1
00:00:00,433 --> 00:00:05,633
[Music]

2
00:00:05,633 --> 00:00:07,966
The Lucy spacecraft will be taking a journey

3
00:00:07,966 --> 00:00:12,533
where no other spacecraft has gone before: The Trojan asteroids.

4
00:00:12,533 --> 00:00:15,533
The Trojans are two groups of asteroids that lead and trail Jupiter

5
00:00:15,533 --> 00:00:17,500
in its orbit around the sun –

6
00:00:17,500 --> 00:00:19,333
and they've been trapped in these stable locations

7
00:00:19,333 --> 00:00:22,400
for over four billion years.

8
00:00:22,400 --> 00:00:25,600
Lucy will have a suite of scientific instruments for collecting data

9
00:00:25,600 --> 00:00:28,466
as it flies by the asteroids.

10
00:00:28,466 --> 00:00:31,266
L'LORRI is a long range reconnaissance imager.

11
00:00:31,266 --> 00:00:33,666
It's often referred to as Lucy's eagle eyes

12
00:00:33,666 --> 00:00:38,133
since it has the highest spatial resolution of all of Lucy's cameras.

13
00:00:38,133 --> 00:00:41,400

This black-and-white camera is actually a type of telescope,

14
00:00:41,400 --> 00:00:44,500
the same kind as the Hubble Space Telescope.

15
00:00:44,500 --> 00:00:48,200
L'LORRI was built to produce clear images of the Trojans' craters,

16
00:00:48,200 --> 00:00:50,433
which will be a challenge since the Trojan asteroids

17
00:00:50,433 --> 00:00:53,733
are extremely dark.

18
00:00:53,733 --> 00:00:56,866
L'LORRI will be able to see 75-yard-wide craters

19
00:00:56,866 --> 00:00:59,033
from over 600 miles away.

20
00:00:59,033 --> 00:01:01,366
That's like standing at one end of a football field

21
00:01:01,366 --> 00:01:04,366
and being able to see a fly at the other end!

22
00:01:04,366 --> 00:01:07,466
The instrument's simple design does not use optical filters

23
00:01:07,466 --> 00:01:09,333
and includes no moving parts,

24
00:01:09,333 --> 00:01:13,300
reducing the risk of part failure during the mission.

25
00:01:13,300 --> 00:01:16,600
L'LORRI will also search the Trojans for evidence of any rings

26
00:01:16,600 --> 00:01:18,533
and new satellites.

27
00:01:18,533 --> 00:01:21,600
The instrument's ability to see faint targets from far away

28
00:01:21,600 --> 00:01:25,200
also makes it perfect for optical navigation.

29
00:01:25,200 --> 00:01:28,133
L'LORRI will help Lucy navigate to a point in space,

30
00:01:28,133 --> 00:01:30,966
and then a terminal tracking camera aboard the spacecraft,

31
00:01:30,966 --> 00:01:33,333
known as T2Cam, will help the instruments

32
00:01:33,333 --> 00:01:36,300
accurately point toward the targets.

33
00:01:36,966 --> 00:01:39,800
L'TES is Lucy's thermal emission spectrometer

34
00:01:39,800 --> 00:01:43,433
which detects far infrared radiation emitted by the asteroids

35
00:01:43,433 --> 00:01:45,633
due to how they are heated up by sunlight.

36
00:01:46,466 --> 00:01:49,300
L'TES detects this radiation using a small telescope

37
00:01:49,300 --> 00:01:52,266
to focus the incoming energy onto a detector –

38
00:01:52,266 --> 00:01:56,333

similar to the way a remote thermometer works.

39
00:01:56,333 --> 00:01:59,466
So, L’TES is not taking images, but rather,

40
00:01:59,466 --> 00:02:03,400
temperature measurements at various points on the asteroid.

41
00:02:03,400 --> 00:02:05,866
This data will be combined so that scientists can get an

42
00:02:05,866 --> 00:02:07,833
understanding of its surface properties.

43
00:02:09,466 --> 00:02:12,433
L’TES will examine the properties of the regolith on the surface

44
00:02:12,433 --> 00:02:15,766
by measuring thermal inertia, which is the measure of how slowly

45
00:02:15,766 --> 00:02:19,766
the asteroid heats up from sunlight and then releases that heat.

46
00:02:19,766 --> 00:02:21,166
By taking the temperature readings

47
00:02:21,166 --> 00:02:23,100
at different parts of the asteroid,

48
00:02:23,100 --> 00:02:25,900
the Lucy science team can measure the thermal inertia

49
00:02:25,900 --> 00:02:28,533
and figure out how much dust, sand or rock

50
00:02:28,533 --> 00:02:31,133
is present on the asteroid’s surface.

51
00:02:31,133 --> 00:02:34,333
That data will tell us a lot about how the asteroid was formed,

52
00:02:34,333 --> 00:02:37,633
providing insight into the history of our solar system.

53
00:02:39,266 --> 00:02:41,833
Lucy’s L’Ralph instrument will search the Trojans

54
00:02:41,833 --> 00:02:45,433
for organics, ices, and hydrated minerals, and will help determine

55
00:02:45,433 --> 00:02:48,133
the surface compositions of the asteroids.

56
00:02:48,133 --> 00:02:50,600
L’Ralph is actually two instruments in one

57
00:02:50,600 --> 00:02:52,400
and together they will measure and analyze

58
00:02:52,400 --> 00:02:56,000
the spectra of light absorbed and reflected by the asteroid.

59
00:02:56,000 --> 00:02:58,266
The first is a color visible imager -

60
00:02:58,266 --> 00:03:01,633
the Multi-spectral Visible Imaging Camera or MVIC.

61
00:03:01,633 --> 00:03:05,000
It takes visible light color images of the Trojan asteroids.

62
00:03:05,000 --> 00:03:08,666
The second is an infrared imaging spectrometer known as LEISA -

63
00:03:08,666 --> 00:03:11,266

the Linear Etalon Imaging Spectral Array -

64
00:03:11,266 --> 00:03:15,400
which collects infrared spectra of the asteroids.

65
00:03:15,400 --> 00:03:19,033
Like L'LORRI, L'Ralph does not have a focusing mechanism.

66
00:03:19,033 --> 00:03:21,466
Instead, it is designed to stay in focus

67
00:03:21,466 --> 00:03:24,466
despite the extreme temperature differences in space

68
00:03:24,466 --> 00:03:28,466
by being made almost entirely from a single block of aluminum.

69
00:03:28,466 --> 00:03:30,700
Using one material throughout the instrument means that

70
00:03:30,700 --> 00:03:32,700
if a part expands or contracts,

71
00:03:32,700 --> 00:03:35,433
the other parts will expand or contract at the same rate,

72
00:03:35,433 --> 00:03:38,033
helping to keep L'Ralph in focus.

73
00:03:38,033 --> 00:03:39,866
Even the mirrors are made of aluminum

74
00:03:39,866 --> 00:03:42,266
finely polished with diamond dust.

75
00:03:42,266 --> 00:03:45,466
Due to the massive size of the images L'Ralph will be taking,

76
00:03:45,466 --> 00:03:49,600
the instrument will have around 256 gigabits of onboard memory.

77
00:03:49,600 --> 00:03:52,200
And while the L'Ralph instrument aboard Lucy does require

78
00:03:52,200 --> 00:03:55,866
substantially more power than its predecessors on other spacecraft,

79
00:03:55,866 --> 00:03:59,366
it still will not use more energy than your average ceiling fan.

80
00:04:01,133 --> 00:04:03,866
In addition to these three main science instruments,

81
00:04:03,866 --> 00:04:07,900
other experiments aboard the spacecraft will help fulfill the mission.

82
00:04:07,900 --> 00:04:11,066
Lucy will use its High Gain Antenna to communicate with Earth

83
00:04:11,066 --> 00:04:13,500
for an additional radio science experiment

84
00:04:13,500 --> 00:04:16,466
to determine the masses of the asteroid targets.

85
00:04:16,466 --> 00:04:19,933
Lucy will also be able to use its two terminal tracking cameras,

86
00:04:19,933 --> 00:04:23,433
or T2CAM, to track the asteroids during the flybys,

87
00:04:23,433 --> 00:04:26,666
keep them in the field of view, and to take wide-field images

88
00:04:26,666 --> 00:04:28,766

so that we can better determine their shapes,

89
00:04:28,766 --> 00:04:31,766
and perhaps discover new asteroids nearby.

90
00:04:33,533 --> 00:04:36,866
As you can see, the Lucy spacecraft has a large suite of tools