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STIRLING ENGINE RADIOISOTOPIC POWER SYSTEM FOR SPACE APPLICATIONS

Abstract

Radioisotope Power Systems (RPS) which generate electrical power by converting heat released from the nuclear decay of radioisotopes into electrical energy are a key enabling technology for future missions to the outer planets and long duration lander and rover missions. To date, on space missions using an RPS, this conversion process has been achieved using a device called a Radioisotope Thermoelectric Generator (RTG) which converts the heat released by the decay of a suitable radioactive material into electricity by the Seebeck effect using an array of thermocouples. RTGs are relatively compact, have no moving parts and have demonstrated proven long term reliability. On the downside, even state-of-the-art RTGs, have a conversion efficiency of less than 7Other, more efficient, technologies are available for converting the heat released from the nuclear decay of radioisotopes into electrical energy and in recent years there has been much interest in the development of a high efficiency power conversion system for space radioisotopic systems. In particular, the development of a Stirling engine based power conversion system. A Stirling engine is a device that converts heat energy into mechanical power by alternately compressing and expanding a fixed quantity of air or other gas at different temperatures. It is noted for its high efficiency, quiet operation and the ease with which it can utilise almost any heat source. Existing work has shown that a 30This paper derives the requirements for a Stirling engine radioisotopic power system for space applications, identifies potential architectures to meet these requirements, highlights possible problem areas and provides potential solutions for these perceived problems.