
NASA
NASA
Bruce Reid, GRAIL Mission Manager
NASA's Launch Services Program

1
00:00:00,580 --> 00:00:06,780
\h Music

2
00:00:06,780 --> 00:00:12,970
\h Narrator: The moon has captivated humanity's collective imagination since ancient times.

3
00:00:12,970 --> 00:00:17,110
\h Humans have studied it for hundreds of years -- first with telescopes,

4
00:00:17,110 --> 00:00:22,700
\h then with robotic probes, even sending twelve American astronauts to the lunar surface.

5
00:00:22,700 --> 00:00:26,790
\h But in many ways, our nearest neighbor remains a mystery.

6
00:00:26,790 --> 00:00:27,870
\h David Lehman, GRAIL Project Manager/Jet Propulsion Laboratory: And so, knowing

7
00:00:27,870 --> 00:00:31,540
\h what happened with the moon will help us understand what happened with the Earth,

8
00:00:31,540 --> 00:00:36,310
\h Venus, Mercury, and Mars. So that's the reason we want to try to understand it.

9
00:00:36,310 --> 00:00:39,920
\h We're trying to understand the past formation of the planets,

10
00:00:39,920 --> 00:00:42,180
\h so that will help us learn the future.

11
00:00:42,180 --> 00:00:46,640
\h Narrator: Clues about our own planet's history -- and the influence of the moon's gravity

12
00:00:46,640 --> 00:00:53,500
\h on Earth, 240,000 miles away -- could be locked below that dusty lunar surface.

13
00:00:53,500 --> 00:00:58,670

\h The Gravity Recovery and Interior Laboratory mission, or GRAIL, features twin

14
00:00:58,670 --> 00:01:03,540
\h spacecraft embarking on a challenging mission to map the moon's gravity.

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00:01:03,540 --> 00:01:05,000
\h David Lehman, GRAIL Project Manager/Jet Propulsion Laboratory: Its sole purpose is to

16
00:01:05,000 --> 00:01:08,710
\h measure gravity of the moon, to try to help us understand how the planets were formed,

17
00:01:08,710 --> 00:01:10,680
\h and how they evolved over time.

18
00:01:10,680 --> 00:01:14,320
\h Narrator: GRAIL's two spacecraft will fly in formation above the lunar surface to

19
00:01:14,320 --> 00:01:17,690
\h measure the variations in gravity.

20
00:01:17,690 --> 00:01:22,570
\h The mission seeks to reveal clues about our moon's thermal history, and how the inner

21
00:01:22,570 --> 00:01:26,180
\h solar system's rocky planets developed.

22
00:01:26,180 --> 00:01:30,560
\h GRAIL is departing from Pad B at Cape Canaveral Air Force Station's Space Launch

23
00:01:30,560 --> 00:01:32,850
\h Complex 17.

24
00:01:32,850 --> 00:01:37,240
\h Prelaunch processing -- and the final countdown -- are managed by NASA's Launch

25
00:01:37,240 --> 00:01:40,820
\h Services Program at nearby Kennedy Space Center.

26
00:01:40,820 --> 00:01:42,420
\h Tim Dunn, NASA Launch Manager/NASA's Launch Services Program: Our team,

27
00:01:42,420 --> 00:01:46,680
\h especially, gets excited whenever we leave Earth orbit, and going to the moon excites us

28
00:01:46,680 --> 00:01:51,170
\h and excites the public.

29
00:01:51,170 --> 00:01:55,530
\h Narrator: The two spacecraft -- called GRAIL-A and GRAIL-B -- are riding into space

30
00:01:55,530 --> 00:02:02,080
\h side-by-side aboard a powerful Delta II Heavy rocket built by United Launch Alliance.

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00:02:02,080 --> 00:02:05,770
\h It's a rocket with an impressive reliability record.

32
00:02:05,770 --> 00:02:07,010
\h Tim Dunn, NASA Launch Manager/NASA's Launch Services Program: If we just look at

33
00:02:07,010 --> 00:02:10,660
\h the Delta II rocket, which is the version of the vehicle that we fly today,

34
00:02:10,660 --> 00:02:15,980
\h NASA has a perfect launch record, 48 for 48.

35
00:02:15,980 --> 00:02:20,510
\h Narrator: The payload for NASA's most recent lunar mission, called LRO-LCROSS,

36
00:02:20,510 --> 00:02:24,870
\h which weighed in at 6,600 pounds and was the size of a minivan.

37
00:02:24,870 --> 00:02:31,340
\h It launched in 2009 aboard a massive Atlas V rocket, but that extra performance isn't

38
00:02:31,340 --> 00:02:37,390

\h needed for the GRAIL spacecraft, which together weigh only about 1,600 pounds.

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00:02:37,390 --> 00:02:42,850
\h Each unit is about the size of a washing machine, designed to be compact and rugged -- a

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00:02:42,850 --> 00:02:45,540
\h perfect fit for the Delta II.

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00:02:45,540 --> 00:02:50,030
\h Preparing two spacecraft adds an extra challenge to the team's workload, from

42
00:02:50,030 --> 00:02:54,230
\h environmental testing before launch all the way through the countdown.

43
00:02:54,230 --> 00:02:56,610
\h Bruce Reid, GRAIL Mission Manager/NASA's Launch Services Program: And then,

44
00:02:56,610 --> 00:03:00,590
\h for instance, on launch day, we have two dedicated teams -- one to GRAIL A and one to

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00:03:00,590 --> 00:03:03,970
\h GRAIL B. And they'll have to individually power up each spacecraft, and go through

46
00:03:03,970 --> 00:03:08,750
\h their health checks, and put the spacecraft in the proper configuration for launch.

47
00:03:08,750 --> 00:03:13,050
\h Narrator: After the climb to orbit, the GRAIL spacecraft will be released from the launch

48
00:03:13,050 --> 00:03:18,560
\h vehicle one at a time, as launch controllers and managers on the ground wait for news of

49
00:03:18,560 --> 00:03:20,650
\h spacecraft separation.

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00:03:20,650 --> 00:03:21,830
\h Bruce Reid, GRAIL Mission Manager/NASA's Launch Services Program: So we will

51
00:03:21,830 --> 00:03:26,130
\h definitely wait to celebrate until both spacecraft are safe and are on their translunar cruise

52
00:03:26,130 --> 00:03:27,390
\h to the moon.

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00:03:27,390 --> 00:03:30,640
\h Narrator: GRAIL's journey to the moon will take three-and-a-half months,

54
00:03:30,640 --> 00:03:32,150
\h a mission plan offering

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00:03:32,150 --> 00:03:37,560
\h plenty of time for controllers to make sure the spacecraft are ready to get to work.

56
00:03:37,560 --> 00:03:38,030
\h Bruce Reid, GRAIL Mission Manager/NASA's Launch Services Program: And

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00:03:38,030 --> 00:03:41,190
\h regardless of when we launch, we're going to have a constant arrival date.

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00:03:41,190 --> 00:03:45,270
\h So GRAIL A will arrive on New Year's Eve of 2011 and GRAIL B will arrive on New

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00:03:45,270 --> 00:03:48,350
\h Year's Day of 2012.

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00:03:48,350 --> 00:03:53,280
\h Narrator: Each spacecraft will have to execute a critical, 38-minute lunar orbit insertion

61
00:03:53,280 --> 00:03:58,750
\h burn to slide into lunar orbit. Then they'll spend the next five weeks reducing their orbit

62
00:03:58,750 --> 00:04:01,910
\h period and getting into formation.

63
00:04:01,910 --> 00:04:06,620

\h During the mission's three-month science phase, the moon will rotate three times beneath

64
00:04:06,620 --> 00:04:11,530
\h the two GRAIL spacecraft as they calculate the gravity they encounter.

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00:04:11,530 --> 00:04:16,990
\h One spacecraft will trail the other in orbit, and each will slow down or speed up in

66
00:04:16,990 --> 00:04:21,110
\h response to the changing gravitational pull from below.

67
00:04:21,110 --> 00:04:22,230
\h David Lehman, GRAIL Project Manager/Jet Propulsion Laboratory: And you need the

68
00:04:22,230 --> 00:04:26,750
\h two spacecraft to do that in order to measure the distance between the two very precisely.

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00:04:26,750 --> 00:04:31,230
\h Narrator: This data will allow scientists an unprecedented chance to study the gravity of

70
00:04:31,230 --> 00:04:36,230
\h the whole moon -- including the far side, facing away from Earth -- and envision the

71
00:04:36,230 --> 00:04:39,690
\h moon's interior from crust to core.

72
00:04:39,690 --> 00:04:44,270
\h The GRAIL mission also marks the first time students have a dedicated camera on board

73
00:04:44,270 --> 00:04:50,130
\h a planetary spacecraft, in order to request photos of specific lunar targets.

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00:04:50,130 --> 00:04:54,900
\h The MoonKam project is headed by Dr. Sally Ride, the first American woman

75
00:04:54,900 --> 00:04:56,850
\h to fly in space.

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00:04:56,850 --> 00:04:57,970
\h David Lehman, GRAIL Project Manager/Jet Propulsion Laboratory: What students need

77
00:04:57,970 --> 00:05:05,760
\h to do is to go on moonkam.ucsd.edu, and that's how they register to submit for images of

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00:05:05,760 --> 00:05:10,890
\h the moon. And then the images will be put on the Internet for the students to see.

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00:05:10,890 --> 00:05:14,850
\h Narrator: At the mission's end, the GRAIL spacecraft will be decommissioned,

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00:05:14,850 --> 00:05:18,270
\h eventually impacting the lunar surface.

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00:05:18,270 --> 00:05:23,460
\h The path from the Earth to the moon has been well traveled in recent decades by pioneers

82
00:05:23,460 --> 00:05:28,570
\h like Surveyor... the Apollo astronauts... Lunar Prospector... and many more.

83
00:05:28,570 --> 00:05:34,690
\h Today, GRAIL is ready to take its place in this long line of lunar explorers.

84
00:05:34,690 --> 00:05:35,980
\h David Lehman, GRAIL Project Manager/Jet Propulsion Laboratory: The moment I'm

85
00:05:35,980 --> 00:05:40,190
\h looking forward to is when we finally get into formation flying and we're ready to start

86
00:05:40,190 --> 00:05:43,410
\h taking science data for the mission.

87
00:05:43,410 --> 00:05:44,590
\h Tim Dunn, NASA Launch Manager/NASA's Launch Services Program: I'm going to be

88
00:05:44,590 --> 00:05:47,660

\h passing Complex 17 about 3:30 a.m. on my way to console.