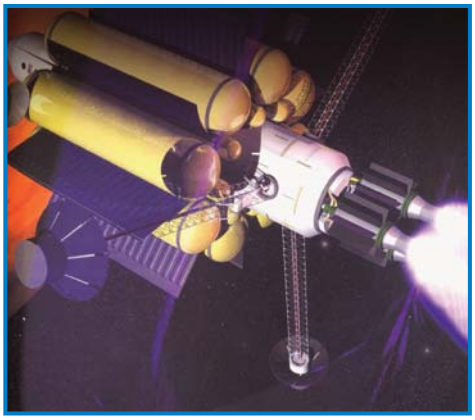
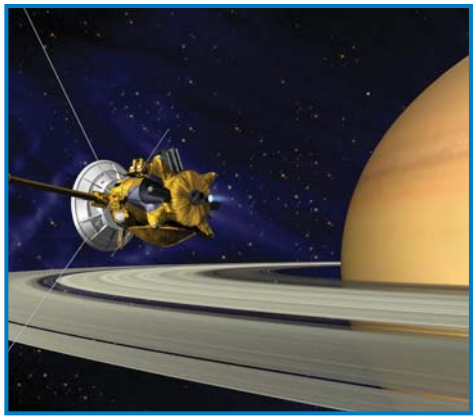
Space and Defense Infrastructure

The U.S. Department of Energy's Office of Nuclear Energy

Radioisotope power systems are used in space exploration and national security missions.





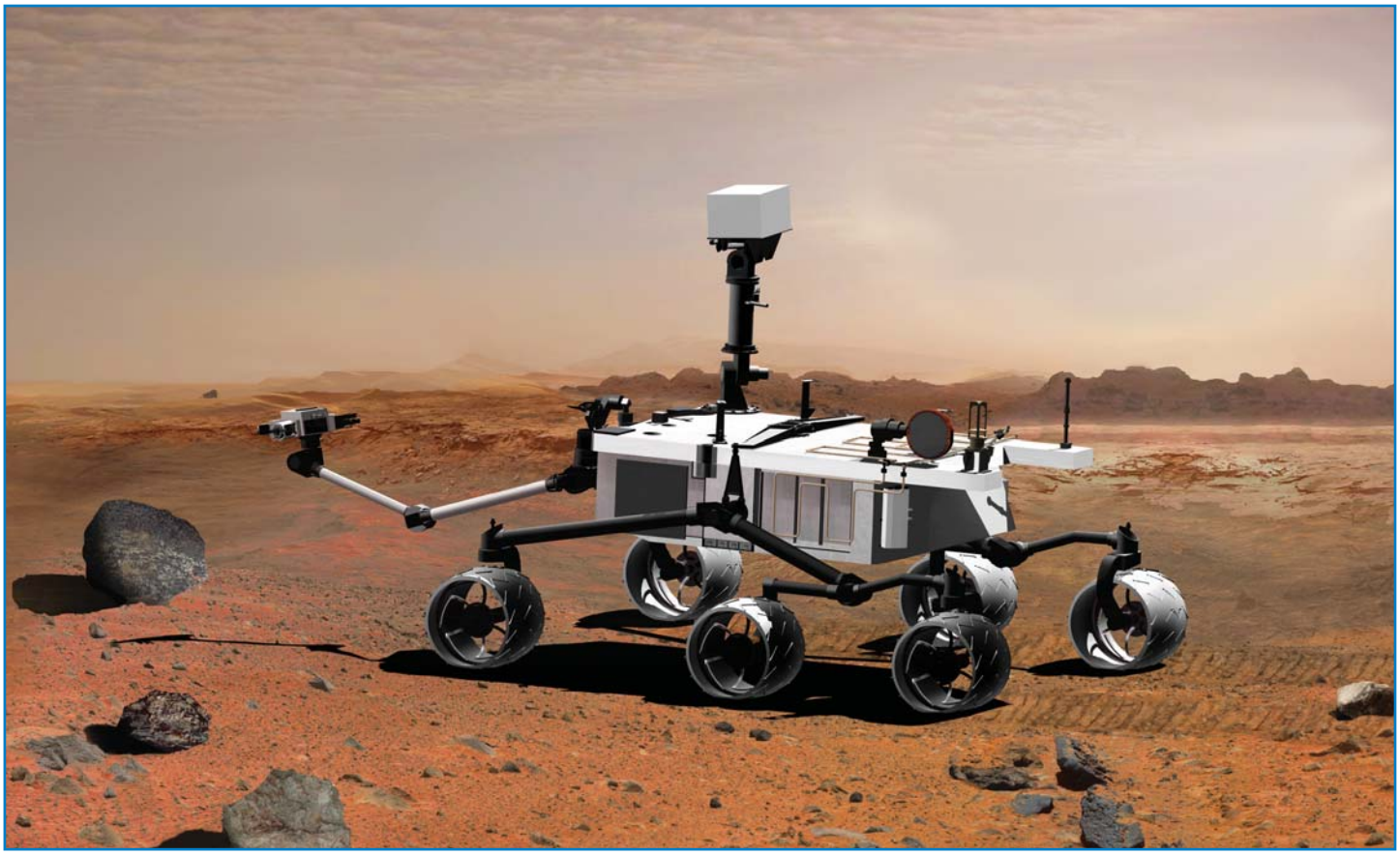
The Department of Energy (DOE) and its predecessors have provided radioisotope power systems that have safely enabled deep space exploration and national security missions for more than four decades.

Radioisotope power systems (RPSs) convert the heat from the decay of the radioactive isotope plutonium-238 (Pu-238) into electricity. Pu-238 is a type of plutonium that is not used for nuclear weapons. RPSs are capable of producing either heat or electricity for decades under the harsh conditions encountered in deep space. They have proven safe, reliable, and maintenance-free in missions to study Jupiter, Saturn, Mars, and Pluto. DOE maintains the infrastructure to develop, manufacture, test, and delivery RPSs for space exploration and national security missions. In addition to providing Radioisotope Thermoelectric Generators (RTGs), DOE also provides Radioisotope Heater Units (RHUs) and develops advanced RPSs.

Radioisotope Thermoelectric Generators (RTGs) — The RTG systems are ideal for applications where solar panels cannot supply adequate power, such as for spacecraft surveying planets far from the sun. RTGs have been used on many National Aeronautics and Space Administration (NASA) missions, including the following.

- *Galileo mission to Jupiter*
  Launched in 1989, the RTG-powered Galileo mission revealed intense volcanic activity on Jupiter's moon Io, and was the first spacecraft to fly past an asteroid and the first to discover a moon of an asteroid.

Photos Courtesy of NASA



NASA's Mars Science Laboratory, a mobile robot shown here in an artist's rendition, will analyze Martian soil samples and rock cores.

- *Cassini mission orbiting Saturn* In July 2004, the Cassini mission entered the orbit of Saturn. Launched in October 1997, the Cassini spacecraft uses three DOE-supplied RTGs and is the largest spacecraft ever launched to explore the outer planets. It is successfully returning data and sending images of Saturn and its surrounding moons, using a broad range of scientific instruments. This mission requires RTGs because of the long distance from the sun, which makes the use of solar arrays impractical.
- *New Horizons mission to Pluto* The New Horizons spacecraft was launched on January 19, 2006. The fastest spacecraft to ever leave Earth, New Horizons has already returned images and scientific data from Jupiter and will continue its journey three billion miles to study Pluto and its moon, Charon, in 2015. It may also go on to study one or more objects in the vast Kuiper Belt, the largest structure in our planetary system. DOE supplied the RTG that provides electrical power and heat to the spacecraft and its science instruments.

Radioisotope Heater Units (RHUs)

The RHUs use the heat generated by Pu-238 to keep a spacecraft's instruments within their designed operating temperatures.

In June and July 2003, NASA launched the Mars Exploration Rovers Spirit and Opportunity to explore evidence of water on Mars. Each rover has eight RHUs to keep the rover instruments warm during the cold Martian nights. The rovers landed at separate sites on Mars in January 2004 on a planned 90-day mission and are still operational more than three years later.

NASA has also identified several new missions potentially requiring RHUs.

Advanced RPSs

Two new RPSs are under development:

Multi-Mission Radioisotope Thermoelectric Generator (MMRTG)

The MMRTG is being developed for operation in planetary atmospheres as well as in the vacuum of space. The first use of an MMRTG will be for the Mars Science Laboratory (MSL) planned for launch in 2009. The MSL will collect Martian soil samples and rock cores, and analyze them for organic compounds and environmental conditions that could have supported microbial life now or in the past.

Advanced Stirling Radioisotope Generator (ASRG)

The ASRG is currently being developed as a high-efficiency RPS technology to support future space missions on the Martian surface or the vacuum of space. This system uses a Stirling converter, which has moving parts to mechanically convert heat to electricity. This power conversion system, if successfully deployed, would reduce the amount of Pu-238 needed per mission, and the cost and weight of each RPS.

Planned Program Accomplishments

FY 2008

- Maintain infrastructure needed to develop, manufacture, test and deliver RPSs.
- Complete the MMRTG dynamic simulator and thermal simulator, and deliver both to NASA.
- Assemble and test the MMRTG qualification unit.
- Assemble and fuel the MMRTG flight unit for the MSL mission.
- Assemble and test the ASRG engineering unit and begin design refinements for a potential qualification unit.
- Support NASA concept studies for missions that may use ASRG.
- Complete assembly of an RPS for a national security mission.

FY 2009

- Maintain infrastructure needed to develop, manufacture, test and deliver RPSs.
- Complete testing and delivery of the MMRTG flight unit for the MSL mission.
- Support MMRTG storage and integration, mission operations, and emergency response activities at the Kennedy Space Center for the MSL mission.
- Complete assembly of an RPS for a national security mission.

Program Budget

Radiological Facilities Management
($ in Millions)

	FY 2008 Request	FY 2008 Actual	FY 2009 Request
Space and Defense Infrastructure	$35.1	$30.4	$35.0