

The Space and Security Power Systems Facility assembles, fuels, tests, and prepares power systems for launch.



Space Nuclear Power and Isotope Technologies Division at INL

Providing unique capability for enabling deep space exploration

Idaho National Laboratory (INL) is proud to host a unique capability for enabling deep space exploration that spans the limits of our own solar system and beyond. INL's Space Nuclear Power and Isotope Technologies Division manages the Space and Security Power Systems Facility (SSPSF), located at INL's Materials and Fuels Complex west of Idaho Falls, where assembly and testing capabilities for Radioisotope Power Systems (RPSs) reside.

Various types of RPSs have provided electricity to space missions since 1961. The RPS that provides more than 200 watts of electric power to the Pluto New Horizons spacecraft was the first one assembled and

tested at INL. It successfully completed a flyby of Pluto in July 2015 after a 9½-year flight. The second RPS assembled and tested for a flight mission at INL was for Curiosity rover's exploration of Mars that began in 2012. The same type of RPS powering Curiosity will be assembled and tested at INL for the next nuclear-enabled space mission, Mars 2020.

Radioisotope Power Systems provide the power to operate spacecraft or rover systems such as scientific instruments, robotic arms, computers, radio, and drive systems. They are fueled with plutonium-238, which gives off a steady supply of heat as the material decays. No moving parts are required to convert this heat into

electricity. Thermocouples are used to create voltage from the temperature difference between the hot interior and the cold exterior in deep space or on a planet's surface. The power supply created using an RPS is steady, reliable, and lasts for decades – the systems included on the Voyager I and II spacecraft launched in 1977 are still operating and sending back data from well beyond the edges of the solar system.

At SSPSF, personnel complete RPS assembly operations, involving placement of fueled clads into graphite components to form general purpose heat source modules. Next, the RPS assembly starts when modules are placed into a converter that

Continued next page

The Energy of Innovation



Continued from previous page

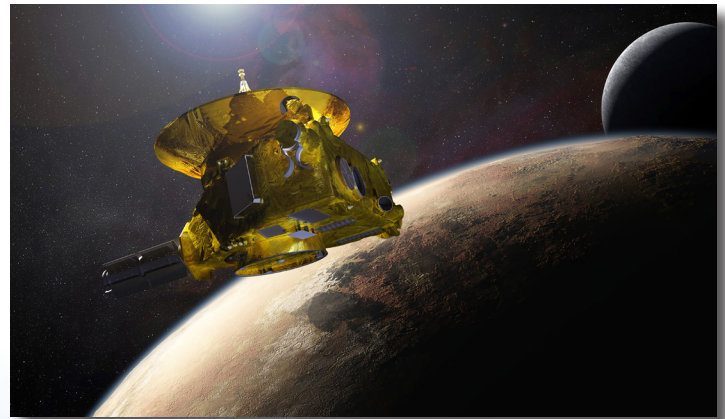
houses thermocouples, together comprising the RPS. Following RPS assembly, a series of acceptance testing is completed, including:

- Vibration testing to simulate rocket launch conditions,
- Magnetic testing to ensure the system's electrical field won't affect sensitive scientific equipment on the rover or spacecraft,
- Mass properties testing to determine the center of gravity, mass, and moments of inertia, which impacts thruster calculations for moving the spacecraft, and
- Thermal vacuum testing to verify operation in the cold vacuum of space.

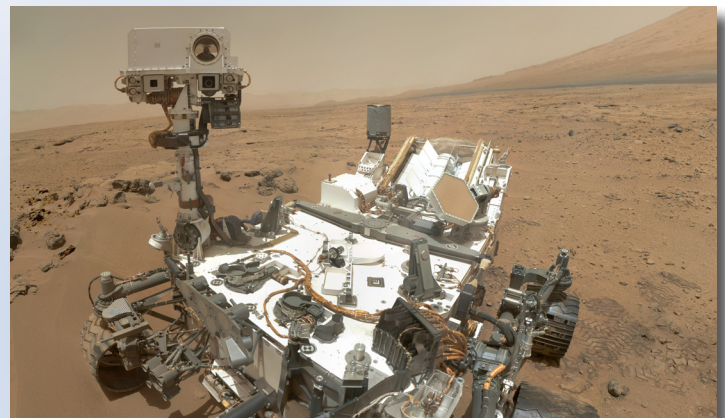
After successful completion of acceptance testing at INL, the RPS is transported to Kennedy Space Center. INL's Space Nuclear Power and Isotope Technologies Division staff members provide ground operations support involving the RPS at Kennedy Space Center and Cape Canaveral Air Force Station until after launch.

Why nuclear?

For 50+ years, RPSs have safely and reliably fueled two dozen U.S. missions to explore our



New Horizons Mission is equipped with a General Purpose Heat Source-Radioisotope Thermoelectric Generator (GPHS-RTG). There are 18 GPHSs, which produced about 249 Watts electric upon launch.



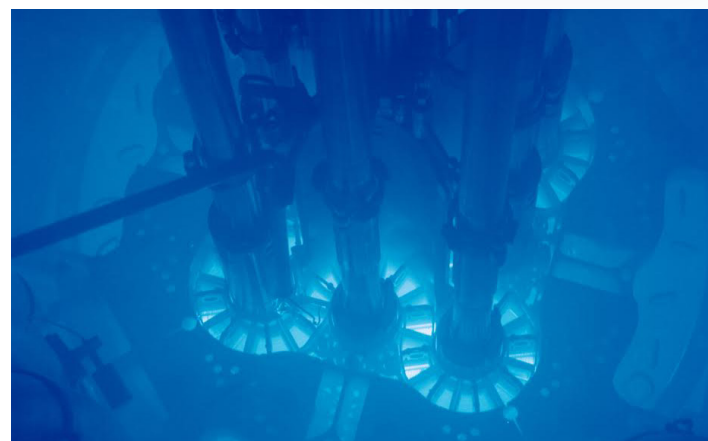
NASA's rover Curiosity is powered by a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG), which uses the decay heat of plutonium-238 to provide dependable power while on Mars.

moon, most of the planets in the solar system, and beyond. These nuclear-enabled missions are provided with safe, reliable power where solar

power cannot be used due to proximity or distance from the sun, or chemical fuels cannot be used due to their weight. Radioisotope power systems have a record for robustness, reliability, and longevity unmatched by any other NASA spacecraft power system.

Isotopes

INL uses the unique capabilities of the Advanced Test Reactor (ATR) to provide specialized isotopes for scientific, engineering, and medical applications. Isotopes such as Co-60 and Pu-238 will be produced at ATR.



The Advanced Test Reactor is a research reactor located on the INL site.

For more information

Nora Heikkinen
 (208) 533-7783
 nora.heikkinen@inl.gov

**A U.S. Department of Energy
 National Laboratory**

