NASA SBIR 2018 Phase I Solicitation

Z1.03 Fission Surface Power Generation

Lead Center: GRC

Participating Center(s): JPL, JSC

Technology Area: TA3 Space Power and Energy Storage

NASA is considering the use of kilowatt class Fission Power Systems for surface missions to the moon and Mars.Â Current work in fission power systems is focused on the Kilopower project which uses a highly-enriched Uranium-Molybdenum reactor core with a Beryllium oxide reflector.Â Depleted uranium, tungsten, and lithium hydride provide shielding of gamma rays and neutrons to the power conversion system, control electronics, payload, and habitat.Â Heat is removed from the core at approximately 800Â° C using sodium heat pipes and delivered to dynamic power conversion systems with conversion efficiencies over 25%.Â Waste heat is removed from the power conversion system at approximately 100Â° C using water heat pipes coupled to aluminum or composite radiator panels.Â The Kilopower project targets the 1-10 kW power range with most previous work focused on a demonstration of the 1 kWeÂ design.Â The current solicitation is focused on innovations that enable the scaling of the 1 kWeÂ design to 10 kWe, with a specific focus on surface power applications.Â Â Areas of interest include:Â

- Isolation of core, heat pipes, and convertor hot end from Martian environment with minimal impact to neutronics.
- Thermal interface methods including bonding of heat pipes to the core and direct coupling of heat pipes to power conversion (both hot and cold side).
- Reduction in shield mass through:
    - Increased radiation tolerance of electronics including power electronics, control electronics, and instrumentation.
    - Increased distance from core with mass effective PMAD and transmission or lightweight possibly retractable booms.
- Robust and reliable power conversion and controller technology.Â Power conversion can consist of multiple lower power units which could be combined to create 10 kW of electric power.Â Power conversion must be reliable and robust while maintaining at least 25% efficiency from heat in to usable electric output from PMAD.
- Compact/stowable heat rejection.Â Options could include flexible / deployable heat pipe radiators or alternatives that make use of the Martian atmosphere for cooling.