



1
00:00:08,340 --> 00:00:04,160
[piano music, LRO title]

2
00:00:08,360 --> 00:00:12,500
position of the Lunar Reconnaissance Orbiter's laser altimeter as it orbits the moon.

3
00:00:12,520 --> 00:00:16,680
Recently, however, they also tried something a little...different. In addition to tracking

4
00:00:16,700 --> 00:00:20,780
the instrument, they used the laser to send a picture of the famous Mona Lisa in the first demonstration

5
00:00:20,800 --> 00:00:24,930
of laser communication with a satellite at the moon. To do this, the LRO team

6
00:00:24,950 --> 00:00:29,100
used the existing laser tracking signal--sent by the Next Generation Satellite Laser

7
00:00:29,120 --> 00:00:33,240
Ranging Station at NASA's Goddard Space Flight Center. The image was divided into pixels,

8
00:00:33,260 --> 00:00:37,290
which were then sent to the spacecraft one at a time by re-timing the regular tracking pulses.

9
00:00:37,310 --> 00:00:41,340
By delaying the tracking pulses by specific amounts, LRO scientists

10
00:00:41,360 --> 00:00:45,380
could use the difference between the expected arrival time and the actual arrival time to indicate the brightness

11
00:00:45,400 --> 00:00:49,410
of an individual pixel. Once the image was sent, scientists corrected for

12
00:00:49,430 --> 00:00:53,430
transmission errors caused by the Earth's atmosphere using common techniques used in CDs and

13
00:00:53,450 --> 00:00:57,600

DVDs. They also studied signal fluctuations due to Earth's atmosphere.

14

00:00:57,620 --> 00:01:01,780

The final image was verified when it was returned to Earth using LRO's radio telemetry system.

15

00:01:01,800 --> 00:01:05,950

This test--and the data obtained from it--sets the stage for future

16

00:01:05,970 --> 00:01:10,130

high data-rate laser communication demonstrations that will be a central feature of NASA's next

17

00:01:10,150 --> 00:01:14,310

moon mission, the Lunar Atmosphere and Dust Environment Explorer. So, while

18

00:01:14,330 --> 00:01:18,420

lasers are currently being used to track NASA satellites, in the future they may also be used to communicate

19

00:01:18,440 --> 00:01:22,550

with them, sending not only data, but perhaps images that one day will be as famous as...

20

00:01:22,570 --> 00:01:26,700

the Mona Lisa. [piano music, Mona Lisa image]

21

00:01:26,720 --> 00:01:30,800

[piano music, beeping, satellite flies by Earth]

22

00:01:30,820 --> 00:01:34,900

[piano music, beeping, Goddard Space Flight Center information]