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PLANS AND CONCEPTS FOR A NEW GENERATION OF RTGS FOR PLANETARY SCIENCE MISSIONS

Abstract

Of the six types of radioisotope thermoelectric generators (RTGs) NASA has flown in space, only the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) is available for spaceflight, and it relies on technology first used for RTGs in the 1970s. The MMRTG is a rugged power system capable of delivering 110W at launch. Its 69 x 65 cm dimensions makes this generator a good fit for compact spacecraft or ones with modest power demands. NASA is considering future missions with higher power demands, however and requested that concepts and plans to address those needs be formulated.

NASA's Radioisotope Power Systems (RPS) Program set the objective for a study to explore what possible options NASA has for a next generation of RTGs. The scope and breadth of the study included many possible destinations within the solar system, and traded a variety of RTG conceptual designs and risk rated a variety of thermoelectric materials and couple configurations. Requirements were defined for the RTG concepts, a variety of thermoelectric materials were evaluated to find the most mature candidates, and performance was estimated for each RTG concept that could use the most mature of these new thermoelectric materials.

The study relied upon mission analyses of mission concepts outlined in the latest Planetary Science Decadal Survey (2011), other more recent mission studies completed throughout the agency, and recent analyses of potential mission to Ocean Worlds to identify requirements that were not applied to previous RTGs but might prove valuable to next-generation RTGs. In addition, destinations within the solar system were analyzed against mission types, including flybys, orbiters, atmospheric probes, aerial vehicles, landers (static, roving, floating, and submersible), melt probes, and possible sample return, to identify new requirements.

The RTG concepts with maximal potential utility were identified as being modular and ranging in power output from 50 to 500W at fueling. Top-level driving requirements were agreed upon that would anchor the technology maturation implementation efforts that would be required to achieve those power levels. A variety of RTG design concepts with several distinguishing architectural characteristics were formulated and will be discussed here, along with performance estimates of the designs and a plan or roadmap to potentially bring these new RTGs to fruition using industrial partners.

Pre-decisional – For Planning Purposes Only