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Mapping the Planets

A new LIDAR system could provide more data on distant planets.

By Tim Barribeau

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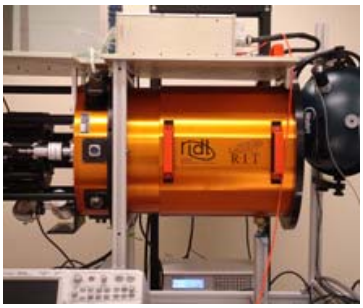

Testing in a vacuum: This helium-cooled vacuum device, known as a Dewar test system, will be used to determine the effectiveness of a new LIDAR system for mapping planets. LIDAR's sensors are placed in the Dewar test system to create a carefully controlled environment in which to determine their efficacy and accuracy.
Credit: Rochester Institute of Technology, Rochester Imaging Detector Laboratory

Researchers at the Rochester Institute of Technology (RIT) and MIT are developing a new generation of LIDAR (light detection and ranging) technology to map planetary bodies in more detail than ever before. These maps could help further our goals to explore outer space by providing more data about the geography and topography of the planet so that landing sites can be selected for future missions. The advanced LIDAR system could also be used to analyze the atmosphere on other planets to find out critical information about biohazards, wind speed, and temperature.

LIDAR works on a similar principle to radar, but through the use of lasers rather than radio waves. The laser is shot at an object, and the time delay between the pulse and the reflection is measured in order to accurately gauge the distance. The advantages of LIDAR over radar are twofold: LIDAR can be used to measure smaller objects, and it works on a greater variety of materials.

Professor Donald Figer and his team at the Rochester Imaging Detector Laboratory (RIDL), along with researchers at MIT's Lincoln Laboratory, have been awarded $547,000 in funding from NASA toward developing new light sensors. If their work is successful, the researchers could be awarded an additional $589,000 for fabrication and testing.

The current LIDAR technology used by NASA has trouble distinguishing between objects with a height difference of less than one meter. With the new sensors, objects with differences down to one centimeter should be distinguishable.

The project focuses on the development of a low-power, continuous two-dimensional sensor array. Once the array is completed, the researchers hope that it will be able to capture data from a wide laser scan, in contrast to the current array, which gathers measurements using point-by-point readings. The pixel resolution of the scans is also greatly increased, from kilometers square to a few feet by a few feet. A prototype currently exists at Lincoln Laboratory. RIDL will soon begin evaluating the device while concurrently improving the design.

Right now, NASA is working on a different method of improving LIDAR for the Lunar Orbiter Laser Altimeter. LOLA is designed for the Lunar Reconnaissance Orbiter, which is scheduled for launch no earlier than November 2008. LOLA will provide a detailed topographic map of the moon's surface to increase surface mobility and exploration for lunar missions. Unlike what Figer and his group are doing, the LOLA LIDAR improves resolution by having five lasers and five receivers working simultaneously. Figer's system also uses one laser, but a beam expander will separate the beam, sending it off at a number of angles. Once the constituent beams are reflected off the objects being measured, the beams are recombined and then analyzed with the new sensors.

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