

# Globe Life

Space

## The damp side of the moon

With plan to crash a rocket into a lunar crater, NASA hopes to get evidence that water lies frozen on the moon's south pole

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The moon was once thought to be a waterless world.

Now, however, many scientists believe vast stores of the precious resource lie frozen in polar craters where the sun never shines.

On Friday, they will get a chance to see if their hunch is correct.

A U.S. rocket will be deliberately crashed into a 98-kilometre-wide crater, named Cabeus, near the south pole of the moon. The impact is expected to throw up a huge cloud of debris, rising six kilometres above the lunar surface. Telescopes - in space and on Earth - will be focused on that material, analyzing it with special instruments for evidence of water.

And there's even a possibility some amateur sky watchers in western North America will be able to witness the celestial dust-up with their backyard telescopes.

Finding lunar water would be welcome news to those who have their hearts set on establishing permanent human bases on the moon and beyond. (The United States is currently reviewing its long-term space plans.)

"It could be an incredibly valuable resource," said Anthony Colaprete, the lead scientist overseeing the mission for the U.S. National Aeronautics and Space Administration.

The cost of shipping a pound of water to the moon is roughly \$50,000 (U.S.) A lot of money could be saved if future moon colonists can use local water for drinking and growing crops. Or, it could be broken down into hydrogen and oxygen to produce rocket fuel for deep-space missions.

Previous moon missions have already provided tantalizing hints of water. Last month, scientists, using data from India's Chandrayaan-1 spacecraft and other lunar orbiters, revealed that trace amounts of water appear to be bound up in rocks and soil across much of the surface.

But other scientists hope to find substantially higher concentrations at the poles, where the sun doesn't rise much above the horizon. Some crater bottoms are in perpetual darkness and the temperature dips to a bone-chilling - 238 C, potentially preserving ice from comets and asteroids that has rained down on the moon over billions of years.

"There are about 14,000 square kilometres of shadowed real estate at the two poles," said Dr. Colaprete.

If the top few metres are made up of just 1 per cent water-ice, the craters could hold as much as 1.3 trillion

gallons of water, he speculated. "That's quite a bit."

For an accurate assessment, however, scientists must excavate a big hole in a polar crater. And that's precisely what they hope to do by sending a probe on a collision course with the moon.

The probe is called the Lunar Crater Observation and Sensing Satellite, or LCROSS for short. It's currently attached to the upper stage Centaur rocket that boosted it into space in June.

(The same rocket also launched another probe, called the Lunar Reconnaissance Orbiter - or LRO - which is mapping the moon.)

About 10 hours before the planned impacts, LCROSS will separate from the Centaur rocket, which will then lead the way in the final plunge to the lunar surface.

The 12.6-metre-long rocket will hit the moon first, blasting an estimated 350 tons of lunar material skyward. LCROSS, following closely behind, will gather images and data and relay them immediately to Earth. Within minutes, LCROSS will pass through the expanding debris plume before it also crashes into the moon.

The impacts are timed to occur when it is the middle of the night in Hawaii, the home of numerous internationally funded observatories - including the Canada-France-Hawaii Telescope - which sit on mountaintops.

"It is nice to have a lot of telescopes at the same place," said Christian Veillet, executive director of the CFHT. "But if the weather is bad, it's going to be bad for all of us" and obstruct the view.

As a backup, major observatories in the western United States will be also focused on the moon, and amateur astronomers are being urged to take pictures and share them with NASA. The Hubble Space Telescope and LRO in lunar orbit will be watching, too.

"We would like to have as many eyes and instruments watching these impacts as possible because this is the way we will get the most data," said Jennifer Heldmann, who is leading the LCROSS observation campaign.

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See it live on the Web

The death dive of a U.S. rocket into the moon is set for 7:30 a.m. ET on Friday. But that timing isn't great for amateur sky watchers in eastern North America. Morning sunlight will drown any chance of seeing the faint debris cloud rising from the moon's surface when the rocket wallops into it.

Observers in the western part of North America, where it will still be dark, have better viewing odds. However, they will need a decent-sized telescope - one with a light-gathering mirror at least 25 centimetres in diameter. Even with the proper equipment, it will be a challenge spotting the proposed crash site. One small crater looks much like another to an untrained eye.

But don't fret about missing the show. Possibly the best seat will be in front of a computer. On one of its Internet sites (<http://www.nasa.gov/ntv>), the U.S. space agency will be streaming live images from the Lunar Crater Observation and Sensing Satellite (LCROSS), providing a bird's-eye view of the main rocket body plunging toward the moon.

"It will look like a ring, or doughnut, rising up out of the crater and expanding outwards," said the lead mission

scientist Anthony Colaprete, describing the anticipated plume from the impact. *Paul Taylor*

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