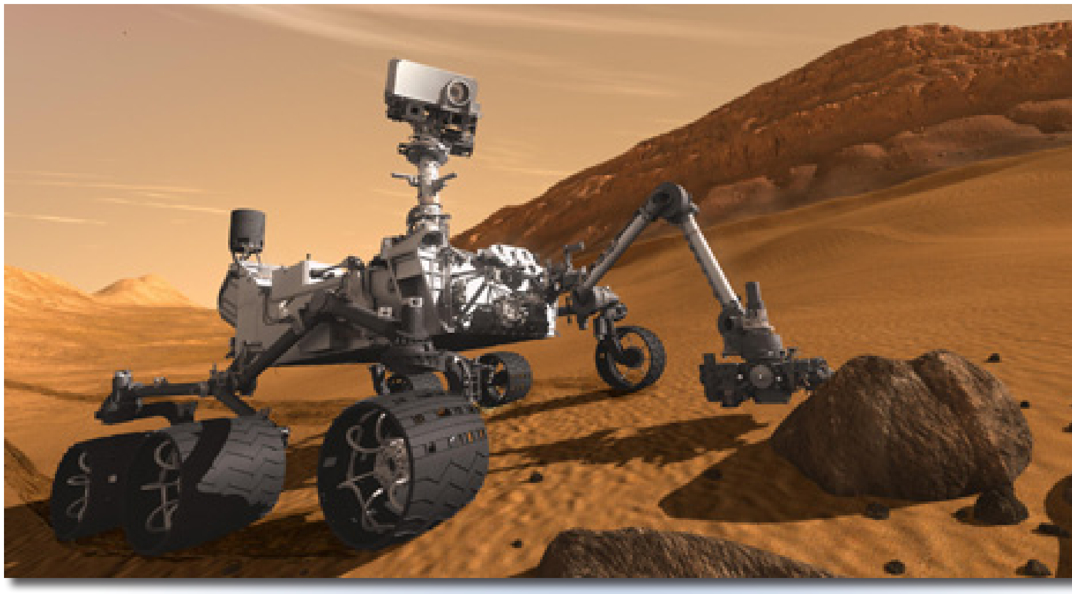

NASA's Mars Science Lab mission and its rover Curiosity will get heat and electricity from a radioisotope power system fueled and tested at INL.

The Energy of Innovation

Idaho National Laboratory

Fueling the Mars Science Laboratory

INL assembled and tested the mission's nuclear heat and power source

NASA's Mars Science Laboratory mission is preparing to set down a large, mobile laboratory — the rover Curiosity — which will carry the most advanced payload of scientific gear ever used on Mars' surface. The rover's electrical power will be supplied by a U.S. Department of Energy radioisotope power system assembled and tested at Idaho National Laboratory.

How it works

The Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) is essentially a nuclear battery that will operate the rover's instruments, robotic arm, wheels, computers and radio. It is fueled with plutonium-238 that gives off heat as it naturally decays. No moving parts are required to convert this heat into electricity. The system uses thermocouples to create voltage from the temperature difference between the nuclear material and the cold Martian exterior.

The system can generate 110 watts of electrical power continuously for years. The Mars Science Lab mission is scheduled to operate an entire Martian year (687 Earth days, nearly 23 months) once it lands in August 2012.

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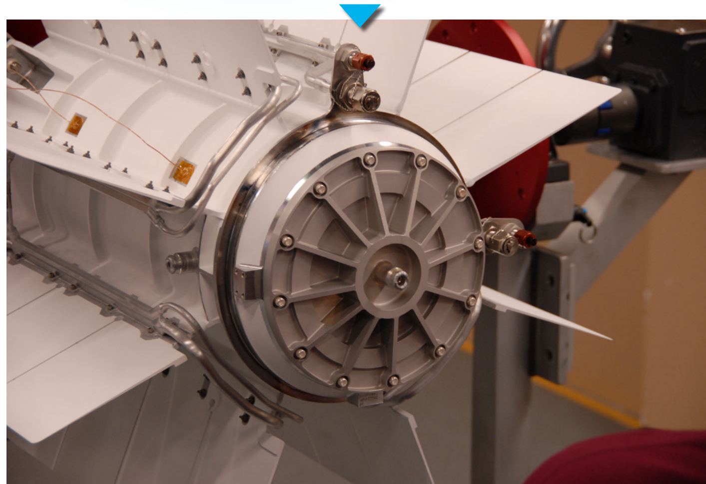
The rover's radioisotope power generator warms and powers the rover and its instruments with heat from natural decay of plutonium-238.



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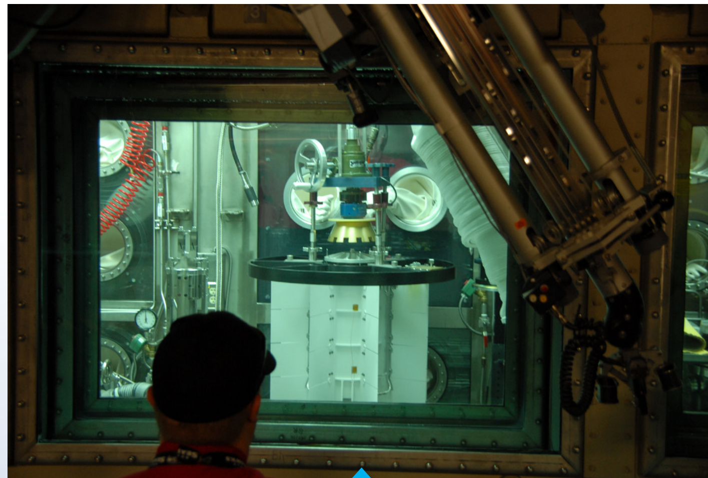
Nuclear heat will also keep instruments, computers, mechanical devices and communications systems within their operating temperatures. The heat is carried by liquid freon plumbed throughout the rover system, which eliminates the need for hibernation periods like those required for NASA's twin solar-powered Mars Exploration rovers, Spirit and Opportunity.



INL employees fuel the system inside a hot cell.

INL's role

INL fuels the generator with a ceramic form of plutonium dioxide encased in multiple layers of protective materials. INL operators remotely place plutonium-filled iridium capsules into 16 graphite impact shells. They then assemble two shells each into high-strength carbon blocks to make eight fuel modules. These modules are then stacked and loaded into the Multi-Mission Radioisotope Thermoelectric Generator.

After assembly, INL subjects the MMRTG to a series of acceptance tests. These include:

- vibrational testing to simulate rocket launch conditions,
- magnetic testing to ensure the system's electrical field won't affect the rover's sensitive scientific equipment,
- mass properties tests to determine the center of gravity, which impacts thruster calculations for moving the rover,
- thermal vacuum testing to verify operation in the cold vacuum of space.

The mission

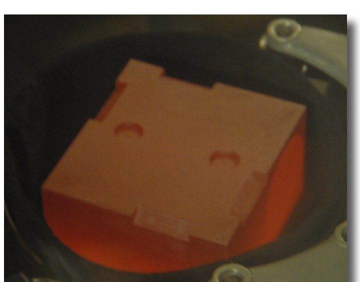
The Curiosity payload is more than 10 times as massive as earlier Mars rovers. Its assignment: Investigate whether conditions have been favorable for microbial life and preserve clues it finds in the rocks. Curiosity will analyze dozens of samples drilled from rocks or scooped from the ground as it explores with greater range than any previous Mars rover.

Why nuclear?

For 50 years, radioisotope power sources have safely and reliably fueled dozens of U.S. missions to explore seven planets in the solar system, including the New Horizons mission to Pluto as well as Apollo, Voyager, Galileo and Cassini missions. Radioisotope power systems have a record for reliability and longevity unmatched by any other NASA spacecraft power system.

The nuclear powered rover can go farther, travel to more places, and power and heat a larger and more capable scientific payload compared to the solar power alternative NASA studied. The radioisotope power system gives Curiosity the potential to be the longest-operating, farthest-traveling, most productive Mars surface mission in history.

Once graphite modules containing the fuel (left) are loaded into the generator, it is removed from the hot cell (right) for a series of acceptance tests.



For more information

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