Advanced Radioisotope Power Systems

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Background

The Department of Energy and its predecessors have provided radioisotope power systems for use in space exploration and national security for more than 35 years. These systems have been proven safe, reliable, and maintenance free, and are capable of producing either heat or electricity for decades under the harsh conditions encountered in deep space. A radioisotope power system converts the heat from the decay of the radioactive isotope plutonium-238 (a type of plutonium that is not usable for nuclear weapons) into electricity, required to power a spacecraft. These systems are ideal for applications where solar panels cannot supply adequate power—such as for spacecraft surveying planets far from the sun, e.g., the Galileo mission to Jupiter and the Cassini mission recently launched to Saturn. In addition to radioisotope power systems, the Department provides radioisotope heater units (RHUs) for space use. These RHUs use the heat generated by plutonium-238 to keep a spacecraft's instruments warm and within their designed operating temperatures. The electronics on the Pathfinder rover launched in late 1996 as a part of the Mars Explorer mission were warmed by these units during the cold Martian nights.

Cassini Launch

In October 1997, NASA launched the Cassini mission to the planet Saturn. The Cassini spacecraft that uses DOE supplied radioisotope thermoelectric generators (RTGs) is the largest spacecraft ever launched to explore the outer planets. It will study the planet Saturn and its surrounding moons using a broad range of scientific instruments. This mission requires RTGs because of the large distance from the sun, which makes the use of solar arrays impractical.

Radioisotope Heater Unit

NASA has identified several new missions that may require radioisotope power systems and heaters. RHUs may also be required for several missions as early as 2003. Radioisotope power systems are also used for national security missions.

To support these future missions, the Department sustains the unique facility and program infrastructure that enables the Department to develop and produce these systems. Mission-specific development and hardware fabrication is then pursued by the Department using funding provided by the user agencies.

FY 2001 Major Accomplishments:

- Continued replacement and upgrade of equipment and facilities that have reached their design lifetimes at LANL.
- Completed competitive process to select system integration contractor to develop a Stirling Radioisotope Power System for potential space exploration missions.
- Completed installation of the gloveboxes for the full scale scrap recovery line to process Pu-238 scrap that will be required for planned future missions.

FY 2002 Planned Accomplishments:

- Proceed with the development of the Stirling Radioisotope Power System for potential use on future NASA space exploration missions such as the Mars Rover and Europa Orbiter missions.
- Initiate competitive process to develop a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) for potential future space exploration missions.
- Bring Pu-238 scrap recovery line to full operation and begin processing Pu-238 scrap for reuse in future missions requiring radioisotope power systems.
- Complete assessment of special purpose fission technology options required to power advanced spacecraft to the outer planets and on the surface of Mars.

FY 2003 Planned Accomplishments:

- Assure operational capability of unique facility and program infrastruictue by producing quality products at key sites "e.g., at least 8 irridium cladding sets at ORNL and at least 8 encapsulated Pu-238 pellets at LANL".
- Process at least 2 kilograms of Pu-238 through the scrap recovery line at LANL.

Program Budget
ARPS[1]
($ in Millions)

FY 2001 Appropriation	FY 2002 Appropriation	FY 2003 Request
$31.7	$28.4	$26.4

[1]*Funds included in the Radiological Facilities Management Program*

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