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# Nasa's mission this week: to make a new crater on the moon

Scientists prepare to crash spacecraft on lunar surface in search of water

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An artist's impression of how the LCROSS spacecraft will begin its collision course with the moon. Image: Nasa

Forty years ago, the moon was the site of one of humanity's greatest triumphs as Neil Armstrong and Buzz Aldrin took their first steps on another world.

On Friday, however, the Earth's nearest neighbour is set to stage one of the strangest moments in space exploration, as Nasa prepares to send a 2.3 tonne satellite smashing into the lunar surface.

If all goes to plan, officials at the space agency say the strike will take place at around 12.30pm UK time on Friday, with a booster rocket and \$79m satellite slamming into a huge crater near the moon's south pole.

The scheme – called "a very exciting mission culminating in a real crescendo event" by Nasa project manager Dan Andrews – is certainly a long way from the landing of the Eagle module in 1969. But the LCROSS (Lunar Crater Observation and Sensing Satellite) mission could eventually have a similarly dramatic an impact on space exploration.

That is because spectacular crash is actually an attempt to uncover water that scientists believe is hidden on the moon – a discovery that would not only shed light on the moon's history, but also open up exciting new possibilities for manned missions into space.

By examining the huge cloud of dust that will be thrown up after the impact takes place, experts hope to find evidence of water ice that previous have indicated exists on the lunar surface.

The area targeted by LCROSS is believed to be one of the richest in potential water deposits, and is also close to the Shackleton crater – the planned home of a Nasa moon base scheduled to be in operation by 2024. Finding water nearby would not only reduce the cost and complexity of setting up a lunar colony, but would also help it become a staging post for more trips further into space.

Although the crash itself will not be visible from Britain, even for those with powerful telescopes, it may be possible to see the separation event in the early hours of the morning – when the LCROSS satellite and its booster rocket split from each other before beginning their descent.

For those who cannot see the event themselves, Nasa will be offering the opportunity to log on to the internet and watch a live relay of images from LCROSS itself, which will film the impact of the Centaur rocket before itself plunging into the same crater.

The crash is expected to displace around 350 tonnes of debris, pushing a cloud up as high as 10km above the surface and casting the dust into direct sunlight for the first time in millions of years.

"The rocket has roughly the mass of a Transit van, and it will hit the moon at 5,600 miles per hour – the energy of the collision is roughly equivalent to two tonnes of TNT," said Dr Vincent Eke of Durham University, whose analysis of data from previous lunar expeditions helped to pinpoint the areas of the moon that were most likely to harbour water.

"While this sounds dramatic, the impact of this will simply create one more dimple on the moonscape," he said. "The cratered surface of the moon shows it has a history of violent collisions with asteroids and comets ... such collisions frequently occur, but the difference is that this time we know precisely where and when to look."

The impact will be visible to telescopes across California and Hawaii, and space scientists will be camped out at observatories across the western US – where it will be the middle of the night when the impact takes place.

To boost excitement around the mission, Nasa has been encouraging people to hold so-called "impact parties" – offering videos, stickers and posters for those interested in what will be taking place. Those gathered at such events will be hoping that the mission makes it all the way to its conclusion – particularly since it has not been smooth sailing since LCROSS took off from Florida in June.

In August, a technical glitch led the spacecraft to burn up half of its remaining fuel – a moment that endangered the entire project for several weeks.

Now the mission appears to be back on track, and closer than ever to uncovering physical evidence of water on the moon. Last week the Indian satellite Chandrayaan confirmed the existence of what appeared to be water ice across the south of the moon – and further data from Nasa's Lunar Reconnaissance Orbiter also indicated that water appears to exist. Nobody, however, has ever managed to actually find ice.

That is something LCROSS hopes to change, although analysing the information gathered during the four-minute window between the two crashes will probably take some time. But the potential is huge, said Dr Kim Ennico, one of the scientists working on the mission.

"Finding resources on the moon – be it water, hydrogen, oxygen, helium or any type of resource for building, for crops, for fuel?" she said. "If it's there and you can live off the land, well that's what we did when we explored other continents on our own planet – and if we're going out to explore other places in the solar system, if you can live off the land, it's more beneficial than trying to take it in with you."

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