

Lunokhod 1 retroreflector found

The Lunar Reconnaissance Orbiter team helped scientists track laser signals to the Russian rover mirror.

Provided by Goddard Space Flight Center, Greenbelt, Maryland

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This artist's concept shows LRO in orbit of the Moon.

Photo by NASA

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Using information provided by NASA's Lunar Reconnaissance Orbiter (LRO) instrument teams, researchers at the University of California, San Diego, have successfully pinpointed the location of a long-lost light reflector left on the lunar surface by bouncing laser signals from Earth to the Russian Lunokhod 1 retroreflector.

The initial imaging of the two Russian rovers, Lunokhod 1 and 2, were made earlier this year by the Lunar Reconnaissance Orbiter Camera (LROC) team, led by Mark Robinson from Arizona State University in Tempe.

On April 22, Tom Murphy from the University of California, San Diego, and his team sent pulses of laser light from the 3.5-meter telescope at the Apache Point Observatory in New Mexico, zeroing in on the target coordinates provided by the LROC images and altitudes provided by the Lunar Orbiter Laser Altimeter.

"We quickly verified the signal to be real and found it to be surprisingly bright — at least 5 times brighter than the other Soviet reflector on the Lunokhod 2 rover to which we routinely send laser pulses," said Tom Murphy, an associate professor of physics at the University of California, San Diego. "The best signal we've seen from Lunokhod 2 in several years is 750 return photons, but we got about 2,000 photons from Lunokhod 1 on our first try. It's got a lot to say after almost 40 years of silence."

Since Apollo deployed laser retroreflectors, astronomers have routinely used them to track how the Moon is slowly moving away from Earth. This helps scientists develop a better understanding of the processes that are causing this motion, including what's occurring inside the Moon's core and the tidal motions on Earth.

The Lunokhod 1 retroreflector was sent aboard the unmanned Luna 17 mission, which landed on the Moon November 17, 1970, releasing a robotic rover that roamed the lunar surface.

Murphy said his team had occasionally looked for the Lunokhod 1 retroreflector over the past 2 years but had little chance of finding it until the LRO team produced coordinates based on the recent images of the lander and rover that were good to within 100 meters.

"It turns out that our previous best-guess position was miles off," Murphy said. "We could only search one football-field-sized region at a time, so without LRO we never would have found it. But with the new coordinates, we found the signal promptly at the very edge of our available window."

Locating Lunokhod 1 and measuring its exact coordinates is important in furthering our understanding of the Moon.

"Getting more than a few photons back from an unknown location at the distance of the Moon is quite an achievement," said Gregory Neumann, Lunar Orbiter Laser Altimeter team member from NASA's Goddard Space Flight Center in Greenbelt, Maryland. "The rediscovery of the Lunokhod-1 retroreflector was made possible by the LRO camera team and by the diligence of Tom Murphy."