Looking for water on Mars

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NASA's Phoenix Scout Lander reached Mars on May 25,, opened a soils lab, and started looking for water. Phoenix uses a robotic scoop arm to deliver regolith samples to the suite of instruments aboard the Lander--with one exception. The thermal and electrical conductivity probe designed by a team of research scientists at Decagon Devices Inc. is actually mounted on the robotic arm and makes direct contact with the regolith. It measures thermal conductivity, thermal diffusivity, electrical conductivity, and dielectric permittivity of the regolith, as well as vapor pressure of the air.

Phoenix uses the probe to look for evidence of water on Mars and to determine thermal properties of the regolith for use in climate models. The data collected so far await analysis, but the numbers look intriguing and promising not just for Mars study but here on earth.

Logistical challenges early on forced the Decagon team to look for flexibility in the transient heated needle technique in order to build a successful thermal properties analyzer for Mars. Phoenix's robotic arm can't insert the needles as gently as a human hand. Long, thin needles approximating an infinitely long line heat source as required by the model were likely to snap when inserted into a surface of unknown hardness. The best alternative design featured stubby, conical needles which violated the assumptions of the transient heated needle theory.

Decagon's Mars team doubted whether the model could even fit time and temperature data collected with a short, conical needle.

"I thought there was very little chance," says Dr. Gaylon Campbell, a team member, "but it turns out that it does."

By correlating the parameters generated with standards of known thermal properties, the team was able to correct the parameters generated by long, skinny needles to fit those from short, fat needles.

Dr. Doug Cobos will present the paper, "Measuring Thermal Properties on Mars: Relaxation of Requirements for Transient Heated Needle Measurements of Material Thermal Properties." His research will discuss the Mars teams' methods and results in a paper on Tuesday, 7 October. He will also describe how their instrument- and theory-related discoveries benefit earth-side users as well.

The paper will be presented during the 2008 Joint Annual Meeting of the Geological Society of America (GSA), Soil Science Society of America (SSSA), American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Gulf Coast Association of Geological Societies (GCAGS) in Houston.

"We don't use conical needles in our commercial thermal properties sensors, but the mathematical models we developed for Mars make those sensors much more accurate and effective," says Dr. Colin Campbell, another member of the team. "The Mars project has expanded both the depth of our understanding and the breadth of our perspective."

Source: Soil Science Society of America