



## NASA SBIR 2011 Phase I Solicitation

### X8.03 Space Nuclear Power Systems

Lead Center: GRC

Participating Center(s): JPL, JSC, MSFC

NASA is developing fission power system technology for future space transportation and surface power applications using a stepwise approach. Early systems are envisioned in the 10 to 100 kWe range that utilize a 900 K liquid metal cooled reactor, dynamic power conversion, and water-based heat rejection. The anticipated design life is 8 to 15 years with no maintenance. Candidate mission applications include initial power sources for human outposts on the moon or Mars, and nuclear electric propulsion systems (NEP) for Mars cargo transport. A non-nuclear system ground test in thermal-vacuum is planned by NASA to validate technologies required to transfer reactor heat, convert the heat into electricity, reject waste heat, process the electrical output, and demonstrate overall system performance.

The primary goals for the early systems are low cost, high reliability, and long life. Proposals are solicited that could help supplement or augment the planned NASA system test. Specific areas for development include:

- 900 K NaK heat transport loops, including pumps and accumulators.
- 10 kWe-class Stirling and Brayton power conversion devices.
- 450 K water heat rejection loops, including pumps and accumulators.
- Composite radiator panels with embedded water heat pipes.
- Radiator deployment mechanisms and structures.
- Radiation tolerant materials and components.
- 120 V - 1k V power management and distribution (PMAD) for high power DC and AC systems, 1 kW to 100 kW respectively.

The NASA system test is expected to provide the foundation for later systems in the multi-hundred kilowatt or megawatt range that utilize higher operating temperatures, alternative materials, and advanced components to

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improve system performance. For the later systems, specific power will be a key performance metric with goals of 30 kg/kWe at 100 kWe and 10 kg/kWe at 1 MWe. Possible mission applications include large NEP cargo vehicles, NEP piloted vehicles, and surface-based resource production plants. In addition to low cost, high reliability, and long life, the later systems should address the low system specific mass goal. Proposals are solicited that identify novel system concepts and methods to reduce mass and increase power output. Specific areas for development include:

- High temperature reactor fuels and structural materials.
- Reactor heat transport technologies for 1100 K and above.
- 100 kWe-class Brayton and Rankine power conversion devices.
- Waste heat rejection technologies for 500 K and above.