

Initial observations of Chang'e 3 landing

December 23 2013, by Rick Elphic



An artist's concept of NASA's Lunar Atmosphere and Dust Environment Explorer (LADEE) spacecraft seen orbiting near the surface of the moon. Credit: NASA Ames / Dana Berry

Much of the world was watching the Chang'e 3 landing in northern Mare Imbrium at 13:10 UTC Dec. 14, 2013. NASA's Lunar Atmosphere and Dust Environment Explorer (LADEE) was watching too.

In the evening of Friday, Dec. 13, Pacific Time, LADEE controllers uploaded a command sequence that scheduled the [science instruments](#) for operations during the Chang'e 3 landing period. LADEE's science instruments gathered data on the [dust](#) and gas species before and after

the landing to provide the science team with a comparison.

The Neutral Mass Spectrometer (NMS) was running in a mode that would allow it to monitor native lunar atmospheric species, as well as those resulting from Chang'e 3's propulsion system. These combustion products were known to include diatomic nitrogen, water, diatomic hydrogen and several other species. The two other LADEE science instruments, the Lunar Dust Experiment (LDEX) and the Ultraviolet-Visible Spectrometer (UVS), ran in their normal configurations. Together they are able to detect ejected dust and gas species from a propulsion system, provided these products could make the long trek to LADEE's position, which was far from the Chang'e-3 landing site.

LADEE's retrograde, near-equatorial orbit never goes beyond approximately 22.5 degrees north and south latitude. Chang'e 3's landing site was far to the north of LADEE's path, at 44.12 degrees north and 19.51 degrees west. At the time of landing, LADEE was orbiting over a different part of the moon east of the Chang'e 3 path, at 21.77 degrees south latitude and 82.17 degrees east longitude - more than 3,400 km (2,100 miles) away.

At 13:41 UTC, about 30 minutes after the Chang'e 3 landing, LADEE flew over 19.51 degrees west longitude. At this time, LADEE was still more than 1,300 km (800 miles) to the south of the [landing site](#). The NMS had started exosphere observations at 13:22 UTC and would continue for 55 minutes as LADEE sped across the lunar sunrise terminator and into lunar night. The UVS had performed atmospheric scans one orbit previous (LADEE's orbit period is about 2 hours), around 12:15 UTC, and would do so again later. The LDEX was operating normally, recording dust impacts prior to, during and after the Chang'e 3 descent.

Surprisingly, the LADEE science teams' preliminary evaluation of the

data has not revealed any effects that can be attributed to Chang'e 3. No increase in dust was observed by LDEX, no change was seen by UVS, no propulsion products were measured by NMS. Evidently, the normal native lunar atmospheric species seen by UVS and NMS were unaffected as well. It is actually an important and useful result for LADEE not to have detected the descent and [landing](#). It indicates that exhaust products from a large robotic lander do not overwhelm the native lunar exosphere. As the descent video shows, the interval of time that dust was launched by the lander is very short, perhaps less than 15 seconds. LADEE would probably have had to be in just the right place at the right time to intercept it. Also, significant amounts exhaust products apparently cannot migrate to large distances (hundreds and thousands of miles) and linger with sufficient density to be measured. We can compare these results to theoretical predictions of gas and exhaust plume particle ejecta, and update our understanding of the interaction of lander propulsion systems with surface materials. In many ways, this has been a very useful experiment!

Provided by NASA

Citation: Initial observations of Chang'e 3 landing (2013, December 23) retrieved 8 April 2024 from <https://phys.org/news/2013-12-intial.html>

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