Lunar prospecting robot to be field tested on Hawaii's Mauna Kea

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The cool, rocky slopes of Mauna Kea, a dormant volcano that is Hawaii's highest mountain, will serve as a stand-in for the moon as researchers from Carnegie Mellon University's Robotics Institute, NASA and other organizations test a robot designed for lunar prospecting.

During the field experiment, Nov. 1-13, the robot called Scarab will simulate a lunar mission to extract water, hydrogen, oxygen and other compounds that could potentially be mined for use by future lunar explorers. The four-wheeled robot will trek to different sites, using a Canadian-built drill to obtain a one-meter geologic core at each site. Each core will be chemically analyzed by on-board instruments developed by NASA.

"People will not return to the moon for prolonged stays unless we can find resources there to help sustain them," said University Professor William "Red" Whittaker, director of the Robotics Institute's Field Robotics Center. "The technology being developed for Scarab will help locate whatever water or resources might exist on the moon as we seek out the raw materials for a new age of exploration."

Scarab was designed and built for NASA's Human Robot Systems program by Carnegie Mellon. It serves as a terrestrial testbed for technologies that would be used to explore craters at the moon's southern pole, where a robot would operate in perpetual darkness at temperatures of minus 385 degrees Fahrenheit. The rover features a novel rocker-arm suspension that enables it to negotiate sandy, rock-strewn inclines and to

lower its 5 ½-foot by 3-foot body to the ground for drilling operations. Scarab weighs 400 kilograms (about 880 pounds) and can operate on just 100 watts of power.

"Last year, we demonstrated Scarab's unique maneuverability and its ability to navigate autonomously," said David Wettergreen, associate research professor of robotics and project leader. "This year we reconfigured Scarab to accommodate a rock sample analysis payload developed by NASA. Now it is a complete robotic system for exploring the lunar poles and prospecting for resources."

Scarab is outfitted with a drill assembly built by the Northern Centre for Advanced Technology Inc. (Norcat) in Sudbury, Ontario. The drill takes hours to cut a one-meter core into a dense layer of weathered rock and soil, known as regolith. The core is then transferred into another Norcat device that pulverizes it, about one foot at a time.

The crushed rock and soil drops into the Regolith and Environment Science and Oxygen and Lunar Volatile Extraction (RESOLVE) experiment being developed by NASA's In Situ Resource Utilization (ISRU) program. Inside RESOLVE's heating chamber, the sample is heated to 900 degrees Celsius (1652 degrees Fahrenheit); gases released by the heat are transported to a gas chromatograph, an instrument that identifies individual chemicals and their relative abundance, and to absorption beds, each of which measures a particular compound of interest. It takes up to 20 hours to analyze an entire one-meter core.

Hawaii, famed for its tropical beaches, may not seem to have much in common with the moon. But the nearly 14,000-foot summit of Mauna Kea, home to a dozen major telescopes, is often snow-capped during winter months. The NASA field test will occur at elevations of approximately 9,000 feet, where Scarab is likely to encounter rain and fog and daytime temperatures of about 40 degrees.

Source: Carnegie Mellon University