NASA Facts

National Aeronautics and
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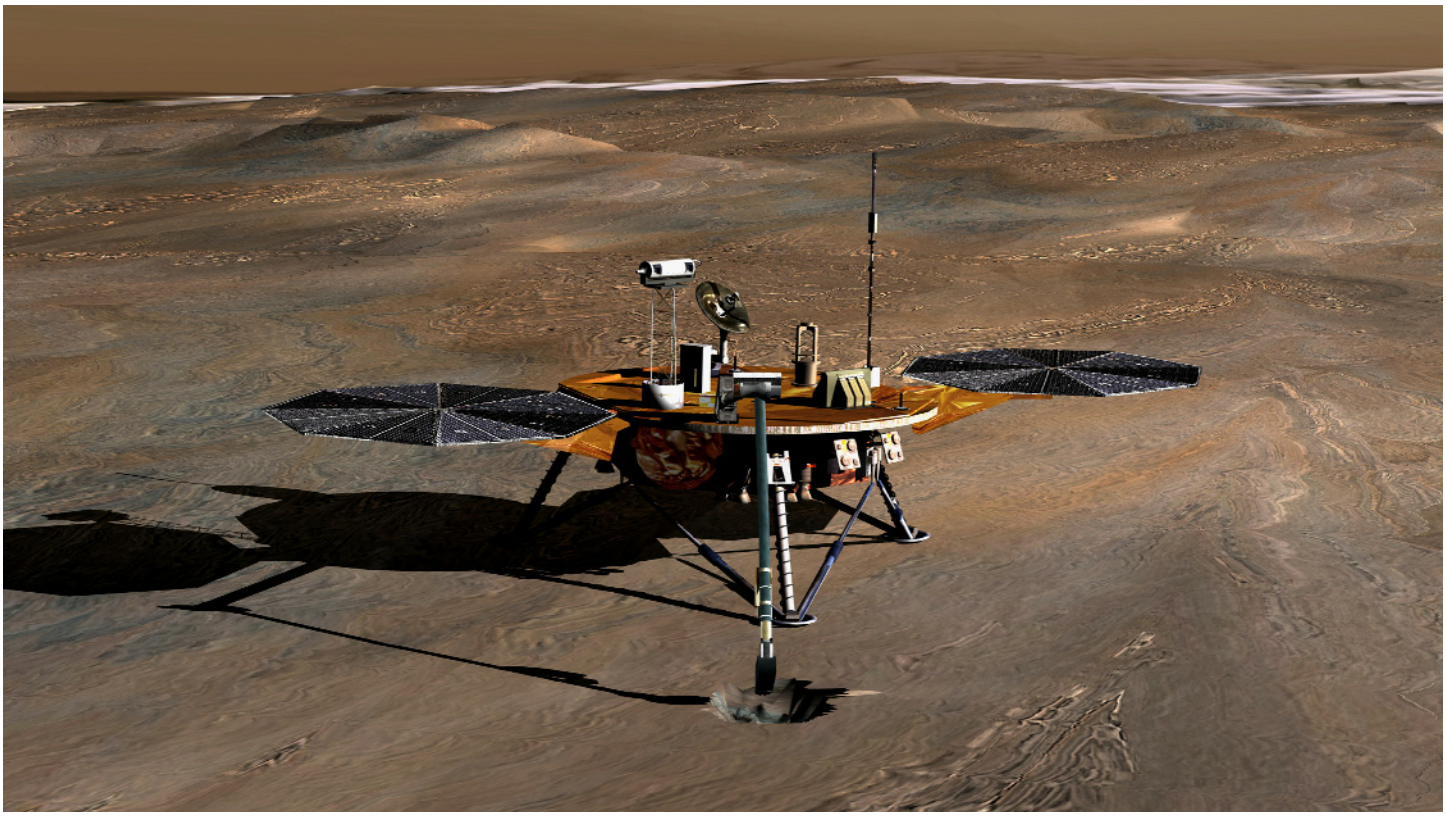
Phoenix Mars Scout

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

Phoenix is in development for launch in August 2007. It would land in May 2008 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 would study the surrounding environment while the other instruments check excavated soil samples for water, organic chemicals and conditions that could indicate whether the site was ever hospitable to life. Microscopes would 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 planned 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 would 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

After extensive testing, Phoenix would be launched from Cape Canaveral Air Force Station, Fla., in August 2007. It would reach Mars in May 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. 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 would dig a trench up to a half meter (20 inches) deep.

The mission's specific landing site will be selected based on detailed reconnaissance of candidate sites still to be conducted by spacecraft orbiting Mars. The candidate sites will lie between the northern latitudes of 65 degrees (the equivalent of Fairbanks, Alaska) and 75 degrees (the equivalent of northern Greenland). Summer will be starting in Mars' northern hemisphere at the time of Phoenix's planned arrival.

Plans call for the lander's primary communications link with Earth to be relay via NASA's Mars Reconnaissance Orbiter, which is in development for launch in August 2005.

Spacecraft

A lander built and tested for NASA's 2001 Mars Surveyor program has been stored at Lockheed Martin Space Systems, Denver, Colo., since the lander portion of the 2001 program was cancelled in the wake of two 1999 Mars mission failures. Plans call for Phoenix to use the lander, three instruments and other components from the 2001 mission.

The spacecraft would carry six instruments.

❑ The *Robotic Arm*, about 2 meters (6.6 feet) long, would dig into the ground and deliver samples to two instruments for analysis. An arm-mounted camera provided by Max Planck Institute in Germany would look for layers and other features in the freshly exposed wall of the excavated trench. The arm will be built by NASA's Jet Propulsion Laboratory, Pasadena, Calif., based on designs from previous missions. It will be longer than a similar arm JPL first created for the Mars Polar Lander in 1999 or a modified version for the 2001 Mars Surveyor Lander.

❑ The *Thermal Evolved Gas Analyzer*, supplied by the University of Arizona, Tucson, is engineered to heat soil samples delivered by the robotic 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*, built by JPL for 2001 Mars Surveyor, combines several components. Optical and atomic-force microscopes would examine samples' mineral grains. Four electrochemistry cells would measure a wide range of chemical properties, such as the presence of dissolved salts and the level of acidity or alkalinity. A new conductivity probe mounted on the robotic arm would check the soil's thermal and electrical properties.

❑ The *Surface Stereo Imager*, mounted on a mast, would 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 is providing this camera, an upgraded version of similar ones flown on Mars Polar Lander and Mars Pathfinder.

❑ The *Meteorological Suite*, provided by the Canadian Space Agency, would monitor changes in water abundance, dust, temperature and other variables in the martian atmosphere.

❑ The *Mars Descent Imager* would 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 relatively low cost, the core 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 plans to select a second Mars Scout from a future round of proposals to fly in 2011.

The Phoenix Team

Dr. 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 NASA Headquarters, Karen McBride is Mars Scout program executive and Dr. James Garvin is Mars Scout program scientist. At JPL, Barry Goldstein is Phoenix project manager and Dr. Leslie Tamppari is Phoenix project scientist. At Lockheed-Martin, Ed Sedivy is flight system program manager for Phoenix.

For More Information

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