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# Tentative signs of water found on the moon

## New orbiter's detector indicates shadowed regions may have ice, hydrogen

**By Andrea Thompson**

Senior writer



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New data and images from NASA's new moon orbiter — the first in more than a decade — have revealed tentative signs of lunar water ice, the space agency announced Thursday.


The powerful **Lunar Reconnaissance Orbiter** has successfully completed its testing and calibration phase and entered its mapping orbit of the moon. The spacecraft's instruments have also made measurements of space radiation in the lunar [environment](#) and have found more widespread possible signatures of water on the moon.

"The LRO mission already has begun to give us new data that will lead to a vastly improved atlas of the lunar south pole and advance our capability for human exploration and scientific benefit," said Richard Vondrak, LRO project scientist at [NASA's Goddard Space Flight Center](#) in Greenbelt, Md.


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The first results from LRO's Lunar Exploration Neutron Detector, or LEND, indicate that permanently shadowed and nearby regions may harbor water ice and hydrogen. LEND relies on a decrease in neutron

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radiation from the lunar surface to indicate the presence of water or hydrogen.

One big finding so far from LEND is that "the hydrogen is not confined to permanently shadowed craters," Vondrak said. Team members want more observations to confirm these findings and determine how significant they are and how to interpret them.

"The power of LRO is that we're not just sending one instrument, like LEND, to look for hydrogen, we're characterizing fully" the lunar south pole, Vondrak said.

**Jump on science**

The spacecraft, launched **toward the moon** on June 18, is in good shape and set to begin its scientific mission in earnest, mission managers reported.

"The LRO instruments, spacecraft, and ground systems continue to operate essentially flawlessly," said Craig Tooley, LRO project manager at Goddard.

Mission scientists were able to get a jump on some of the science objectives during the commissioning phase of the instrument and get some results that mission officials emphasize are preliminary.

"But some of them are really intriguing too," said Michael Wargo, chief lunar scientist at the Exploration Systems Mission Directorate, NASA Headquarters in Washington, D.C.

The powerful \$540 million orbiter, which is about the size of a Mini Cooper car, is on a one-year mission to seek out potential landing sites for future astronauts, as well as build new maps of the moon's surface, temperature extremes and radiation environment. It will also hunt for water ice in the permanently shadowed craters of the moon's south pole. A source of water ice on the moon would be a boon to any future moon bases because it could be melted for water and hydrogen for fuel could be extracted from it.

**First results**

In addition to the initial LEND results, data from LRO's Lunar Orbiter Laser Altimeter, or LOLA, used to map elevation indicates that exploring the moon's south pole will be challenging because the terrain is very rough. Some of the **crater slopes** that LOLA has measured are relatively steep and would be difficult to drive a truck or car over, let alone a moon rover, said David Smith, LOLA principal investigator at Goddard.

That roughness is probably a result of the lack of atmosphere and absence of erosion from wind or water, Smith said. LOLA has already mapped a good portion of the lunar south pole, he added.

LRO's other instruments also are providing data to help map the moon's terrain and resources.

The probe's Diviner instrument for mapping temperature revealed **large, frigid expanses** in the permanently shadowed craters are about



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minus 400 degrees Fahrenheit (minus 240 Celsius), "which is extremely cold and is much colder than the temperature needed to trap a volatile, such as water," Vondrak said. In fact, these permanently shadowed regions "are perhaps the coldest part of the solar system," he added.

The team will [monitor](#) seasonal changes in the temperature over the course of the mission. Currently, the lunar south pole is heading into summer.

**The moon up close**

The Lunar Reconnaissance Orbiter [Camera](#) is providing **high-resolution images** of permanently shadowed regions while lighting conditions change as the moon's south pole enters lunar summer.

"By the end of this mission, we will fully characterize and get the best possible information we can on the existence of hydrogen" on or below the lunar surface, Vondrak said.

But, "if you really want to find out what's below the surface, you have to touch the surface," Vondrak said, which is where LRO's companion mission, the Lunar Crater Observation and Sensing Satellite, comes in.

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LCROSS will impact the moon's south pole on Oct. 9 to generate debris that can be analyzed for signs of water. LCROSS' target crater, called Cabeus A, was announced by NASA last week.

Meanwhile, LRO's Cosmic Ray Telescope for the Effects of Radiation instrument is exploring the lunar radiation environment and its potential effects on humans during record high, "worst-case" cosmic ray intensities accompanying the extreme solar minimum conditions of this solar cycle.

LRO has sent back several batches of images, taken by LROC, before this newest set, including a region known as Mare Nubium (or Sea of Clouds), the [Apollo 11 landing site](#), and the tracks from a difficult Apollo spacewalk.

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