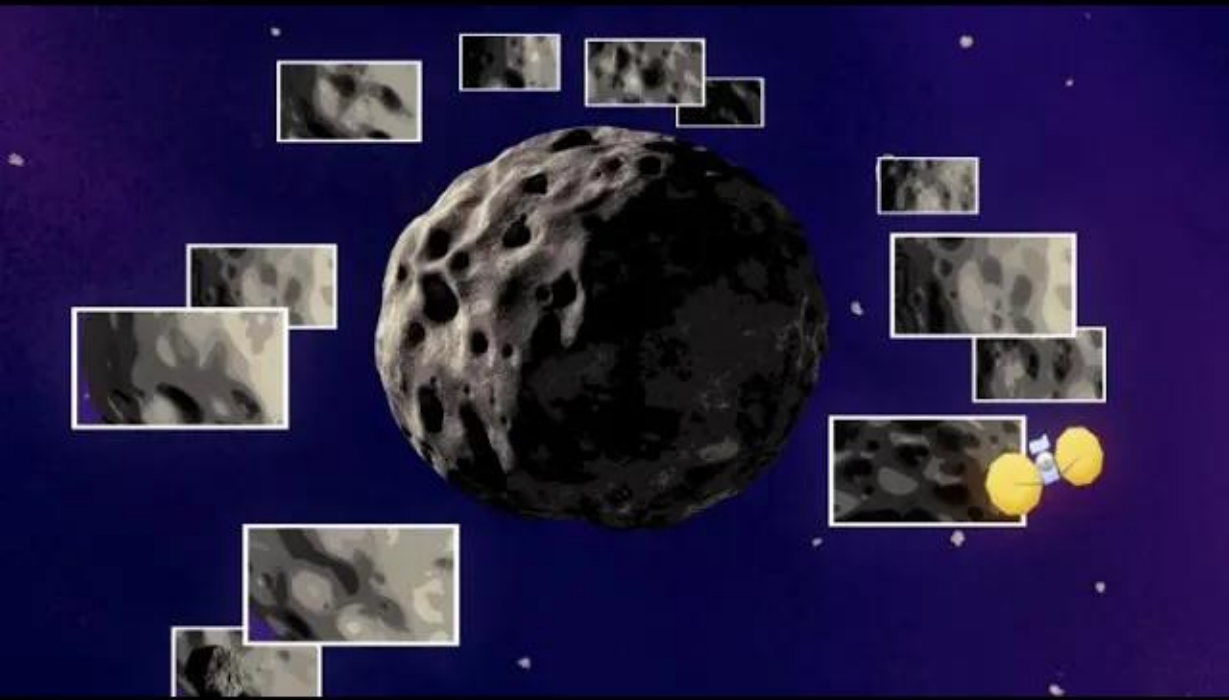

1
00:00:00,000 --> 00:00:03,003
(music throughout)

2
00:00:18,985 --> 00:00:20,620
So to steer a spacecraft from

3
00:00:20,620 --> 00:00:24,691
millions of miles away,
we have to first track its trajectory.

4
00:00:24,724 --> 00:00:28,695
So we have to determine where
in the Solar System the spacecraft is,

5
00:00:28,962 --> 00:00:32,932
predict where it's heading, and compare
that to where we want it to go.

6
00:00:32,966 --> 00:00:37,003
So the navigation team ensures
Lucy's on the right trajectory by tracking

7
00:00:37,003 --> 00:00:41,441
Lucy's position and velocity in the solar
system, predicting where it's headed

8
00:00:41,574 --> 00:00:45,445
and adjusting its course
so that it aces the flyby.

9
00:00:46,713 --> 00:00:49,849
So once Lucy starts approaching
one of its asteroid targets,

10
00:00:50,050 --> 00:00:54,454
the navigation team utilizes
the instruments, the cameras on board

11
00:00:54,454 --> 00:00:57,657

to take pictures of the asteroid
and background stars.

12
00:00:57,791 --> 00:01:02,062
And that helps us hone in on targeting
this close flyby.

13
00:01:03,730 --> 00:01:06,099
So commands travel at the speed of light.

14
00:01:06,299 --> 00:01:07,801
And over the course of Lucy's

15
00:01:07,801 --> 00:01:11,671
trajectory, its position
from Earth is varying substantially.

16
00:01:11,971 --> 00:01:15,775
When Lucy is near
Earth, during our earth, gravity assists.

17
00:01:16,042 --> 00:01:21,081
It takes a mere seconds for the data
or commands to be received

18
00:01:21,081 --> 00:01:24,084
by the spacecraft and for the spacecraft
to send data back to us.

19
00:01:24,084 --> 00:01:26,553
But at the farthest
extent of Lucy's trajectory

20
00:01:26,686 --> 00:01:30,924
and the farthest distance from Earth,
it can take up to an hour for our commands

21
00:01:31,124 --> 00:01:33,426
to be received traveling
at the speed of light.

22
00:01:34,594 --> 00:01:35,862
It's not only the data

23
00:01:35,862 --> 00:01:39,532
encoded in the signals, but
it's the properties of the signal itself.

24
00:01:40,033 --> 00:01:42,368
We know what time the spacecraft

25
00:01:42,535 --> 00:01:45,672
sent the data and we know what time
it was received on Earth.

26
00:01:45,872 --> 00:01:50,276
So we can calculate how long it took the
signal to travel at the speed of light.

27
00:01:50,443 --> 00:01:54,080
And that gives us information
about how far Lucy is from Earth.

28
00:01:54,647 --> 00:01:59,252
And then we also can get velocity
information because the spacecraft

29
00:01:59,252 --> 00:02:01,921
is moving away from the Earth
as it's sending those signals.

30
00:02:01,921 --> 00:02:06,192
And so there's a change in the frequency
of this radio signal.

31
00:02:06,326 --> 00:02:08,761
And that gives us
information about velocity.

32

00:02:08,761 --> 00:02:13,666
So like all NASA missions,
Lucy is designed to be robust to anomalies

33
00:02:13,666 --> 00:02:17,537
or surprises. But in the event
that something unexpected happens,

34
00:02:17,704 --> 00:02:22,375
there's either a contingency
plan on the shelf or a group of relevant