

Mars Rovers Head for New Sites After Studying Layers

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This image from Spirit shows coarse-grained layers from around the edge of a low plateau called "Home Plate" inside Mars' Gusev Crater. Image credit: NASA/JPL/Cornell

NASA's Mars rover Spirit has reached a safe site for the Martian winter, while its twin, Opportunity, is making fast progress toward a destination of its own.



The two rovers recently set out on important -- but very different -drives after earlier weeks inspecting sites with layers of Mars history. Opportunity finished examining sedimentary evidence of ancient water at a crater called "Erebus," and is now rapidly crossing flat ground toward the scientific lure of a much larger crater, "Victoria."

Spirit studied signs of a long-ago explosion at a bright, low plateau called "Home Plate" during February and March. Then one of its six wheels quit working, and Spirit struggled to complete a short advance to a north-facing slope for the winter. "For Spirit, the priority has been to reach a safe winter haven," said Dr. Steve Squyres of Cornell University, Ithaca, N.Y., principal investigator for the Mars Exploration Rover project.

The rovers have operated more than eight times as long as their originally planned three-month explorations on Mars. Each has driven more than 6.8 kilometers (4.2 miles) about 11 times as far as planned. Combined, they have returned more than 150,000 images. Two years ago, the project had already confirmed that at least one place on Mars had a wet and possibly habitable environment long ago. The scientific findings continue.

Opportunity spent most of the past four months at Erebus, a highly eroded impact crater about 300 meters (1,000 feet) in diameter, where the rover found extensive exposures of thin, rippled layering interpreted as a fingerprint of flowing water. "What we see at Erebus is a thicker interval of wetted sediment than we've seen anywhere else," said Dr. John Grotzinger of the California Institute of Technology, "The same outcrops also have cracks that may have formed from wetting and drying."

In mid-March, Opportunity began a 2-kilometer (1.6-mile) trek from Erebus to Victoria, a crater about 800 meters (half a mile) across, where a thick sequence of sedimentary rocks is exposed. In the past three



weeks, Opportunity has already driven more than a fourth of that distance.

At Home Plate, Spirit found coarse layering overlain by finer layering in a pattern that fits accumulation of material falling to the ground after a volcanic or impact explosion. In one place, the layers are deformed where a golfball-size rock appears to have fallen on them while they were soft. "Geologists call that a 'bomb sag,' and it is strong evidence for some kind of explosive origin," Squyres said. "We would like to have had time to study Home Plate longer, but we needed to head for a northfacing slope before winter got too bad."

Spirit is in Mars' southern hemisphere, where the sun is crossing lower in the northern sky each day. The rovers rely on solar power. The amount available will keep dropping until the shortest days of the Mars winter, four months from now. To keep producing enough electricity to run overnight heaters that protect vital electronics, Spirit's solar panels must be tilted toward the winter sun by driving the rover onto north-facing slopes. However, on March 13 the right-front wheel's drive motor gave out. Spirit has subsequently driven about 80 meters (262 feet) using five wheels and dragging the sixth, but an initial route toward a large hill proved impassable due to soft ground. Last week, the team chose a smaller nearby ridge, dubbed "Low Ridge Haven," as the winter destination. Spirit reached the ridge Sunday and has a favorable 11-degree tilt toward the north.

"We have to use care choosing the type of terrain we drive over," Dr. Ashitey Trebi-Ollennu, a rover planner at NASA's Jet Propulsion Laboratory, Pasadena, Calif., said about the challenge of five-wheel driving. In tests at JPL, the team has been practicing a maneuver to gain additional tilt by perching the left-front wheel on a basketball-size rock.

Spending eight months or so at Low Ridge Haven will offer time for



many long-duration studies that members of the science team have been considering since early in the mission, said Dr. Ray Arvidson of Washington University in St. Louis, deputy principal investigator. These include detailed mapping of rocks and soils; in-depth determination of rock and soil composition; monitoring of clouds and other atmospheric changes; watching for subtle surface changes due to winds; and learning properties of the shallow subsurface by tracking surface-temperature changes over a span of months.

Source: NASA, Jet Propulsion Laboratory

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