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Introduction:

The Radioisotope Power Systems (RPS) Technology Advancement Project (TAP) is the technology development project of the RPS Program managed out of the Glenn Research Center (GRC).

The objectives of the TAP are twofold: develop new technologies for advanced radioisotope power systems and sustain critical NASA RPS capabilities and infrastructures that are vital to the development and implementation of flight systems. These objectives flow directly from the RPS Program Plan. The TAP works closely with the RPS program office to plan, establish and prioritize the TAP content and resources required to implement the project. The goal of TAP is to identify, develop and mature promising technologies to the point they can be transferred to a flight development project.

The main customers/beneficiaries of the TAP are the Planetary Science Division, the flight missions/projects they sponsor, and the science community. By increasing the conversion efficiency, specific power, and system life of future potential systems, the TAP provides mission and system designers with more capability, flexibility, and reliability in their RPS choices. This provides the science community with additional mission capabilities and enables new discoveries.

The approach TAP uses is to fund promising energy conversion and other associated technologies. The TAP portfolio is comprised of low to mid-Technology Readiness Level (TRL) tasks, ranging from fundamental materials science to technology maturation and demonstrations, performed at GRC and the Jet Propulsion Lab (JPL) with significant support from industry and academia.

TAP is divided into two main technology areas, thermoelectric energy conversion, led by JPL, and dynamic energy conversion, led by GRC.

Dynamic Energy Conversion. The TAP Dynamic Energy Conversion tasks are focused on advancing the state of the art of Stirling convertors. The GRC Thermal Energy Conversion Branch leads the tasks in this area and has a long history and significant expertise with Stirling convertors. Recent efforts have focused on understanding how certain key component technologies improve the performance and enhance reliability at the system level. As such, TAP has identified technology candidates for potential flight systems and their usefulness and effectiveness will be evaluated through design development and prototype demonstrations. These potential systems are a small RPS 80W system, an upgraded Stirling Radioisotope Generator (SRG) 150W class system configuration leading to a potential larger system in the 500W range.

Thermoelectric Energy Conversion. The Thermoelectric (TE) tasks are separated into three tasks spanning the full range of TRLs from 0 to 5. The first is the Advanced TE Materials task that combines fundamental experimental and theoretical materials science for the discovery and engineering of novel high performance compounds that may enable a threefold increase in conversion efficiencies over state-of-practice technologies. The second is the Advanced Thermoelectric Couples (ATEC) task that matures high performance component technologies, inherited from the Advanced TE Materials task, and develops long life advanced thermoelectric couples capable of supporting an advanced Radioisotope Thermal Generator (RTG) with at least 10% system conversion efficiency in the near term and 15% efficiency in the longer term. The third task is dedicated to develop to TRL 5 the most mature ATEC technology while at the same time helping sustain critical industry capabilities. This Technology Maturation task could lead to the development of an enhanced Multi-Mission Radioisotope Thermal Generator (MMRTG) that would offer a 50% increase in power at end-of-mission while preserving the form factor and interfaces of the MMRTG.

The presentation will describe the current technology portfolio, the roadmap to achieve mid and long term goals and the strategies to decide on adding new technologies to the project, while ending investment in others. It will discuss the potential for an NRA to be released in future.