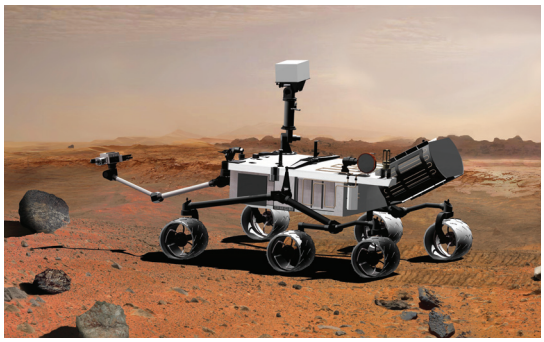
NASAfacts

Mars Science Laboratory Launch Nuclear Safety

In late 2011, NASA plans to launch the largest, most capable rover ever sent to another planet. The Mars Science Laboratory is designed to enable scientists to determine whether past or present environmental conditions at a selected area on the Red Planet could support microbial life and its preservation in the rock record.

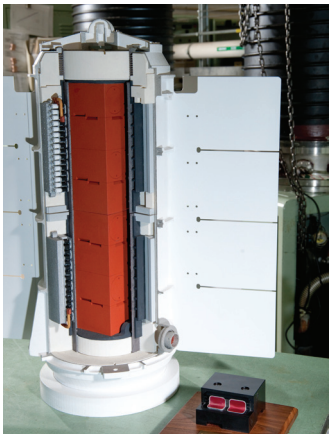
Outfitted with six wheels and a sophisticated suite of scientific equipment that includes a large robot arm, a laser, a weather station, and a drill, the Mars Science Laboratory's jeep-sized rover is named Curiosity.



Artist's concept of Curiosity on Mars

The technology of the rover and its landing system is designed to demonstrate substantial new capabilities and operational techniques that would benefit future NASA missions, from precision landing in a small target zone to extended surface lifetimes to the transmission of extremely large data volumes back to Earth.

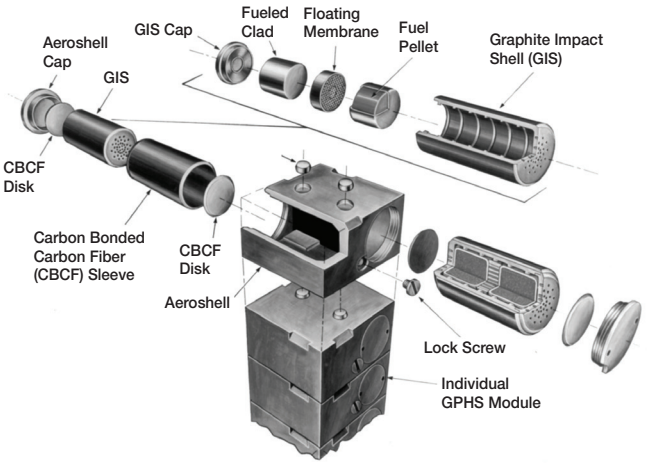
Scheduled for launch on an Atlas V rocket, Curiosity will derive its electrical power from a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG). Similar to the radioisotope power systems used to safely and successfully power numerous solar system exploration missions from Voyager to Pluto/New Horizons for more than 40 years, the MMRTG will significantly enhance the range and lifetime of the rover. It will also promote greater operability of the rover's science experiments, which include the first-ever plans to drill into Martian rocks for powdered samples to analyze on-site. The MMRTG contains 10.6 pounds (4.8 kilograms) of plutonium dioxide as the source of the steady supply of heat used to produce the onboard electricity and to warm the rover's systems during the frigid Martian night.



Full-scale cutaway models of an MMRTG and one of its heat source modules, which produce electricity passively using thermocouples with no moving parts.

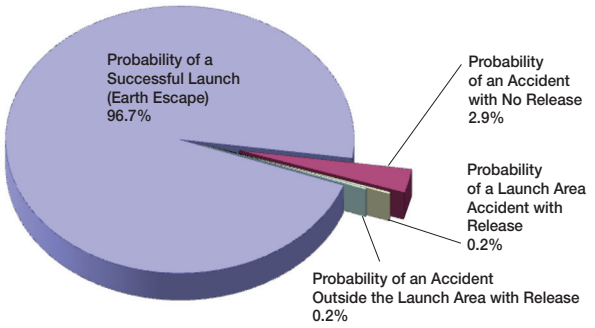
As with any NASA mission that relies on a radioisotope power system, the Mars Science Laboratory has undergone a comprehensive multi-agency environmental review, including public meetings and open comment periods, as part of NASA's compliance with the National Environmental Policy Act. Additionally, the mission will not launch until formal approval is received from the Office of the President.

Like previous generations of this type of electrical-power generator, the MMRTG is built with several layers of protective material designed to contain its plutonium dioxide fuel in a wide range of potential accidents, verified through impact testing. Each MMRTG carries eight individually shielded general purpose heat source modules (compared to 18 modules in the previous generation). The thickness of the protective graphite material in the center of the modules and between the shells of each module in the MMRTG has been increased by 20 percent over previous modules.



Each MMRTG heat source module includes several layers of protective material

Extensive technical analysis of the planned launch of the Mars Science Laboratory, including review of all similar past expendable rocket launches, has been conducted by NASA, the U.S. Department of Energy (which provides the MMRTG), and external experts. This work has determined that the chances of any launch accident are small (3.3 percent), and the chances of an accident of the type that would release plutonium are about ten times smaller.



In the event of a launch accident, it is unlikely that any plutonium would be released or that anyone would be exposed to nuclear material. The type of plutonium used in a radioisotope power system is different from the material used in weapons, and cannot explode like a bomb. It is manufactured in a ceramic form that does not become a significant health hazard unless it becomes broken into very fine pieces or vaporized and then inhaled or swallowed. Those people who might be exposed in a Mars Science Laboratory launch accident would receive an average dose of 5-10 millirem, equal to about a week of background radiation. The average American receives 360 millirem of radiation each year from natural sources, such as radon and cosmic rays.

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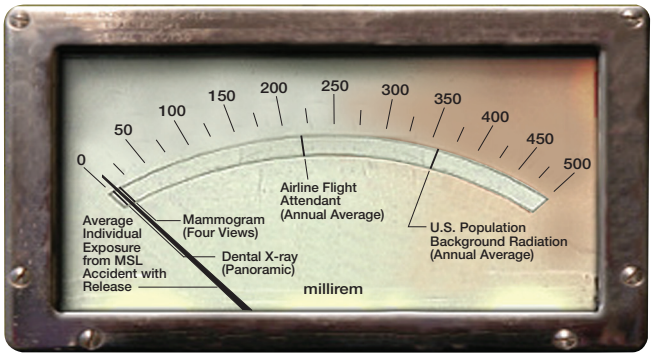

A comparison of potential radiation exposures (calculated using effective whole-body dose in millirem). Source: Health Physics Society

NASA, several other federal agencies, the State of Florida and the local governments surrounding Kennedy Space Center are preparing in advance to respond to any launch accident through specific communication procedures, the use of advanced environmental sensors around the launch area, rehearsal of coordinated response to various launch scenarios, and informational briefings to local communities and emergency responders. In the case of a launch accident, related alerts could include precautionary measures such as directions for people to stay indoors for a limited duration.

NASA and the Department of Energy are committed to continuing their long heritage of safe and careful use of radioisotope power systems in service of the peaceful exploration of space for the benefit of all humankind. This commitment includes providing easily accessible and widely broadcast updates during the launch activity for Curiosity. The information campaign will include ongoing updates to TV, radio and online media outlets, and active use of social media, in order to provide timely and complete information to the public.

Key Facts: Mars Science Laboratory

Launch Period: November 25 – December 18, 2011
Mass of Rover: 1,950 pounds (890 kilograms)
Launch Vehicle:
Atlas V 541 from Cape Canaveral Air Force Station, FL
Arrival at Mars: August 6-20, 2012

Website for more information: *mars.jpl.nasa.gov/msl*

More information on radioisotope space power systems:
www.ne.doe.gov/space/neSpace2d.html

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