NASA SBIR 2004 Phase I Solicitation

E2.06 Energy Conversion for Space Applications

Lead Center: GRC

Participating Center(s): GSFC

Earth science observation missions will employ spacecraft, balloons, sounding rockets, surface assets, and piloted and robotic aircraft and marine craft. Advanced power technologies are required for each of these platforms that address issues of size, mass, capacity, reliability, and operational costs. A vigorous effort is needed to develop energy conversion technologies that will enable the revolutionary Earth science missions. Exploiting innovative technological opportunities, developing power systems for adverse environments, and implementing system-wide techniques that promote scalability, adaptability, flexibility, and affordability are characteristic of the technological challenges to be faced and are representative of the type of developments required beyond the current state-of-the-art.

The energy conversion technologies solicited include photovoltaics, Brayton, Rankine, Stirling, and thermophotovoltaic, as well as related technologies such as concentrators and thermal technologies. Specific areas of interest follow.

- Photovoltaic cell and array technologies with significant improvements in efficiencies, cost, radiation resistance, and wide operating conditions are solicited. Potential concepts include rigid arrays, concentrator configurations, and ultra-lightweight array technologies that exploit the properties of lightweight, flexible thin-film photovoltaic cells. Photovoltaic cell and array technologies for extreme environments such as high- or low-temperature operation are solicited. Technologies for electrostatically-clean spacecraft solar arrays are also of interest.

- Future micro-spacecraft require distributed power sources that are integrated with microelectronics devices/instruments. These microelectronic devices/instruments integrate energy conversion and storage into a hybrid structure.

- Thermal power conversion technologies for Earth orbiting spacecraft and/or orbit transfer vehicles are sought.

- Advances may be in solar concentrators (rigid or inflatable, primary or secondary) and receivers to improve specific power and reduce mass.

- Topics of interest in power conversion include heat cycles (Brayton, Rankine, and Stirling), compact heat...
exchangers, advanced materials and fabrication techniques, and control methods, as they relate to life, reliability and manufacturability.

- Thermal technology areas include heat rejection, composite materials, heat pipes, pumped loop systems, packaging and deployment, including integration with the power conversion technology. Highly integrated systems are sought that combine elements of the above subsystems to show system level benefits.