1
00:00:08,250 --> 00:00:04,120
[silence]

2
00:00:08,270 --> 00:00:12,370
[music] Narrator: If you wanted to find out how

3
00:00:12,390 --> 00:00:16,490
tall mountains are on other planets, how would you do it? If you're on Earth, it's easy.

4
00:00:16,510 --> 00:00:20,590
You can take a picture, fly over the mountain, fly over the mountain, or

5
00:00:20,610 --> 00:00:24,660
you can actually go there and measure how high it is. On other planets, it's much

6
00:00:24,680 --> 00:00:28,740
more difficult. You might be able to estimate height using shadows, or even take

7
00:00:28,760 --> 00:00:32,780
3D pictures from a satellite. But what if you wanted to know what the mountain looked like as a 3D

8
00:00:32,800 --> 00:00:36,810
model? To find out, NASA scientists can use a precise measuring tool called

9
00:00:36,830 --> 00:00:40,830
LIDAR. Mounted on a satellite orbiting high above a planet, LIDAR instruments

10
00:00:40,850 --> 00:00:44,860
are able to accurately measure the distance between the instrument and the landscape below using

11
00:00:44,880 --> 00:00:49,020
laser pulses. To make these measurements, the LIDAR instrument first sends a laser

12
00:00:49,040 --> 00:00:53,170
pulse down to the planet's surface. The pulse hits the ground and reflects back to the

13
00:00:53,190 --> 00:00:57,290

instrument, where an onboard computer measures the time it took the pulse to make its trip. That

14
00:00:57,310 --> 00:01:01,380
gives a precise measurement between the instrument and the ground--with respect to the planet's

15
00:01:01,400 --> 00:01:05,470
gravitational center. As the satellite passes over the landscape, the instrument

16
00:01:05,490 --> 00:01:09,560
sends out a series of regular pulses. By recording and combining these measurements,

17
00:01:09,580 --> 00:01:13,620
scientists can use the instrument to gradually build up a map of the height of the terrain.

18
00:01:13,640 --> 00:01:17,680
After many more measurements, the end result is a high-resolution

19
00:01:17,700 --> 00:01:21,720
3D model that scientists can view as if they were actually on the planet, flying over the terrain.

20
00:01:21,740 --> 00:01:25,740
They can then study its shape in more detail, looking for clues to the relative

21
00:01:25,760 --> 00:01:29,760
ages of craters, the shape of valleys and landscape features, and much more.

22
00:01:29,780 --> 00:01:33,900
But LIDAR is far more versatile than simply measuring the shapes of mountains and craters.

23
00:01:33,920 --> 00:01:38,020
Earth scientists, for example, use LIDAR to measure the height and density of the Earth's forests.

24
00:01:38,040 --> 00:01:42,120
Others use LIDAR to study small changes in the heights of the Earth's major icecaps

25
00:01:42,140 --> 00:01:46,210
over time. Still other scientists use LIDAR to study the composition and structure of Earth's

26
00:01:46,230 --> 00:01:50,320
atmosphere, as well as the atmosphere of other planets. And they can do all

27
00:01:50,340 --> 00:01:54,410
that without ever having to climb a mountain.

28
00:01:54,430 --> 00:01:58,480
[rumbling]