NASAfacts

Mars Phoenix Lander

The Phoenix Mars Lander is the first project in NASA's openly competed program of Mars Scout missions. Phoenix will land in icy soils near the north polar permanent ice cap of Mars and explore the history of the water in the ice while monitoring polar climate. It will serve as NASA's first exploration of a potential modern habitat on Mars and renew a search for carbon-bearing compounds, last attempted with NASA's Viking missions in the 1970s.

Launch opportunity dates for Phoenix begin Aug. 3, 2007. If Phoenix launches during the first portion of a three-week launch opportunity, it will land May 25, 2008. The landing will be on arctic ground where a mission currently in orbit, Mars Odyssey, has detected high concentrations of ice just beneath the top layer of soil.

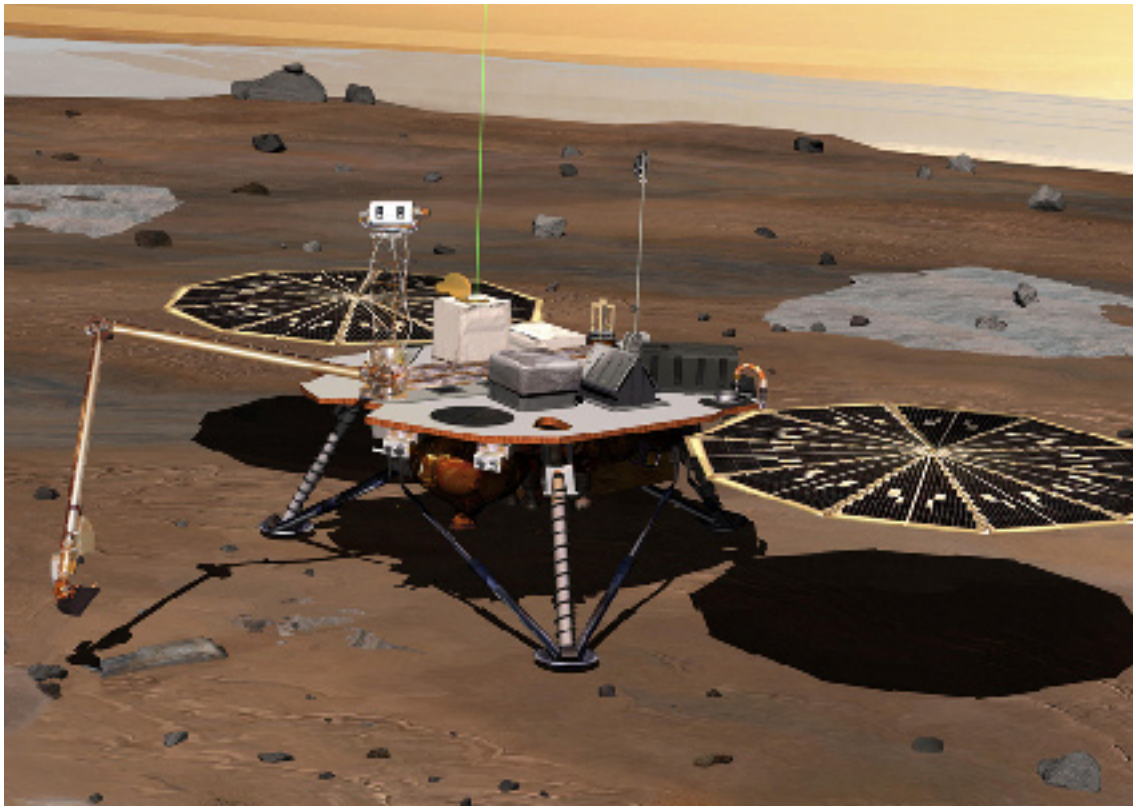
A stereo color camera and a weather station will study the surrounding environment while the other instruments check samples of soil and ice for evidence about whether the site was ever hospitable to life. Microscopes will reveal features as small as one one-thousandth the width of a human hair.

Like its namesake mythological bird, Phoenix rises from remnants of its predecessors. It will use many components of a spacecraft originally built for a 2001 Mars lander mission, which was kept in careful storage after that mission was cancelled. The science payload for Phoenix includes instruments built for the 2001 lander and improved versions of others flown on the lost Mars Polar Lander in 1999.

Science Objectives

Findings from Mars Odyssey indicate the top half meter (20 inches) of Mars' surface layer is mostly ice throughout large regions of the planet pole-ward of 65 degrees north latitude. Phoenix will seek clues about the history of that ice. Is this the frozen residue of an ancient ocean? Did it diffuse into the ground from water vapor in the atmosphere? Did a retreating ice sheet leave it behind? Information such as the amount of layering, the textures of the ice and soil, and the chemical composition at different depths could distinguish among those and other possibilities.

Indicators about the history of the near-surface ice, together with Phoenix instruments' observations of seasonal changes over a span of several months, will improve understanding about climate cycles on Mars. One tantalizing question is whether cycles, either short-term or long-term, might



produce conditions when even small amounts of near-surface water might stay melted.

The goal of learning about ice history and climate cycles dovetails with the Phoenix mission's most exciting task -- to evaluate whether an environment hospitable to microbial life may exist at the ice-soil boundary. Even if water remains liquid only for short periods between long intervals, life can persist if other factors are right, as studies of arctic environments on Earth testify. Phoenix will examine some of those other factors, such as whether organic compounds are present and whether strong oxidants in the soil make conditions too harsh for life.

Mission Overview

Phoenix was assembled and tested at Lockheed Martin Space Systems, Denver. It will be launched on a Delta II launch vehicle from Cape Canaveral Air Force Station, Fla., in August 2007. It will reach Mars in May or early June 2008 and land with the use of descent engines just prior to touchdown, rather than making an airbag-cushioned landing like those of the Mars Pathfinder and the Mars Exploration Rover missions. This method has not been used successfully on Mars since 1976. It allows a higher ratio of payload weight to total weight than airbags do. The Phoenix team has extensively examined the landing system for potential weaknesses and addressed those identified, but no landing on Mars is risk free.

The Phoenix mission timeline calls for the solar-powered lander to operate on Mars' surface for up to three months. The spacecraft's robotic arm will dig a trench to reach the icy layer, probably within a few inches of th surface. NASA's Mars Odyssey and Mars Reconnaissance Orbiter have examined potential landing areas for Phoenix and will provide communication relays between the lander and Earth. The leading candidate site is at 233 degrees east longitude, 68 degrees north latitude, a latitude equivalent to northern Alaska.

Spacecraft

A lander built and tested for NASA's 2001 Mars Surveyor program has been adapted as the main structure for Phoenix. Besides the lander with its research instruments, the spacecraft includes a cruise stage for the trip between Earth and Mars and an aeroshell to shield the lander during descent through Mars' atmosphere.

The lander carries seven instruments.

❑ The Robotic Arm, about 2.35 meters (7.7 feet) long, will dig into the ground and deliver samples to two instruments for analysis. The arm can reach far enough to dig about half a meter (20 inches) deep. However, the subsurface ice layer expected at the landing site may not lie that deep. Once the arm reaches the icy-soil layer, the powered rasp will be used to acquire samples. The arm was built by NASA's Jet Propulsion Laboratory, Pasadena, Calif., based on designs from previous missions.

❑ The Robotic Arm Camera, mounted just about the scoop at the end of the arm, will provide close-up color images of the soil and ice. It will look for layers and other features in the freshly exposed wall of the excavated trench. The Max Planck Insitute for Solar System Research, in Germany, and the University of Arizona, Tucson, supplied this camera.

❑ The Thermal and Evolved-Gas Analyzer, supplied by the University of Arizona, will heat soil samples delivered by the arm and measure how much water vapor, carbon dioxide and volatile organic compounds are given off as the temperature climbs. The instrument is based on one originally flown on Mars Polar Lander.

❑ The Microscopy, Electrochemistry and Conductivity Analyzer, combines several components. Optical and atomic-force microscopes will examine samples' mineral grains. Four electrochemistry cells will measure a wide range of chemical properties, such as the presence of dissolved salts and the level of acidity or alkalinity. A conductivity probe mounted on the robotic arm will check the soil's thermal and electrical properties. JPL provided the instrument, adapted from one intended for Surveyor.

❑ The Surface Stereo Imager, mounted on a mast, will provide high-resolution, color, stereo images of the terrain at the landing site and positioning information for use of the arm. The University of Arizona supplied this camera, an upgraded version of similar ones flown on Mars Polar Lander and Mars Pathfinder.

❑ The Meteorological Station, provided by the Canadian Space Agency, will monitor changes in water abundance, dust, temperature and other variables in the Martian atmosphere.

❑ The Mars Descent Imager will provide geological context for the landing site. It was built by Malin Space Science Systems, San Diego, Calif., for 2001 Mars Surveyor.

Mars Scout Program

Mars Scouts are competitively proposed missions intended to supplement, at moderate cost, the sequence of larger, strategic missions of NASA's Mars Exploration Program. The Phoenix mission plan, developed by a team led by a University of Arizona scientist, was one of 25 proposals submitted for the first Mars Scout solicitation round. NASA solicited proposals in 2006 for the second Mars Scout mission, to fly in 2011.

The Phoenix Team

Peter H. Smith of the University of Arizona is principal investigator for Phoenix. JPL, a division of the California Institute of Technology, Pasadena, manages the project for the NASA Office of Space Science, Washington, D.C. Lockheed Martin Space Systems is the primary industrial partner for the mission. At JPL, Barry Goldstein is Phoenix project manager and Leslie Tamppari is Phoenix project scientist. At Lockheed- Martin, Ed Sedivy is flight system program manager for Phoenix. International contributions are provided by the Canadian Space Agency, the University of Neuchatel (Switzerland), the University of Copenhagen (Denmark), the Max Planck Institute (Germany) and the Finnish Meteorological institute.

For More Information

The Phoenix mission Web site is at http://phoenix.lpl.arizona.edu

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