
2011
2013

1
00:00:00,010 --> 00:00:09,780
[ambient drone]

2
00:00:09,800 --> 00:00:13,600
[music]

3
00:00:13,620 --> 00:00:17,680
LRO is this amazing spacecraft that has seven science instruments on it,

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00:00:17,700 --> 00:00:22,440
and it's been in orbit around the Moon since June of 2009.

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00:00:22,460 --> 00:00:27,240
And it's collecting all sorts of data to help NASA make really good decisions in the future

6
00:00:27,260 --> 00:00:33,980
about where to send robotic spacecraft and humans, and to address fundamentally-important science question

7
00:00:34,000 --> 00:00:38,030
not only about the Moon, but about the solar system in general.

8
00:00:38,050 --> 00:00:42,980
I'm Mark Robinson, and I'm the principal investigator of the Lunar Reconnaissance Orbiter Camera.

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00:00:45,650 --> 00:00:51,180
Okay, what is LROC? That's a great question. Sounds like one camera, Lunar Reconnaissance Orbiter Camer

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00:00:51,200 --> 00:00:56,030
It's actually three cameras. There are two identical narrow angle cameras that are very high resolution,

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00:00:56,050 --> 00:01:01,110
they have pixels about this big, 50 centimeters, and it was designed so that you could look

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00:01:01,130 --> 00:01:05,710
at a human scale on the surface to find safe and engaging landing sites.

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00:01:05,730 --> 00:01:09,260

Then there's a third camera, wide angle camera, which is literally about this big.

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00:01:09,280 --> 00:01:13,700
It maps the Moon in UV and visible wavelengths, and its key purpose is to

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00:01:13,720 --> 00:01:18,980
look at compositional differences for both scientific and resource evaluation.

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00:01:24,000 --> 00:01:27,780
It's not easy to find new impact craters because most of them are very small.

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00:01:27,800 --> 00:01:33,760
The only way we can really do this is if we have a before image and an after image, and we've been in orbit for

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00:01:33,780 --> 00:01:40,480
So what we're doing now is we're going back to images that were taken in the first year or two, put them on a c

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00:01:40,500 --> 00:01:43,240
And then it becomes really obvious, "Oh, look, there's a new crater there!"

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00:01:43,260 --> 00:01:48,400
because it wasn't in the before, it's in the after, before after, and we call these temporal pairs.

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00:01:48,420 --> 00:01:54,730
So now we have several thousand pairs, and to sit down and look at every single pixel in all those images

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00:01:54,750 --> 00:01:58,280
would probably take one person, you know, ten or twenty or thirty years.

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00:01:58,300 --> 00:02:04,110
So we started working on an algorithm, or a computer program, that searches the images by using a little temp

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00:02:04,130 --> 00:02:10,480
the before and after pairs, and it automatically finds them. It gets like about a 90% success rate.

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00:02:10,500 --> 00:02:13,980
So far we've found hundreds of changes on the surface.

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00:02:14,000 --> 00:02:18,680
Many of them are too small to really know for sure if they're craters or if they're secondary craters,

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00:02:18,700 --> 00:02:23,630
but we have found over 25 that are absolutely, positively confirmed craters,

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00:02:23,650 --> 00:02:30,780
you can see the rim and the ejecta, and we've also made this amazing discovery that we find secondary crater

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00:02:36,680 --> 00:02:42,210
There was a bright flash that was recorded by a video camera by a team at Marshall Space Flight Center,

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00:02:42,230 --> 00:02:47,110
and it was the brightest flash they recorded so it must be therefore one of the biggest craters,

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00:02:47,130 --> 00:02:50,800
and so they were really interested for us to take a picture, can you see the crater?

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00:02:50,820 --> 00:02:54,730
Because they predicted how big it was going to be based on the energy but this is all a model,

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00:02:54,750 --> 00:02:57,980
and so it's a great opportunity to actually calibrate their model.

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00:02:58,000 --> 00:03:02,280
So we took a picture centered on their coordinates, and we didn't find a crater.

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00:03:02,300 --> 00:03:08,310
We found these enigmatic little splotches, there was something...disturbance of the soil

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00:03:08,330 --> 00:03:11,280
that wasn't in the original image, but we didn't know what it was.

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00:03:11,300 --> 00:03:15,880
So we thought, okay, well their coordinates are off a little bit, because their pixels are really big from their came

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00:03:15,900 --> 00:03:18,780

in fact their pixels are bigger than our image footprints.

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00:03:18,800 --> 00:03:24,030
So we said, okay, no problem we'll move over to the west and we'll take a - you know, we're building up a mosa

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00:03:24,050 --> 00:03:30,200
So the next month comes around, we take a picture and we do the same thing, look at the before, look at the a

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00:03:30,220 --> 00:03:36,680
But more of these splotches...but also in that image we saw what looked like very faint rays,

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00:03:36,700 --> 00:03:39,830
and we thought, "Boy, I wonder if those are actually rays from a crater?"

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00:03:39,850 --> 00:03:44,680
So we just did this simple exercise of drawing lines and see where they converged,

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00:03:44,700 --> 00:03:47,780
and then so the next month we came around, remember this is the third opportunity,

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00:03:47,800 --> 00:03:52,800
we center the field of view of the camera right on that latitude-longitude, boom take another picture,

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00:03:52,820 --> 00:03:57,330
comes down and there it is: beautiful 18-meter-diameter crater.

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00:03:57,350 --> 00:04:02,810
And then we started looking and now we've got three of these, and there's hundreds of these little splotches th

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00:04:02,830 --> 00:04:08,130
these rays, and then we have the big picture: you could see that the splotches are actually lined up.

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00:04:08,150 --> 00:04:13,480
These very small clods of ejecta were thrown out ten, twenty, thirty kilometers away,

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00:04:13,500 --> 00:04:19,500
that's thirty-thousand meters compared to an 18-meter-diameter crater, so it's a very exciting discovery.