

Scientific triumph on Mars as Spirit lands and explores surface

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19 January 2004

On Thursday, January 15 the Mars *Spirit* rover rolled onto the Martian landscape for the first time, after NASA scientists successfully maneuvered the six-wheeled vehicle off the lander, and away from the deflated airbags that were impeding its progress. Now the mission that began so promisingly two weeks ago can continue, with the exploration of a wider swath of the Martian surface.

On Tuesday, January 6, the Jet Propulsion Laboratory in Pasadena, California released the first color photograph of the Martian surface, taken by the vehicle's panoramic camera. The photograph revealed with astonishing clarity a flat rust-colored and rock-strewn landscape under a pinkish sky. Off in the distance there are shapes suggestive of distant mountains.

According to NASA scientists, the photo, at 12 million pixels, is the highest resolution photograph ever taken of the surface of another planet. The first photographs transmitted two weeks ago were black and white, but were produced stereoscopically so that with 3-D glasses, evocative of 1950s sci-fi movies, one could obtain a clearer perspective of the Martian landscape. This method, seemingly primitive, revealed details in the landscape that NASA scientists hope the rover will explore.

But it is the color photo that really brings home to the viewer the magnitude of the achievement. There is something strikingly familiar about the Martian surface. Gazing at the photo, one is seized with the desire to stride away from the lander and explore the distant terrain. Like earth, Mars is a terrestrial planet quite unlike the spectacularly strange gas giants that lie beyond the "Red Planet" and the Asteroid Belt. It is also more like Earth than Mercury, airless and baked by the Sun's proximity, or Venus, the earth's "sister"

planet, shrouded in greenhouse gases and ravaged by volcanism. And while its atmosphere is too thin for humans to survive unaided, and its temperatures for the most part too cold, it is the most likely site for a future extraterrestrial human settlement.

Spirit's lander touched down, or rather, bounced down on the Martian surface last Saturday night, after journeying for more than six months. The technology that brought *Spirit* to the Martian surface is remarkable while at the same time ingenious in its simplicity. The lander that contained *Spirit* made its trip to Mars encased in a protective "spaceship" that NASA scientists likened to a racecar housed inside a semi-trailer. Once in orbit, the lander was released for descent to the surface, its speed retarded by the deployment of a parachute and the firing of retro-rockets shortly before touchdown. Meanwhile, airbags inflated to completely surround the craft and cushion its impact.

According to subsequent computer analysis of the descent, a sudden wind gust pushed the lander sideways towards a large crater, but the lander's onboard computer detected the wind pressure and ordered steering rockets fired to prevent a change in course. The lander then hit the surface of the planet, bouncing 28 times into the air and traveling a distance of nearly 1,000 feet from the point of its first touchdown. By keeping the mass of the lander balanced asymmetrically—so the bottom is much heavier than the top—its designers were able to increase the probability that it would land base down and top up, thus avoiding a complicated maneuver for righting itself.

Once the lander was resting on the Martian surface, the airbags deflated and the petals and egress aids deployed, enabling the vehicle to move off the lander and begin performing its tasks. The principal work of

the rover will be to analyze the Martian landscape for signs that liquid water had once existed on the surface, long enough to make the planet hospitable for life at one time in its history.

Recent studies of the planet show evidence that expanses of water ice were located not only at Mars' poles, but also at its central latitudes. In an article in the current issue of *National Geographic* the presence of this mid-latitude ice is explained by scientists as related to extreme changes in the tilt of the Martian axis by as much as 20 degrees. It is believed that there could have been as many as 50 such obliquity variations over the last 5 million years, a relatively short period of time. Mars may be influenced by the gravitational pulls of other planets, as it makes its somewhat eccentric orbit around the sun. Scientists believe that on Earth this phenomenon, involving a change of only one degree, has contributed to the onset of ice ages.

Close observations of the Martian surface leave little doubt that natural forces are continuously at work changing the face of the Martian landscape. The current debate among Mars researchers centers on whether or not water, in either liquid or solid form, is still shaping the Martian landscape, and whether this water could still harbor primitive life.

The target area for the landing was selected because it appears to be the dry bed of what once was a lake. It is located in the Gusev crater, approximately 2,113 miles south of the Martian equator. The lakebed is believed to contain hematite, a crystalline iron compound usually formed in the presence of water. *Spirit* will relay its data to earth, using x-band radio waves, to the Deep Space Network, a series of antennas established at three communications facilities spaced at approximately 120-degree intervals. The DSN facilities, located at Goldstone in the Mojave Desert of California, Madrid, Spain and Canberra, Australia, are so placed as to allow constant observation of the Mars spacecraft as the earth rotates on its axis.

Spirit is one of three unmanned Mars expeditions launched last summer to take advantage of the unusually close proximity (35 million miles) of Mars and Earth. The joint European Mars exploratory vehicle, *Beagle 2*, named after the ship that carried Charles Darwin on his epic voyage of discovery in the 1830s, touched down on the Martian surface near the equator on Christmas Day, but has as yet failed to

communicate to Earth. While scientists are still attempting to locate the *Beagle* by way of its mother ship, *Mars Express*, still in orbit around the planet, it is possible that the *Beagle* has fallen into a crater. The likely demise of the European Mars explorer is unfortunate, since its primary task, to search for evidence of life on the planet, would have been a fitting complement to the work of the *Spirit* mission. A third probe, *Spirit's* twin, *Opportunity*, is approaching Mars and is expected to land on January 24.

While there have been some attempts by the media to accentuate the element of competition between Europe and the United States with regard to space exploration, the exchanges between NASA representatives and their European counterparts have been cordial and collaborative. A spokesperson for NASA expressed regret over the failure of *Beagle* to communicate, citing the loss of valuable scientific information.



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