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ADVANCED STIRLING RADIOISOTOPE GENERATOR (ASRG) - DEVELOPMENT STATUS AND POTENTIAL NEAR-TERM MISSION APPLICATIONS

Abstract

The United States (US) is developing a new radioisotope power system (RPS) for deep space missions. The new RPS is being developed jointly by the US Department of Energy (US DOE) and the National Aeronautics and Space Administration (NASA). The Advanced Stirling Radioisotope Generator (ASRG) is designed to deliver 128W at the beginning of mission, with a mass of no more than 36 kg. Stirling cycle engines are used to convert the heat flux from the slow natural decay of plutonium-238 (in the form of plutonium dioxide) to electrical power. Control avionics are used to synchronize the operation of the free-piston-Stirling engines and rectify the alternating current (AC) output for use on a direct current spacecraft power bus. The goal of the ASRG project is to provide an RPS that provides similar power levels to earlier generations of thermoelectric-based RPS, using considerably less fuel per generator.

In 2010, NASA established the RPS program office to guide development of the agency's RPS power systems. The ASRG project is jointly managed by the US DOE and NASA Glenn Research Center. At present, three NASA Discovery-class missions are competing for a potential 2016 launch opportunity; two of these missions have proposed using the ASRG as the spacecraft power system. The two proposed missions involving ASRG are the Titan Mare Explorer (TiME) and the Comet Hopper (CHopper). A decision is expected from NASA Headquarters by mid-summer 2012 on a final selection for the 2016 opportunity.

The ASRG project is presently in the final design review phase. The system level Final Design Review was originally conducted in summer of 2011. The independent review board presented several additional questions for the project management team, and the result was an extended final design phase that reached into 2012. The extended design time has been used to complete a more robust and more manufacturable design, adding confidence to the reliability analysis supporting the unit's 17-year operational lifetime requirement. A complete status of the build and test phase of the ASRG project will be presented in the final paper.