components/systems. Other desired capabilities are high radiation tolerance, and ability to operate in extreme environments (high and low temperatures and over wide temperature ranges).

Advanced Photovoltaic Energy Conversion

- Photovoltaic cell and array technologies with significant improvements in efficiency (>30%), mass specific power (>600W/kg), stowed volume, cost, radiation resistance, and wide operating conditions are solicited;
- Photovoltaic cell technologies for low intensity, low-temperature operation (LILT) are solicited;
- Array technologies of interest are concentrators, deployable arrays, ultra-lightweight arrays for flexible, thin-film cells, and electrostatically-clean solar arrays.

Stirling Power Conversion

Novel methods or approaches for radiation-tolerant, sensorless, autonomous control of the Stirling converters with very low vibration and having low mass, size, and electromagnetic interference (EMI). Technologies of interest include:

- High-temperature, high-performance regenerators;
- High-temperature, lightweight, high-efficiency, low EMI, linear alternators;
• High-temperature heater heads (> 850°C) and joining techniques.

Energy Storage

Energy storage requirements for Science mission are: >10,000 charge/discharge cycles for LEO spacecraft, as low as 40K low-temperature storage/operation for planetary missions, and high mass specific power for small spacecraft. Energy storage technologies that enable one or more of the above requirements are of interest. Technologies of interest include:

• Fuel cells;
• Batteries including structural batteries;
• Integrated power systems (generation/storage/control integrated into one module).

Power Management and Distribution

Advanced electrical power technologies are required for the electrical components and systems on future platforms to address the size, mass, efficiency, capacity, durability, and reliability requirements. In addition to the above requirements, proposals must address the expected improvements in energy density, speed, efficiency, or wide-temperature operation (-125°C to 200°C) with a high number of thermal cycles. Advancements are sought in power electronic devices, components, and packaging. Technologies of interest include:

• Power electronic components and subsystems;
• Power distribution;
• Fault protection;
• Advanced electronic packaging for thermal control and electromagnetic shielding.