

Radionuclide Thermal Generators

Blake Owens

- ## Topics to be Covered
- Basics of RTG's
 - Health Physics Concerns
 - Safety and Design
 - Examples

Basics of RTG's

Generating Electricity

- RTG's use heat generated from radioactive decay to produce electrical energy.
- Thermoelectricity was discovered in 1822 by a German scientist, Thomas Johann Seebeck.
- RTG's are the most desired power sources for unmanned or unmaintained environments.

Plutonium Pellet



Wow... That's Hot!

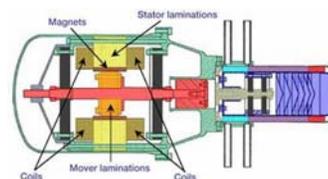
Spacecraft Power

- RTG's are commonly used as the power source for spacecrafts.
- Radioisotope power applications have been used since 1956.
- The SNAP-3 device was developed in 1959, it was the size of a grape fruit, and weighed about 4 lbs.



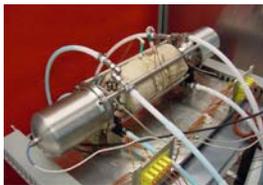
Examples

Advanced Stirling Radioisotope Generator (ASRG)



ASRG

- The Stirling radioisotope generator (SRG) is based on a Stirling engine powered by a large radioisotope heater unit. The hot end of the Stirling converter reaches high temperature and heated helium drives the piston, heat being rejected at the cold end of the engine. A generator or alternator converts the motion into electricity. This Stirling converter produces about four times as much electric power from the plutonium fuel than a radioisotope thermoelectric generator (RTG). The Stirling generators have been extensively tested but have not yet been deployed on actual missions.



Other RTG Applications

- There are approximately 1000 radioisotope thermoelectric generators in Russia which provide power to lighthouses and navigation beacons.
- They have exhausted their 10 year lifetime design.
- Some of the RTG's have been replaced with solar panels.
- Ex. Woodcutters, Vandalism, Striped for Metal



How far have we come?

SNAP-3

- 1959
- 2.5 W
- 280 days

ASRG

- Scheduled for use in 2012
- 224 W
- 14 years

The Future

- Eventually, the need will arise for a nuclear reactor system to provide power in order to execute longer missions.
- Isotopes alone cannot provide enough power to execute a mission of this caliber.
- As technology grows, the need for more power will also grow.

