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NASA's Goddard Wins Science Awards for Robotic Moon Mission

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1 PRESS RELEASE

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NASA selected two proposals from researchers at NASA's Goddard Space Flight Center in Greenbelt, Md., to assist with measurements the agency's Lunar Reconnaissance Orbiter will make. The orbiter, also

known as LRO, is being built and managed by Goddard and is scheduled for launch later this year. LRO represents NASA's first step in its plans to return humans to the moon by 2020. The orbiter will conduct a one-year primary mission exploring the moon, taking measurements to identify future robotic and human landing sites. In addition, it will study lunar resources and how the moon's environment will affect humans. The launch of LRO also will involve a second [spacecraft](#) called the Lunar Crater Observation and Sensing Satellite, or LCROSS, which will impact a permanently shadowed crater near a lunar pole to search for evidence of polar water ice.

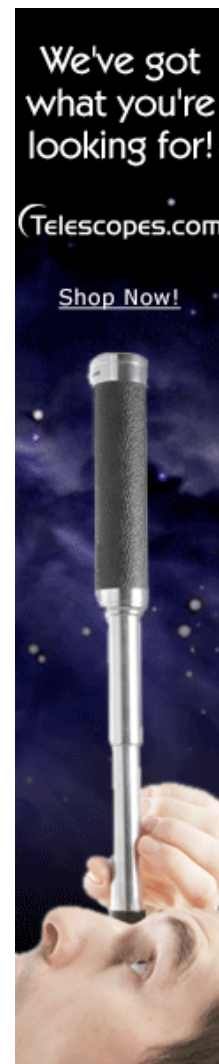


One of the Goddard proposals will investigate whether electrically charged dust is propelled across the moon by electric fields on the lunar surface, and the other proposal will aid in the search for hydrogen and water ice deposits in the permanently-shadowed craters of the lunar poles. The dust investigation, "Mapping Lunar Surface Electric Fields and Characterizing the Exospheric Dust Environment," is led by Dr. Timothy Stubbs, a researcher with the University of Maryland, Baltimore County, who is contracted to Goddard. The water ice investigation, "Enhancement of Lunar Exploration Neutron Detector Mission Operations and [Science](#) Return," is led by Dr. Timothy McClanahan of NASA Goddard.

"From the experiences of the [astronauts](#) during the Apollo program, [lunar](#) dust is recognized to be a significant nuisance, and potential hazard, to robotic and human exploration," said Stubbs. "These dust problems were likely exacerbated by electrostatic processes, so it is important to understand lunar surface and dust charging to develop effective mitigation strategies."

The dust investigation will determine how much lunar dust is electrostatically transported above the moon's surface and create maps of electric fields on the lunar surface to help predict when and where this dust transport is likely to be most active.

The investigation will characterize the high altitude lunar dust "atmosphere" using dust strikes detected by



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LRO's Cosmic Ray Telescope for the Effects of Radiation instrument. The investigation also will evaluate the amount of lunar dust above the surface of the moon by using the Lunar Reconnaissance Orbiter Camera, known as LROC, and Lyman-Alpha Mapping Project imagers to view a glow on the lunar horizon that is thought to be caused by sunlight scattered by dust particles. It will map the lunar surface electric fields using surface charging models together with topographic and shadowing data from LROC and the spacecraft's Lunar Orbiter [Laser](#) Altimeter instrument. Inputs to the computer models that estimate electric charging on the lunar surface will come from spacecraft that are measuring the plasma and energetic particles upstream of the moon and from observations of the incoming solar ultraviolet and soft X-ray radiation.

The hydrogen and water ice investigation is similar to a treasure hunt. "It costs tens of thousands of dollars per pound to put materials into space," said McClanahan. "That makes ordinary water on the moon more precious than gold. To make lunar exploration affordable, we need to use the resources of the moon as much as possible, so we can avoid the cost of bringing them up from Earth." With almost no atmosphere, most of the moon is drier than the driest terrestrial desert. However, there may be concentrations of hydrogen, a component of water, and even some water ice at the bottom of craters in the lunar poles. The depths of some craters in the [polar regions](#) are in permanent shadow. These places are very cold and are never exposed to direct sunlight. In these conditions, hydrogen and possibly water ice is thought to have accumulated over billions of years.

Some scientists believe water vapor from past comet impacts has migrated across the lunar surface to the poles to become embedded in the soil at the bottom of these dark craters. Others believe hydrogen, a primary component of the solar wind, has become embedded in the lunar soil in these polar cold traps over time. If water ice exists in the eternal shadows of the lunar poles, and it is practical to extract it from the soil, the water could be broken down into hydrogen and oxygen for use as rocket fuel and breathable air. Even sufficient concentrations of hydrogen by itself would be valuable because the hydrogen could be used as fuel or combined with oxygen from the soil to make water.

The investigation will use the presence of hydrogen as a sign of potential ice deposits. The moon is constantly being hit by cosmic rays, particles moving at almost the speed of light that come from explosions on the sun and in space. These particles hit the lunar soil and, like the break at the start of a pool game, create a shower of other particles. Neutrons, a component of the nucleus of atoms, are among these particles, and some fly back out into space.

These [neutrons](#) can be detected by LRO's Lunar Exploration Neutron Detector, also known as LEND. The neutrons have a wide range of speeds. If the neutrons hit hydrogen atoms in the lunar soil before being ejected into space, the impact will slow them down. As LRO scans the lunar surface, LEND counts the neutrons moving at speeds in the middle of the range. If LEND detects a decrease in the amount of neutrons moving at mid-range speeds, it means the neutrons are being slowed by impacts with hydrogen, so there is probably a concentration of hydrogen or even water ice in that particular area.

"The Lunar Prospector mission created rough maps of hydrogen concentrations based on this decrease in neutron speed," said McClanahan. "LRO will create maps with much greater detail, which is needed to make the search for hydrogen deposits practical."

McClanahan's investigation will help LRO scientists interpret what they are seeing from the LEND instrument by creating computer models of how the data will appear based on different temperatures, soil compositions, and levels of cosmic radiation.

NASA received a total of 55 proposals in response to a [NASA](#) Research Announcement released in 2007. A peer review panel and NASA Planetary Science Division Research and Analysis Program scientists evaluated the proposals, from which 24 investigations were selected. Selection criteria included intrinsic merit, relevance, responsiveness to planetary science goals and objectives, as well as cost. Scientists will be fully or partially funded depending on their research work and scope of activities. Both Goddard proposals are fully funded by NASA. For a complete list of the selected scientists and their investigations, visit:

http://www.nasa.gov/pdf/216482main_LRO_Participating_Scientists.pdf

For images, visit:

http://www.nasa.gov/centers/goddard/news/topstory/2008/lro_awards_release.html

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