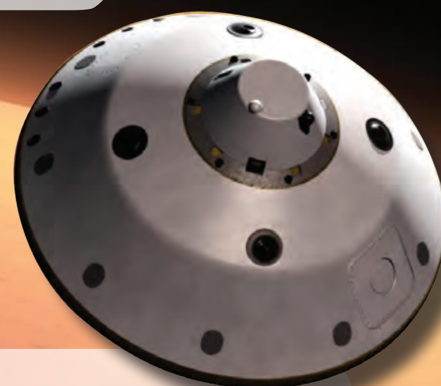
A LABORATORY ON MARS



By Allison Lyons

The most advanced scientific instruments used on Mars' surface landed in a crater near the planet's equator on August 5 at 10:30 p.m. Pacific Time.

The instruments are part of the Mars Science Laboratory (MSL), an ambitious NASA mission that set the Curiosity rover on a carefully selected site called Gale Crater. The mission's primary goal is to assess whether Mars is, or ever was, capable of supporting microbial life.

Sushil Atreya

An unprecedented landing technique was used because Curiosity, which is larger than a Mini Cooper, is twice as long and five times as heavy as twin rovers Spirit and Opportunity, launched in 2003.

To land, MSL descended on a parachute and then used downward-firing thruster rockets to continue to slow itself. Then, during the final seconds before landing when the descent stage of the craft was 60 feet above the surface, it lowered Curiosity to the ground using a tether, similar to a sky crane.

Once on solid ground, Curiosity began assessing the habitability potential of the Gale Crater landing site. It is searching for the building blocks of microbial life. One of MSL's scientific objectives is to search for organics, an umbrella term for molecules featuring carbon, the same molecules life on Earth is based on.

To search for organics, Curiosity is scooping up soil and drilling inside rocks. As one of its many scientific objectives, the Sample Analysis at Mars (SAM) suite of MSL instruments, parts of which were built and tested at Michigan Engineering's Space Physics Research Lab, is analyzing the solid samples and the air the rover sniffs to determine whether organics are present. SAM has ovens to heat solid samples to temperatures as high as 2,000 degrees Fahrenheit, a process that is expected to release trace amounts of any organics that are present. This advanced equipment, mission scientists believe, is capable of detecting organics if they are present in the Gale Crater.

"Organics, whether or not connected to life, have never been positively identified on the surface of Mars, which seems puzzling considering that they have been raining down on Mars for 4.5 billion years, even if Mars never had its own source," says Sushil Atreya, a professor in the University of Michigan Department of Atmospheric, Oceanic and Space Sciences.

A science lead on the Goddard Space Flight Center's SAM instrument suite, Atreya contributed to the conceptual development of the MSL mission decades ago, and now he lends his expertise on trace gases to the mission.

"I will be looking at the SAM

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measurements of atmospheric trace gases, and the gases evolved from solid samples along with their isotopic composition," Atreya says. "Methane is one such trace constituent, as its presence could signify either biological activity or complex water-rock reactions. By combining the SAM data on trace gases and the noble gases with mineralogical, geologic and environmental data collected by other instruments on MSL, I'll be examining the question of habitability and the climate evolution of Mars."

Comparing them with their values on Earth, Venus and meteorites will provide important insight into the climate and geologic history of the terrestrial planets.

Even with advanced technology, organics are hard to find. Groundwater could have destroyed organics through oxidation on Mars, as is the case for many rocks on Earth that are billions of years old. Other chemicals detected on Mars can cause this oxidation as well, and there is also the destructive effect of radiation. The hope is that some organics will have survived after undergoing rapid mineralization.

If Curiosity does not detect organics, Atreya will remain optimistic.

"Their absence in the Gale Crater landing site would not necessarily imply that organics are absent from other parts of Mars. Even in the Gale Crater region, they could have existed at one time, even if they are not detected now," he says.

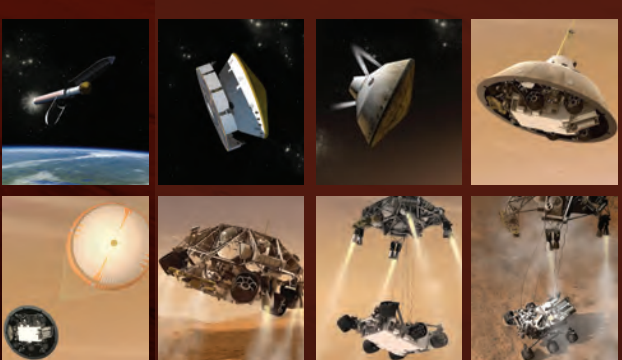
Atreya is looking forward to the search for organics and trace constituents, he says, but he isn't a rookie when it comes to space discovery. He has been involved in over 10 planetary spacecraft missions, starting in 1974 with the Voyager missions to the giant planets.

"Nothing will ever beat Voyager. Every day, every moment had a discovery," Atreya says. In fact, the Voyagers continue to make discoveries as both Voyager 1 and 2 spacecraft are still sending scientific information about their surroundings outside the solar system through the Deep Space Network.

Still, Atreya states MSL is his most exciting Mars mission to date.

Ultimately, Curiosity's findings will be combined with findings from previous and current missions. This information, Atreya hopes, will be applied to extrasolar planets, which are planets outside the solar system. Armed with knowledge of the planets around our Sun, such as Mars, scientists can begin to study the possibility of life on extrasolar planets.

"We want to find out how life began here or elsewhere," Atreya says. "These are very profound, deep questions and with these kind of experiments, we're beginning to inch our way to addressing them."



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