NASA SBIR 2005 Phase I Solicitation

S2.04  Deep Space Power Systems

Lead Center: GRC

Participating Center(s): GSFC, JPL, JSC

Innovative concepts using advanced technology are solicited in the areas of energy conversion, power electronics, and power system materials. Power levels of interest range from milliwatts to 1 KW. NASA Space Science missions in deep space environments require energy systems with long life capability, high radiation tolerance, reliability, and low overall costs (including operations) which can operate in high and low temperatures and over wide temperature ranges. Advanced technologies are sought in the following areas:

Energy Conversion

All proposed energy conversion technologies must be able to show substantial increases over state-of-the-art in efficiency and specific power (W/kg) and to operate in deep-space environments with high radiation and wide-temperature operations (-200°C to 300°C). Long-life (>14 years), highly reliable advanced energy conversion technologies are sought that keep manufacturability in mind. Advances in photovoltaic technology are sought, including high power solar arrays and ultra lightweight, thin film, and concentrator arrays. Advances in radioisotope thermal to electric power conversion technology (milliwatt/multiwatt and 100W-1KW classes with efficiencies (state-of-the-art) are sought. This includes advances in thermophotovoltaics, thermoelectrics, Brayton, Rankine, and Stirling technologies as well as compact heat exchangers. Innovative control methods are also sought.

Power Electronics

Advanced power electronic materials and devices for deep-space power systems are sought. The materials of interest include soft magnetics, dielectrics, insulation, and semiconductors. Devices of interest include transformers, inductors, electrostatic capacitors, high-power semiconductor switches and diodes, and integrated control and driver circuits. Proposed technologies must improve upon the following characteristics: high temperature operation (>200°C), low-temperature (cryogenic) operation, wide-temperature operation (-125°C to 200°C), and/or high levels of space radiation (>150 krad) resistance.

Electronics Packaging and Materials

Advanced electronics packaging technologies that reduce volume and mass capable of either high temperature, cryogenic, wide temperature operation, and/or space radiation resistance for use in space power systems are of interest. Advances are sought in power electronics packaging materials, surfaces, and components that are
durable for soft X-ray, electron, proton, and ultraviolet radiation and thermal cycling environments.