1
00:00:00,010 --> 00:00:05,990
[music]

2
00:00:12,030 --> 00:00:16,020
[Andy Freeberg] I'm here with Rich Vondrak, the Project Scientist for LRO

3
00:00:16,040 --> 00:00:21,030
and Rich you're going to explain to me a little bit about the LRO spacecraft and tell me what this is gonna do he

4
00:00:21,050 --> 00:00:23,040
[Rich Vondrak] Okay

5
00:00:23,060 --> 00:00:27,050
[Andy] So this is LRO in all it's deployed glory right?

6
00:00:27,070 --> 00:00:31,060
This kind of square shape is to fit a lot inside right?

7
00:00:31,080 --> 00:00:36,070
[Rich] That's right, the inside here is a large propulsion tank.

8
00:00:36,090 --> 00:00:40,080
The LRO spacecraft with fuel weighs about 2 tons

9
00:00:40,100 --> 00:00:45,090
but the spacecraft without the fuel, before it's fueled, weighs only about one ton.

10
00:00:45,110 --> 00:00:50,100
So it's like having an automobile where your automobile has as much

11
00:00:50,120 --> 00:00:54,110
gasoline in it as the whole weight of your car.

12
00:00:54,130 --> 00:00:58,120
And we need that in order to stay in orbit.

13
00:00:58,140 --> 00:01:02,130

We also have an adjustable high-gain antenna system

14
00:01:02,150 --> 00:01:06,150
that's always pointed at the Earth, to take the measurements we make

15
00:01:06,170 --> 00:01:10,160
and send them back to Earth so that

16
00:01:10,180 --> 00:01:13,170
they can be analyzed by the scientist on the mission.

17
00:01:13,190 --> 00:01:16,190
[Andy] And that can send a lot of data back with this one right here right?

18
00:01:16,210 --> 00:01:20,210
[Rich] An awful lot of data, much more than any planetary mission has ever returned before.

19
00:01:20,230 --> 00:01:25,230
[Andy] Okay so how about if I say I'm building my map of the Moon and you explain how you're doing it. All rig

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00:01:25,250 --> 00:01:29,250
the first thing I'm going to want with a map is I'm going to want pictures. I'm going to want images of the Moon.

21
00:01:29,270 --> 00:01:31,270
[Rich] That's right.

22
00:01:31,290 --> 00:01:33,280
[Andy] So what on LRO is going to be able to do that?

23
00:01:33,300 --> 00:01:38,300
[Rich] We have a camera system, called the LRO Camera or LROC.

24
00:01:38,320 --> 00:01:43,320
It has two very high resolution

25
00:01:43,340 --> 00:01:48,340
cameras so objects that are the size of this table

26
00:01:48,360 --> 00:01:51,370
or this big, can be detected.

27
00:01:51,390 --> 00:01:53,400
[Andy] Or maybe a lunar rover for example?

28
00:01:53,410 --> 00:01:58,420
[Rich] A lunar rover, we expect that when we go over the Apollo sites we'll be able to

29
00:01:58,440 --> 00:02:03,450
image the lunar module, the lunar rovers, see the tracks the

30
00:02:03,480 --> 00:02:06,480
astronauts left as they disturbed the surface.

31
00:02:06,500 --> 00:02:11,510
[Andy] So now we sort of have some images, but I want to know kind of

32
00:02:11,530 --> 00:02:16,540
in three dimensions what this looks like. What am I looking at for sure, is it a hill or is it a valley?

33
00:02:16,560 --> 00:02:21,570
[Rich] That's right, what we lack now is an accurate

34
00:02:21,590 --> 00:02:26,610
topographic map of the Moon. With LRO

35
00:02:26,630 --> 00:02:31,640
we have a laser altimeter system so every second we'll

36
00:02:31,660 --> 00:02:36,650
have 140 spots deposited on the surface, it'll measure the return

37
00:02:36,670 --> 00:02:41,650
with this system and then measure the distance to the surface

38
00:02:41,670 --> 00:02:46,660

the roughness of the surface, and by looking at the five spots

39
00:02:46,680 --> 00:02:49,670
together we'll know the tilt of the surface.

40
00:02:49,690 --> 00:02:52,670
[Andy] Those are two sort of basic, tangible ones, but you're going to want to know

41
00:02:52,690 --> 00:02:55,680
temperatures, I think that's a big deal on the Moon right?

42
00:02:55,700 --> 00:02:58,680
[Rich] Yes, because the Moon goes through

43
00:02:58,700 --> 00:03:03,690
large temperature variations, unlike the Earth where our atmosphere

44
00:03:03,710 --> 00:03:07,690
redistributes the temperature variations

45
00:03:07,710 --> 00:03:11,700
so that we don't have large temperature variations like you do on the Moon

46
00:03:11,720 --> 00:03:16,700
Also, some places on the Moon we think are shadowed

47
00:03:16,730 --> 00:03:20,720
from sunlight, so they get very cold.

48
00:03:20,740 --> 00:03:25,730
So we want to measure temperatures around the Moon. To do that we have

49
00:03:25,750 --> 00:03:30,740
this instrument at the top called the Diviner

50
00:03:30,760 --> 00:03:35,760
experiment. By looking at the day/night variations we can understand

51
00:03:35,780 --> 00:03:40,770
what the surface properties are and understand

52
00:03:40,790 --> 00:03:45,770
parameters like rock abundance, you know, whether it's a smooth, hard soil

53
00:03:45,790 --> 00:03:50,780
or whether it's rubbly like gravel. A surface texture that you cannot see

54
00:03:50,800 --> 00:03:53,790
with the imager even at 50 centimeters.

55
00:03:53,810 --> 00:03:59,810
[Andy] Right so a sandy area, when it goes from day to night, will change temperature differently than a rocky

56
00:03:59,830 --> 00:04:04,820
[Rich] Right. The heating and cooling runs at different rates depending on the surface characteristics.

57
00:04:04,840 --> 00:04:05,830
[Andy] Interesting.

58
00:04:05,850 --> 00:04:10,840
[Rich] We also have a UV-spectrometer called LAMP.

59
00:04:10,860 --> 00:04:15,860
And this instrument will use starlight to

60
00:04:15,880 --> 00:04:19,870
image the dark regions where the Sun doesn't shine.

61
00:04:19,890 --> 00:04:23,880
And by looking at the reflectivity of

62
00:04:23,900 --> 00:04:28,890
the starlight and ultraviolet it can tell whether there's water frost on the surface or not.

63
00:04:28,910 --> 00:04:32,900

[Andy] So that kind of does a lot of the mapping, is there anything in particular

64
00:04:32,920 --> 00:04:36,920
can you talk about the one we missed that's kind of a more unique type of camera?

65
00:04:36,940 --> 00:04:40,940
[Rich] Right, we have here at the bottom this large instrument, which is

66
00:04:40,960 --> 00:04:44,950
the neutron detector. It's call LEND,

67
00:04:44,970 --> 00:04:48,970
for Lunar Exploration Neutron Detector, and it's being

68
00:04:48,990 --> 00:04:53,000
supplied by Russia and in regions where we think there is water

69
00:04:53,020 --> 00:04:57,020
the hydrogen associated with the water will

70
00:04:57,030 --> 00:05:02,040
cause the neutron flux to decrease. So LEND will

71
00:05:02,060 --> 00:05:07,060
search for these regions where there's decreased neutron flux

72
00:05:07,080 --> 00:05:10,080
in order to measure hydrogen abundance.

73
00:05:10,100 --> 00:05:13,100
[Andy] So we're missing one big one, this whole big brown thing right here.

74
00:05:13,120 --> 00:05:15,130
Can you explain to me what that is?

75
00:05:15,150 --> 00:05:18,160
[Rich] Yeah, that one was added late in the mission.

76
00:05:18,180 --> 00:05:23,180
And what it is an advanced radar system. What this system

77
00:05:23,200 --> 00:05:28,230
will do, it will send radio waves to the surface and measure the reflection

78
00:05:28,250 --> 00:05:33,270
of the surface in radio waves and it uses several

79
00:05:33,290 --> 00:05:38,290
techniques to see if there's the signature, first of all of surface roughness,

80
00:05:38,310 --> 00:05:44,290
and then also to see if there's some unique signatures associated with buried water ice.

81
00:05:44,310 --> 00:05:45,330
on the lunar surface.

82
00:05:45,350 --> 00:05:49,350
[Andy] All right, well thank you very much for showing this to me, we'll look forward to

83
00:05:49,370 --> 00:05:53,350
seeing what it starts sending back once we get it into orbit.