

ABSTRACT
EARLY MARS SUBSURFACE ACCESS
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During the Fall of 1999, NASA JPL, JSC, and the commercial drilling firm of Baker Hughes conducted an intensive study to determine the feasibility of a 200 meter Mars drill, to be the prototype and technology demonstrator for a 3-4 kilometer drill deployed on a subsequent mission.

A proprietary design developed by Baker Hughes satisfied all mission requirements for performance, autonomy, cost, mass, development schedule, and risk. It would reach 200 meters in depth in less than one Earth year of operations. It satisfied the NASA team that the concept, which uses existing, proven technologies, would provide a very low risk mission, capable of providing enormously significant scientific and engineering returns at very reasonable cost. Baker Hughes has offered to deliver this drill in 24 months, at a fixed price of \$12 million.

Because of the enormous costs of producing or delivering drilling fluids to Mars, the drill uses a dry mechanical auger coupled to a Baker-Hughes proprietary drill bit. It will produce intact, protected core samples from the entire depth of the hole, and will bring these samples to the surface for analysis or subsequent return to the Earth. Cuttings are also captured for surface or in-situ analysis. The drill can also incorporate "measurement while drilling" (MWD) technology, using a variety of sensors, to analyze the media being drilled in real time. A wireline from the drill to the surface enables the transmission of large data rates.

This drill was fully integrated with a robotic spacecraft in the 1999 design process. The integrated drill/spacecraft was capable of being launched to Mars on a standard Delta rocket.

Since the 1999 design activity, several iterations of the drill design have been made. Currently, JSC, in conjunction with Baker Hughes, is designing a 50 kg version of the drill capable of reaching at least 20 meters depth on Mars with extremely low power (275-440 watt hours per sol).

Using OSF Advanced Mission funding, and the active support of Baker Hughes, JSC will build and test a prototype of the 20 meter drill. This drill will be manufactured at the Center, using either Civil Service or support contractor labor. The drill bit is being designed, developed, manufactured, and tested by Baker Hughes, for delivery to NASA. Testing will be performed in several phases, beginning with simple functional tests late in 2001, and continuing with environmental testing,

as resources allow, into the Spring of 2002. The goal of these tests is to demonstrate a technology readiness level of at least four. It will also be a technology demonstrator for the 200 meter and 3-4 kilometer drills.

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September 25, 2001