

## **THOR Mars Mission To Seek Underground** Water

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A new, low-cost mission concept to Mars would slam a projectile into the planet's surface in an attempt to look for subsurface water ice.

"I'm interested in exploring mid-latitude areas of Mars that look like they're made of snow and ice," Phil Christensen, the project's principal investigator, told SpaceDaily.com.

Christensen, of Arizona State University, and colleagues at NASA's Jet Propulsion Laboratory, are proposing a mission called THOR – for Tracing Habitability, Organics and Resources – as part of NASA's Mars Scout program.

Like last year's Deep Impact mission to comet Tempel 1, THOR aims to ram a projectile at high speed into the surface of Mars while a host spacecraft remains in orbit and observes the impact and its aftermath. If approved by NASA, the mission would launch in 2011.

Christensen said he originally had conceived of a mission to the Martian mid-latitudes, because "there are lots of gullies there that look like they are rice in ice, possibly even glaciers."

His idea was to attempt to land small probes in at least several locations to examine the surface, "but landing is difficult and expensive." After Deep Impact's success, however, "this light bulb went off. We could launch a projectile, dig a deep hole, and observe the ejected material."



Christensen estimates that a projectile of sufficient size could blow a crater at least 30 feet deep in the Martian subsurface. Along with ground water, the impact could excavate organic compounds. The mission will also look for methane in the atmosphere, which Earth-based telescopes and other Mars spacecraft already have detected.

THOR would comprise an impact projectile and an orbiting spacecraft. The projectile would aim for an impact site somewhere between  $30^{\circ}$  and  $60^{\circ}$  latitude, either north or south.

"In many areas of Mars' middle latitudes, we see tantalizing evidence of dust-covered layers of snow or ice," Christensen said. "THOR will aim for this material." The suspected ice-rich layers were deposited during the past 50,000 to 1 million years, as the Martian climate changed due to orbital variations.

Christensen said the mission should cost about \$450 million, including the launch vehicle. He said NASA probably will receive about a dozen other Scout Mission proposals and should choose the winning designs sometime this summer.

"The THOR mission plans to use a straightforward, low-risk approach to reach the Martian subsurface," said JPL's David Spencer, study lead engineer for THOR. Spencer is the former mission manager for Deep Impact.

"With such a large target region on Mars, delivering THOR<sup>1</sup>s impactor will be less challenging than the Deep Impact comet encounter," Spencer said.

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