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Author: Mr. Donald Palac
NASA Glenn Research Center, United States, d.palac@nasa.gov

FISSION POWER: ABUNDANT POWER FOR SOLAR SYSTEM EXPLORATION

Abstract

Since the development and demonstration of the systems technologies of the turbojet engines and rocket engines during the 1940's by England and Germany, aerospace technology development has largely focused on improvements to existing systems. Jet engines have become highly efficient turbofans, rockets now operated at combustion chamber pressures of thousands of pounds per square inch to produce high thrust at high fuel efficiency, and airplanes travel reliably and efficiently literally around the world. Space power systems have benefitted from dramatic increases in solar cell efficiency, and improvements in chemistry and design of batteries and fuel cells promise high gains in energy storage. However, no space fission power system is available today for space mission applications, and the readiness of this system technology remains to be demonstrated.

Since 2006 a NASA/DOE team has been laying the groundwork for demonstration of space fission power system technology readiness in a relevant environment. A reference concept was selected based on a Constellation lunar or Mars surface power system application, and preparation of the elements of a technology demonstration were begun. Candidate technologies for non-nuclear reactor simulation, heat transfer loop, power conversion, heat rejection, and power management and distribution elements were identified and tested via "Pathfinder" reduced-scale test articles. Lessons learned from Pathfinder testing were used to plan the Fission Power System Technology Demonstration Unit (TDU) development project. In 2010-2011, major elements of the TDU were designed and built, or are in fabrication. The current schedule, subject to FY12 budget definition, calls for completion of the TDU test program by the end of FY14. Successful completion of TDU test and analysis will mark the establishment of fission power system technology readiness for application to space missions.