Moon probe returns first images

By Paul Rincon
Science reporter, BBC News

Lunar Reconnaissance Orbiter (LRO) reached the Moon on 23 June

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The US space agency's Lunar Reconnaissance Orbiter (LRO) spacecraft has returned its first images since reaching the Moon on 23 June.

The probe's two cameras returned images of a region in the lunar highlands south of Mare Nubium (Sea of Clouds).

LRO blasted off on 18 June atop an Atlas rocket from Cape Canaveral Air Force Station in Florida.

Its data will help mission planners select future landing sites and scout locations for lunar outposts.

There are two cameras on board, a low-resolution wide-angle camera and a high-resolution narrow-angle camera.

These are known collectively as the Lunar Reconnaissance Orbiter Camera (LROC) instrument.

"At the time we took the images, we were in the 'terminator' orbit. This means that when you look down for a whole orbit, all you see beneath you is the boundary between night and day," Mark Robinson, from Arizona State University in Tempe, US, told BBC News.

> **We waited a couple of hours for the images to come down to the ground. When they appeared on the screen, they were gorgeous**

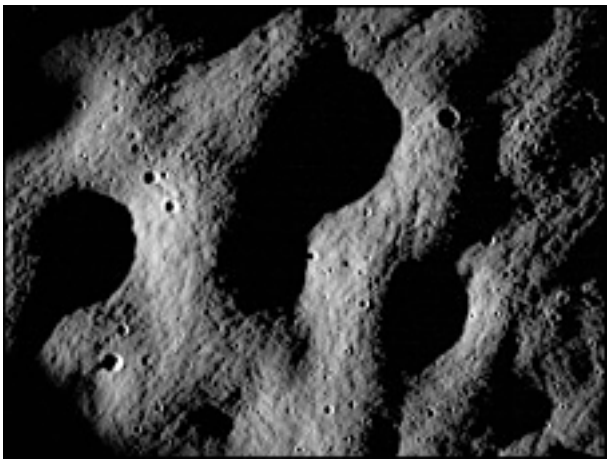
Professor Mark Robinson, ASU

This meant that light levels were low and that much of the surface was in shadow - not ideal conditions for photography.

"In some areas where we thought we'd see the surface, we didn't, because local topography caused some things to be shadowed. While in other areas, we were able to see the surface," explained Professor Robinson, who is the principal scientific investigator for LROC.

The images were taken over two orbits on Tuesday, during an engineering test of the LROC instrument. Though they are not part of the formal imaging campaign, Mark Robinson described them as "spectacular".

"It was a huge relief. You spend four years making this incredibly delicate, sensitive instrument. Then you bolt it on a rocket, which vibrates for eight minutes," he said.



The pictures are of cratered terrain near the Mare Nubium region

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"It's maybe an illogical nervousness, because everything is designed and tested to withstand that. But there are hundreds of people that want it to work.

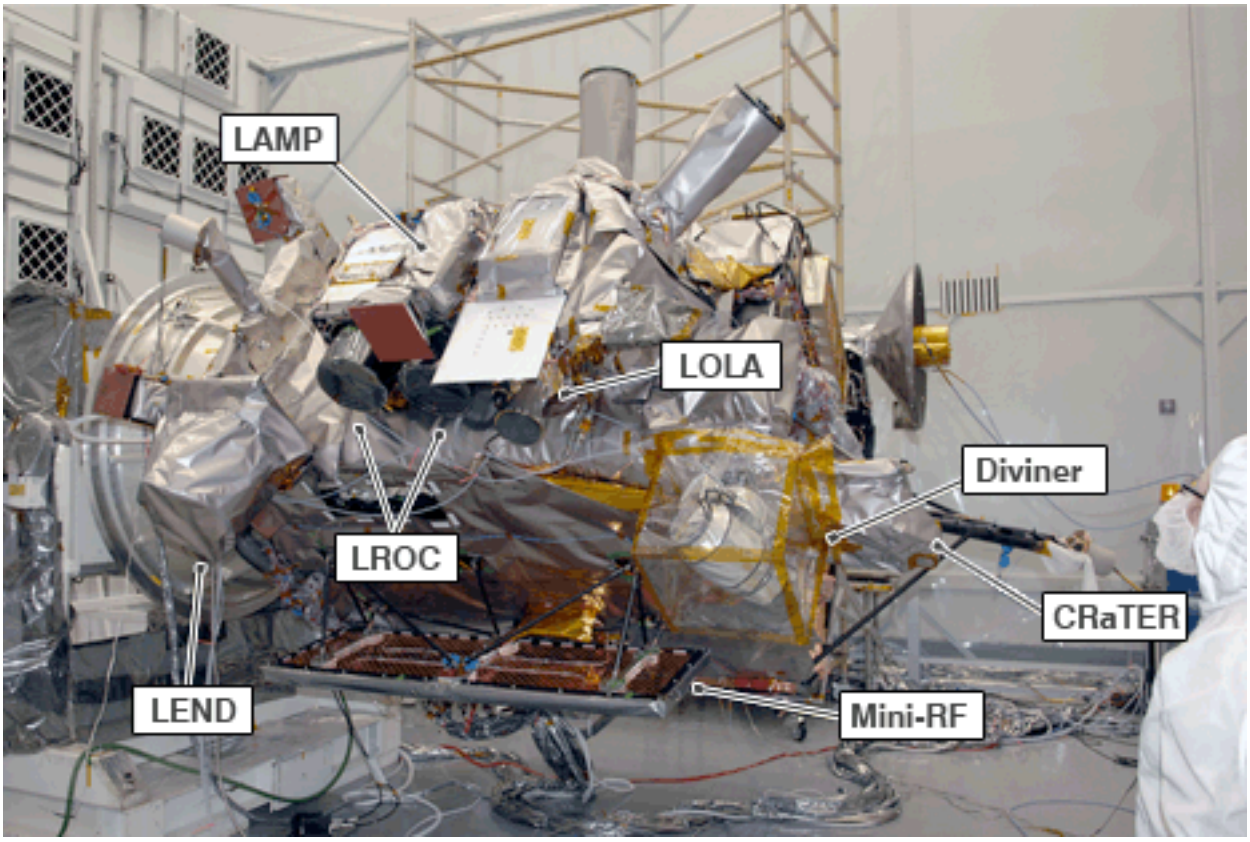
"We turned it on, and held our breath. Then we waited a couple of hours for the images to come down to the ground. When they appeared on the screen, they were gorgeous."

The test was designed to check parameters on LROC such as the exposure. Scientists also wanted to see whether the camera was in full focus.

LROC uses a telescope structure made of carbon fibre. Though lightweight, this material absorbs water from the Earth's atmosphere, causing it to expand. The team had to build the camera so that it was out of focus on Earth.

But once in space, the carbon fibre telescope can be baked to drive the water out. This causes the structure to shrink and bring the instrument into focus.

LRO'S SCIENCE INSTRUMENTS



CRaTER - will characterise the global lunar radiation environment
Diviner - is to measure lunar surface temperatures
LAMP - will map the Moon's permanently shadowed regions
LEND - measures the flux of neutrons from the Moon
LOLA - will provide a global lunar topographic model
LROC - LRO's camera will help select future landing sites
Mini-RF - uses radar to search for evidence of water ice

"It's roughly a three-week process, and we had only been baking out for 10 days when we turned (LROC) on," said Professor Robinson.
Nevertheless, he said the pictures suggested the camera was about 80% of the way to being in full focus.
On Friday, LROC will begin taking images "in earnest". Over two-and-a-half days, and 32 orbits, it will photograph some of the least known regions of the lunar surface, on the Moon's far side.
On Sunday, engineers will switch the LROC instrument off again to resume the baking process.
The spacecraft is currently in an elliptical orbit around the Moon, with a low point of 30km above the south pole and a high point of 199km over the north pole. This means the resolution of pictures will be lower in the north and higher in the south.
In mid-August, the spacecraft will perform a burn to bring it into a circular orbit of 50km above the lunar surface. This will give LROC a resolution of 50cm per pixel.
This month marks the 40th anniversary of the Apollo 11 Moon landing. LRO will start flying over the Apollo landing sites in mid-July.
However, the spacecraft will still be in its checkout phase at this time. If LRO does manage to take images of any Apollo sites in July, the pictures will not be at the best possible resolution.
When the orbiter flies over the Apollo 11 site it is likely to be at an altitude of 100km - allowing the camera to capture images at a resolution of 100cm per pixel.
LRO will spend at least one year using its six instruments to collect detailed information about the lunar environment.
The orbiter was one of two payloads launched on the same Atlas V rocket.
The second mission, called the Lunar Crater Observation and Sensing Satellite (LCROSS), will send a rocket crashing into the Moon to scour the debris plume for evidence of water ice.
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