MARS PATHFINDER PROJECT PROGRESS REPORT

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Abstract

Mars Pathfinder, launching on December 2, 1996 and landing on Mars on July 4, 1997, will demonstrate a low-cost delivery system to the surface of Mars. 1 listorically, spacecraft that orbit or land on a distant body carry a massive amounts of fuel for braking at the planet. Pathfinder require.s fuel only to navigate to Mars; the spacecraft aerobrakes into the Mars atmosphere directl y from Earth-Mars transfer trajectory, deploys a parachute at 10 km above the surface and, within 100 m of the surface, fires solid rockets for final braking prior to deployment of airbags that cushion touchdown. After landing,, petals open to upright the lander, followed by deployment of a small rover and several science instruments.

A major objective of Pathfinder– -acquisition and return of engineering data on entry, descent, and landing (EDL) and lander performance--will be completed within the first few hours after safe landing. In addition, the lander will transmit images of the Martian surface the first day. Next, a rover will be deployed, as early as the first day, to perform mobility tests, image its surroundings, including the lander, and place an Alpha Proton X-Ray Spectrometer (APXS) against a rock or soil to make elemental composition measurements. The primary mission durations for the rover and lander arc onc week and one month, respectively. 1 lowever, there is nothing to preclude longer operations up to a year.

Pathfinder will also accomplish a focused, exciting set of science investigations with a stereo, multi-color lander imager on a pop-up mast; atmospheric instrumentation for measuring a pressure, temperature and density profile during entry and descent and for monitoring n iartian weather after landing; and the rover with its forward and aft cameras and the APXS. The APXS and the visible to near infrared filters on the lander imaging system will determine the elemental composition and constrain the mineralogy of rocks and other surface materials, which can be used to address first order questions concerning the composition of the crust, its differentiation and the development of weathering products. Regular tracking of the lander will allow determination of the martian pole of rotation, its precession since Viking cra measurements, and the moment of inertia, which should allow discrimination between interior models that include a metallic core and those that do not.

The Pathfinder Landing Site selected is Arcs Vallis (19.5°N, 32.8 °W), which is near the sub-solar latitude (15°N) for maximum solar power at landing on July 4, 1997 and is at 2 km below the datum for comet operation of the parachute. The site is in Chryse Planitia a lowland where a number of catastrophic floods from the highlands to the north debouch. It is a "grab bag" site with the poter dial for sampling a wide variety of different martian crustal materials, such as ancient crustal materials, intermediate age ridged plains and a variety of reworked channel materials. Even though the exact provenance of the samples would not be known, data from subsequent orbital remote sensing missions could be used to infer the provenance for the "ground truth" samples studied by Pathfinder. Available data suggest the site is about as rocky as the. Viking sites, but perhaps a bit less dusty. This site has streamlined islands (carved by the flood) nearby and a ver y smooth depositional surface at Viking resolution, except for small hills andsecondar y craters.

This paper reports on the status of Mars Pathfinder's drive to space qualify its Flight System for launch on December 2, 1996 under a cost cap– -in particular how the Project is dealing with qualification of its entry, descent and landing event and the surface operations phase as well as the normal launch and space flight phases. It also reports on its landing site selection and science plan