# Phoenix probe lands on Mars (Update 4)

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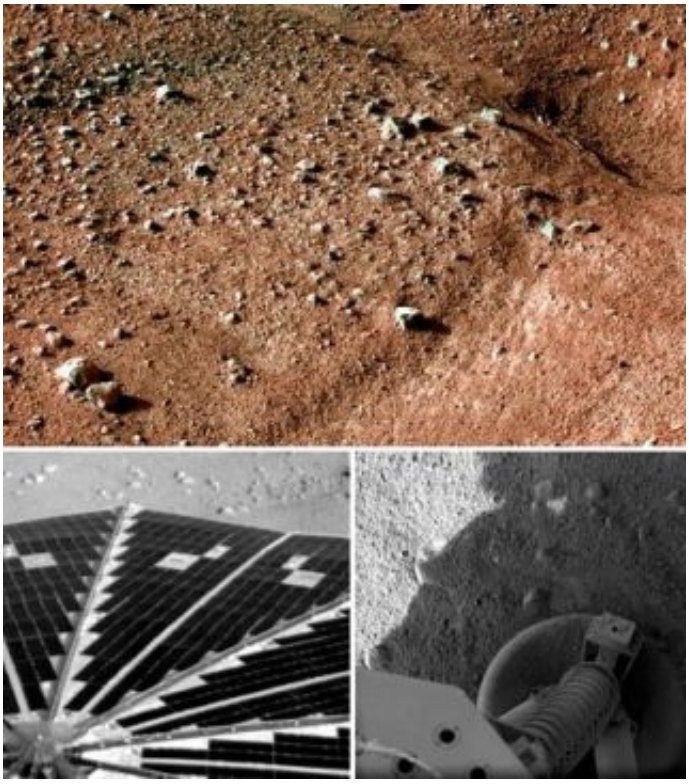

First pictures beamed back to Earth from Phoenix's arctic landing site. Image credits: NASA/JPL-Calech/University of Arizona.

NASA's Phoenix spacecraft landed in the northern polar region of Mars Sunday to begin three months of examining a site chosen for its likelihood of having frozen water within reach of the lander's robotic arm.

Radio signals received at 4:53:44 p.m. Pacific Time (7:53:44 p.m.

Eastern Time) confirmed the Phoenix Mars Lander had survived its difficult final descent and touchdown 15 minutes earlier. The signals took that long to travel from Mars to Earth at the speed of light.

Mission team members at NASA's Jet Propulsion Laboratory, Pasadena, Calif.; Lockheed Martin Space Systems, Denver; and the University of Arizona, Tucson, cheered confirmation of the landing and eagerly awaited further information from Phoenix later Sunday night.

Among those in the JPL control room was NASA Administrator Michael Griffin, who noted this was the first successful Mars landing without airbags since Viking 2 in 1976.

"For the first time in 32 years, and only the third time in history, a JPL team has carried out a soft landing on Mars," Griffin said. "I couldn't be happier to be here to witness this incredible achievement."

During its 422-million-mile flight from Earth to Mars after launching on Aug. 4, 2007, Phoenix relied on electricity from solar panels. The cruise stage with those solar panels was jettisoned seven minutes before the lander, encased in a protective shell, entered the Martian atmosphere. Batteries will now provide electricity until the lander's own pair of solar arrays spread open.

"We've passed the hardest part and we're breathing again, but we still need to see that Phoenix has opened its solar arrays and begun generating power," said JPL's Barry Goldstein, the Phoenix project manager. If all goes well, engineers will learn the status of the solar arrays between 7 and 7:30 p.m. Pacific Time from a Phoenix transmission relayed via NASA's Mars Odyssey orbiter.

The team will also be watching for the Sunday night transmission to confirm that masts for the stereo camera and the weather station have

swung to their vertical positions.

[Update: The stereo camera and weather station have swung to their vertical positions.]

"What a thrilling landing! But the team is waiting impatiently for the next set of signals that will verify a healthy spacecraft," said Peter Smith of the University of Arizona, principal investigator for the Phoenix mission. "I can hardly contain my enthusiasm. The first landed images of the Martian polar terrain will set the stage for our mission."

Another critical deployment will be the first use of the 7.7-foot-long robotic arm on Phoenix, which will not be attempted for at least two days. Researchers will use the arm during future weeks to get samples of soil and ice into laboratory instruments on the lander deck.

The signal confirming that Phoenix had survived touchdown was relayed via Mars Odyssey and received on Earth at the Goldstone, Calif., antenna station of NASA's Deep Space Network.

## Phoenix, the Mars polar explorer

NASA's three-legged Phoenix Mars Lander is slated to descend onto the planet's north pole region on Sunday on a mission to examine the frigid area's water history, probe the soil for the possibility of life and assess the habitability of the region.

-- Shaped like a cone as it descends, the 420-million-dollar Phoenix will open up after landing to unfurl two solar panels, to resemble a five meter (16 feet) by 1.5 meter (five feet) table.

-- It weighs 350 kilograms (772 lbs), including 25 kilograms (55 pounds) of scientific instruments.

-- The backhoe-like robotic arm, 2.35 meters (7.7 feet) long, is designed to dig trenches and pick up samples of soil and water ice, which it will deliver to instruments for detailed chemical and geological analysis.

-- The robotic arm also carries a box-shaped camera with a double Gauss lens system like that in 35mm cameras, and two lighting assemblies. Located just above the arm's scoop, it will take images of the surrounding area and of samples the arm picks up.

-- Meteorological station: the Canadian-built unit will monitor the daily weather of Mars' northern polar climate, one aim of which is to examine how water cycles between its solid and gas phases in the region. It carries a lidar instrument (for light detection and ranging) which uses laser light pulses to study atmospheric particles in the area.

-- Surface stereo imager: what NASA calls Phoenix's "eyes," the SSI will produce high-definition and panoramic images of Mars' arctic region. Sitting two meters (6.6 feet) above the ground, its stereo capability will help give scientists on Earth three-dimensional views of the work the robotic arm does. It can also be turned vertically to take images that will provide information on atmospheric particles.

## Chronology of the global race to Mars

Chronology of international missions to Mars. Only about half of the attempted missions have been successful.

-- 1960-64: The USSR fails at six tries to send probes to Mars, and the United States' first try, in November 1964, also fails.

-- Nov 28, 1964: The US probe Mariner 4 starts an eight-month journey to Mars, collecting the first close-up pictures of another planet in a July 1965 flyby.

-- Nov 30, 1964: The USSR's Zond gets close to Mars in a flyby but does not send back any data.

-- Feb-Mar 1969: The US launches Mariner 6 and Mariner 7 carrying sensors to analyze the Martian atmosphere and surface, and they send back nearly 200 pictures of the northern and southern polar caps and the moon Phobos.

-- May 31, 1971: Mariner 9 launches to become the first successful orbiter of Mars, photomapping all of the planet's surface and taking close-up images of Phobos and Deimos, Mars' second moon.

-- May 1971: The USSR launches twin orbit vehicles Mars 2 and 3, both carrying surface rovers. The two successfully went into orbit but both rovers fail. Two more landers fail in March 1974.

-- July-Sept 1976: The US successfully places two landers on the surface from the Viking 1 and 2 orbiters launched a year earlier. The Viking 2 lander's biology experiments fail to find evidence of life, but reveal surprising chemical activity in the Martian soil.

-- Sept 11, 1997: The US Mars Global Surveyor goes into orbit around Mars, and over nine years tracks changes in the planet's surface including evidence of modern water flows and seasonal shifts.

-- July 4, 1997: The US Mars Pathfinder parachutes onto the rocky Ares Vallis region of Mars, its landing cushioned by airbags. The lander and rover return more than 17,000 images and extensive data on soil and rock composition and wind and other weather factors. The data suggests Mars was formerly warm and wet, with a more dense atmosphere and liquid water.

-- July 4, 1998: Japan enters the Mars exploration race, but its Nozomi

probe never reaches Mars's orbit.

-- April 7, 2001: The US Mars Odyssey orbiter is launched to carry out experiments on Mars's geology and climate, aiding the search for evidence of water and life.

-- June 2, 2003: European Space Agency launches Mars Express, carrying the British-built Beagle 2 lander. The lander loses contact upon separating from the orbiter in Dec 2003, its fate unknown.

-- Jan 2004: The US places two more rovers, Spirit and Opportunity, on opposite sides of the Mars surface and they begin extensive geological analysis of the surface.

-- Jan 14, 2004: US President George W. Bush announces a new NASA initiative to eventually send humans to Mars via a moon base after 2020.

-- Feb 25, 2007: European Space Agency's Rosetta spacecraft performs a risky low-altitude flyby of Mars.

-- Jan 2008: Lev Zelyony, director of Russia's Space Research Institute, says it could land a Russian on the Red Planet by 2025.

## Mars: A factfile

Factfile on Mars: the fourth planet from the Sun, long called the "Red Planet" for its reddish appearance caused by ferric atmospheric and surface dust.

ORBIT: 227.9-million-kilometer (142.4-million-mile) mean distance from the Sun, about 1.5 times the distance between the Sun and Earth

DIAMETER: 6,794 kms (4,246 miles), slightly more than half the

Earth's diameter

MARTIAN DAY: 24 hours, 37 minutes, 22 seconds

MARTIAN YEAR: 669 Martian days (687 Earth days)

TEMPERATURE: Average - 55 C (- 67 F). Minimum: - 133 C (- 207 F) at the poles in winter. Maximum temperature: 27 C (81 F) in summer on equator

ATMOSPHERE: Composition 95.3 percent carbon dioxide ($CO_2$), 2.7 percent nitrogen, 1.6 percent argon, 0.1 percent oxygen. Pressure at surface is less than 1/100th Earth's atmospheric pressure.

LANDSCAPE: Rocky, dusty and dry. The northern hemisphere is smooth and flat, while the southern hemisphere comprises deeply cratered, rugged highlands. Oceans once covered Mars' surface, and residual water in the form of ice lies at the polar caps and, possibly, in abundance close to the surface in other regions. The north pole has a large, permanent cap of what is believed to be mainly water ice. The south pole has a small cap, possibly of frozen carbon dioxide ($CO_2$), which almost disappears during the Martian summer.

MAJOR FEATURES: Olympus Mons, at 26,000 meters (84,500 feet) the highest known volcano in the solar system; Tharsis Dome, a mysterious bulge 10 kms (six miles) high and 4,000 kms (2,500 miles) across; Valles Marineris, a canyon 4,000 kms (2,500 miles) long and up to seven kms (4.4 miles) deep.

MOONS: Phobos, diameter 22 kms (13.75 miles), orbit 5,981 km (3,738 miles) from surface; Deimos, diameter 12 kms (7.5 miles), orbit 20,062 kms (12,538 miles) from surface.

Source: NASA