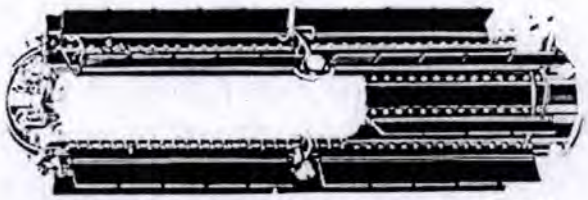
History

The U.S. Department of Energy (DOE) has provided radioisotope thermoelectric generators for space applications since 1961. These generators provide electrical power for spacecraft by direct conversion of the heat generated by the decay of plutonium-238 (Pu-238) oxide to electrical energy. The first generator was used on the Navy Transit 4A spacecraft launched on June 29, 1961. Between 1961 and 1972, DOE provided power systems for six Navy navigational satellites. In addition, DOE provided power systems for two Air Force communications satellites, LES 8 and LES 9, both launched together on March 14, 1976.



Radioisotope Thermoelectric Generator (RTG)

DOE first supported the use of radioisotope power systems on National Aeronautics and Space Administration (NASA) spacecraft with the launch of power systems on the NASA Nimbus B-1 meteorological satellite on May 10, 1968. This was followed by the Nimbus III satellite on April 14, 1969. DOE radioisotope generators were used on six missions to the Moon, Apollo 12 through 17, to power the seismic stations on the lunar surface (1969 to 1972). Our involvement with NASA continued as NASA moved out into the solar system with the Pioneer, Voyager, Galileo, and Ulysses missions (six missions beginning in 1972). These solar system exploration missions have continued far beyond their design life of about 5 years each, with the Voyager spacecraft now having traveled through the solar system and beyond, providing data over the last 20 years. The Voyager spacecraft is expected to provide data for another 25 years.

Cassini Spacecraft

DOE has also played a key role in the support of exploration of Mars. The Viking landers, launched in 1975, were both electrically powered by radioisotope power systems. The Mars Pathfinder spacecraft and rover were launched in December 1996 and landed on Mars July 4, 1997. The Rover had three Pu-238 oxide heater units that provided heat to the Rover electronics. The heater units are small, contained, radioisotope units that are placed next to spacecraft instruments to provide heat only (not electricity). The Rover would probably not

have remained operational after the first Martian night without the heater units.

In all, DOE has provided a total of 44 RTGs and more than 240 heater units for 26 missions since 1961. DOE continues to maintain the capability to provide power and heater systems to NASA for further missions