Mars Surveyor Program Architecture and Future Missions

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In the months after the double loss of the Mars Climate Orbiter and the Mars Polar Lander, the architecture of the Mars Surveyor Program is being reexamined. An approach is sought to accomplish the science objectives with an appropriate balance between science and engineering, with increased program resiliency and enhanced mission success. The results are expected to be developed in the winter and spring of 2000 and will be presented in this paper, along with descriptions of the future and candidate-future missions.

The primary scientific goal of the Mars Surveyor Program is to understand Mars as an abode of past or present life. With the current level of technology for detecting evidence of life or markers of biological processes, bringing samples back to Earth for analysis in sophisticated laboratories is the best way to search for this evidence, at least for the next decade. Hence, the previous architecture had as a focus returning samples of Martian rock and soil to Earth. It is anticipated that the new architecture will still includes sample return missions. However, the schedule and the set of precursor missions will likely be modified.

The previous architecture included a set of sample return missions with launches in 2003 and 2005, with additional sets as soon as practical thereafter. Two large landers were to be launched in 2003 and 2005, respectively, each landing at a carefully selected site. Each lander was to carry an instrumented rover which would select promising rocks, obtain tens of sample rock cores, and return to the lander. There the rover would transfer the samples to an ascent vehicle, which would deliver the sample canister to Mars orbit. A French orbiter, launched in 2005, also part of the sample return mission set, was to capture one or both of the canisters launched from the two landers and return them to Earth by 2008.

The previous architecture included other missions in addition to sample return missions. An orbiter was to be launched in 2001 which would use remote sensing instruments to map the temperatures and elemental composition of the surface, and to search for near-surface reservoirs of water. A lander would also be launched in 2001 and would be targeted for a near-equatorial region. It would carry a Sojourner-type rover and would analyze rocks and soil in the vicinity of the lander. Three instruments would also be carried that would support the possible future human exploration of Mars. The architecture also included participation in the European Space Agency's Mars Express mission, with a radar sounder and a number of co-investigators on other experiments. In addition, a set of micromissions was being planned to be incorporated into the program.

The updated architecture may include some or all of the following:

Maintaining the 2001 orbiter, possibly adding a sample canister experiment

Communication of spacecraft events and status during atmospheric entry of landed missions

A more robust landing system with active hazard avoidance or a very robust system immune to most hazards

A "black box" to communicate even more information after landing of the entry, descent, and landing events and status

Enhanced infrastructure at Mars, including increased communication and navigation capability

The addition of more surveillance orbiters

The addition of small scout landed or atmospheric missions to characterize landing sites for future Mars landed missions

The return of a "scientifically selected" sample set of at least 500 grams, perhaps in 2010

The new architecture will be described and an overview given of the missions contained therein.

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