Mars Science Laboratory

Draft Environmental Impact Statement (DEIS)

NASA is proposing to launch a mission in the fall of 2009 that would land a large, highly capable rover on Mars. The proposed Mars Science Laboratory rover would carry a suite of science instruments designed to gather detailed information on the past and present habitability of Mars. The proposed mission would demonstrate NASA's capability to deliver more capable science instruments to Mars and operate in scientifically promising regions of Mars over a wide latitude range. The proposed Mars Science Laboratory rover would be capable of visiting and investigating multiple, geologically diverse sites by being able to drive for several miles and operate for one Martian year (683 Earth days, a little less than 2 Earth years). A new, more precise landing technique would give the rover access to key sites of scientific interest.

The Mars Science Laboratory DEIS addresses the potential environmental impacts from both a successful launch and from various postulated launch accidents. This fact sheet summarizes some of the key points made in the DEIS.

The NEPA Process

The National Environmental Policy Act (NEPA) requires federal agencies to prepare an Environmental Impact Statement (EIS) for major federal actions that may significantly affect the quality of the human environment. Federal agencies consider potential environmental impacts of their proposed actions before deciding whether and how to proceed. NASA developed a Draft Environmental Impact Statement (DEIS) as part of the process for deciding whether to continue with the preparations for a Mars Science Laboratory mission.

Alternatives Considered in the DEIS

Proposed Action (Alternative 1, Radioisotope Power System-Powered Rover): Under this alternative, NASA would implement the proposed mission using a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) power system as its source of electrical power. This rover would be capable of performing all the science experiments planned for the mission for an entire Martian year over a wide latitude range on Mars (60^{o} North latitude to 60^{o} South latitude).

Alternative 2 (Solar-Powered Rover): Under this alternative, NASA would implement an alternative Mars Science Laboratory mission based on a rover using solar arrays as its source of electrical power. The solar-powered rover would be capable of performing all the science experiments planned for the mission for a full Martian year at 15^{o} N latitude. Such a rover could accomplish the minimum science objectives over a latitude range of approximately 5^{o} North to about 20^{o} North latitude. At other latitudes a solar-powered rover would be unable to generate sufficient power for the rover to survive the extreme cold temperatures, and thus would not be able to survive for an entire Martian year.

Alternative 3 (No Action): Under this alternative, NASA would discontinue preparations for the proposed Mars Science Laboratory mission and the spacecraft would not be launched. The No-Action Alternative would not accomplish any science or technology objectives of NASA's Mars Exploration Program.

Potential Environmental Impacts

The potentially affected environment for the launch of the Mars Science Laboratory mission includes areas on or near the Atlas V launch pad at NASA's Kennedy Space Center, the Cape Canaveral Air Force Station, Florida and the environment in general. Environmental impacts are not considered for Alternative 3 since the proposed launch would not occur.

Successful Launch:
The environmental impacts associated with successfully implementing either the Proposed Action (Alternative 1) or Alternative 2 would be associated principally with the exhaust emissions from the launch vehicle. These effects would include short-term impacts on air quality from the exhaust cloud at and near the launch pad, and short-term acidic deposition on the vegetation and surface water bodies at and near the launch complex. These effects would be transient and there would represent neither long-term nor cumulative impacts to the environment. Some short-term ozone degradation would occur along the flight path of the vehicle but these effects would be transient and neither long-term nor cumulative impacts would be expected to the ozone layer.

Non-Radiological Impacts of a Launch Accident:
The environmental impacts associated with a launch vehicle accident that does not release radiological material are the same for Alternative 1 and Alternative 2. Possible impacts include a spill during fueling operations or a launch vehicle failure. If a spill of liquid propellant were to occur, operations personnel would remotely shut down the fuel loading system to minimize the amount of fuel released. A launch vehicle failure during the early ascent phase of flight could release propellants from the Atlas V and the Mars Science Laboratory spacecraft; however, burned propellants chemically resemble those from a normal launch and would not reach levels that could threaten public health. Debris would likely fall in areas already cleared of personnel or members of the public by range safety -- on or near the launch pad or into the Atlantic Ocean.

Radiological Impacts of a Launch Accident:
To support the NEPA decision making process, the Department of Energy (DOE) prepares a nuclear risk assessment for any proposed launch of radioisotope powered missions.

NASA and DOE examine many possible accident scenarios based on extensive data from past launches, tests and modeling. These data are used to simulate potential accident conditions and to develop a detailed assessment of the launch system's failure modes. The DOE risk assessment for the Mars Science Laboratory mission covers accident scenarios from pre-launch to post-launch and through commanding the spacecraft onto its flight path to Mars.

The DOE assessment indicates which launch accidents could potentially result in a release of radioactive material. It also predicts the amount, particle size and movement of any material that could be released and estimates potential radiation exposures and health effects to the general public.

The risk assessment identifies potential launch accidents that while not expected, could result in a release of plutonium dioxide in the launch area, southern Africa following suborbital reentry, or other global locations following orbital reentry. However, in each of these regions an accident resulting in a release of plutonium dioxide is unlikely (i.e. the estimated probability of such an accident in each region ranges from 1 in several hundred to 1 in several thousand). Accidents which would result in impacts in the Atlantic Ocean would not result in a release of plutonium dioxide. Failures occurring after the spacecraft escapes the Earth's gravity field would not result in a release of plutonium dioxide on Earth.

What do results of the DOE Risk Assessment show?

- For the overall mission, there is a 1 in 220 chance that a failure could result in a release of plutonium.
- There is a 1 in 420 chance of a failure resulting in a release of plutonium dioxide in the launch area.

- The chances of any radiological impact occurring as the result of launch of the proposed Mars Science Laboratory mission is small, less than 0.5 percent.

- For the overall mission given an accident with a release of plutonium the maximally exposed individual would be expected to only receive a dose over a period of 50 years approximately equal to that received by the average citizen from natural background radiation in one year.

Radiological Contingency Planning:

For any launch of radioactive materials, a comprehensive set of radiological response plans, which are fully coordinated with local, state, and federal representatives, is developed by NASA prior to launch to ensure that any launch accident could be met with a thoroughly tested response. NASA's plans are developed in accordance with the National Response Plan and applicable state and county emergency plans, in coordination with federal agencies responsible for emergency response, the State of Florida, Brevard County, and local launch site response organizations. At the time of launch, emergency response personnel and equipment will be pre-deployed both on-site and in surrounding communities to continuously monitor the air to detect a potential release of radioactive material following a launch accident. The selection of the types and capabilities of response personnel and equipment is based on a radiological contingency planning effort that was initiated early and continues throughout the mission planning process.

What's Next?

The public is welcome to comment on the information in the DEIS; the comment period ends on October 23, 2006. Comments will be addressed in the Mars Science Laboratory Final Environmental Impact Statement scheduled for completion and released in November 2006. NASA's Record of Decision selecting one of the Alternatives is planned for issue in December 2006.

For More Information

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