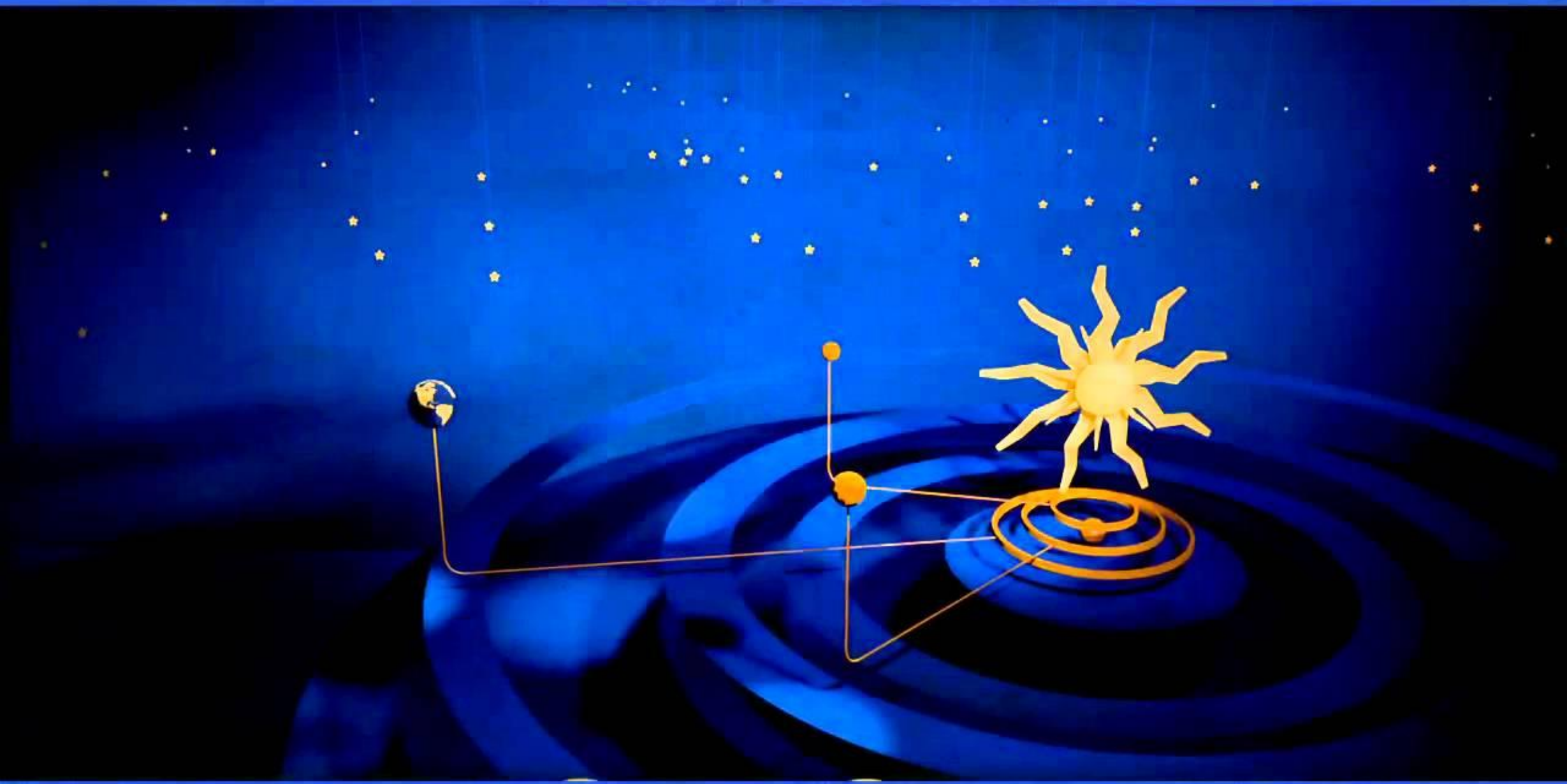

1
00:00:00,010 --> 00:00:04,160
[music] Narrator: A long time ago, in ancient Egypt,

2
00:00:04,180 --> 00:00:08,280
a clever human named Eratosthenes figured out that when the Sun was directly above a deep

3
00:00:08,300 --> 00:00:12,390
well in one city, you could stand in a nearby city to the north, measure the angle

4
00:00:12,410 --> 00:00:16,470
of the shadows there, and multiply that by the distance between the two cities

5
00:00:16,490 --> 00:00:20,570
to get the distance around the entire Earth. With that, the science of

6
00:00:20,590 --> 00:00:24,660
geodesy was born. Geodesy deals with the measurement and representation

7
00:00:24,680 --> 00:00:28,720
of the Earth--or, to put it more simply, it's the science of where things are, and just

8
00:00:28,740 --> 00:00:32,780
as importantly, where they have been and where they are going. Through geodesy,

9
00:00:32,800 --> 00:00:36,810
we learned the rough size and shape of the Earth, the direction of its rotation,

10
00:00:36,830 --> 00:00:40,830
its distance from the Sun, and more. Through triangulation,

11
00:00:40,850 --> 00:00:44,850
we could create detailed maps of entire countries. We even figured out

12
00:00:44,870 --> 00:00:48,970
that the Earth isn't quite a perfect sphere, and after some arguments and expeditions

13
00:00:48,990 --> 00:00:53,080

to Lapland and Peru, we measured that it's just a bit thicker in the middle.

14
00:00:53,100 --> 00:00:57,200
Building on this information, we found tons of practical uses for geodesy.

15
00:00:57,220 --> 00:01:01,290
Using stars as reference points and accurate watches, we could reliably

16
00:01:01,310 --> 00:01:05,390
determine latitude and longitude so that ships could cross giant oceans to get

17
00:01:05,410 --> 00:01:09,480
where they needed to go. Explorers visited uncharted regions, mapped them,

18
00:01:09,500 --> 00:01:13,540
and even found the tallest mountain in the world. Later, engineers built railroads

19
00:01:13,560 --> 00:01:17,580
to get us to all of these places. With a little math and the same reference

20
00:01:17,600 --> 00:01:21,620
surface, rail tunnels could be started on both sides of a mountain and somehow still

21
00:01:21,640 --> 00:01:25,660
meet in the middle. Life was good. And once we invented radio

22
00:01:25,680 --> 00:01:29,680
telescopes and satellites, things got even better. When scientists

23
00:01:29,700 --> 00:01:33,800
used a bunch of small radio dishes like one big one to look at quasars, somebody

24
00:01:33,820 --> 00:01:37,940
got the idea that you could use these measurements to determine very accurately the

25
00:01:37,960 --> 00:01:42,040
distance between the telescopes. Now, we can look at the movement of the Earth's crust, changes

26
00:01:42,060 --> 00:01:46,150
in how long days are, and how the Earth wobbles on its axis. Satellites

27
00:01:46,170 --> 00:01:50,230
also became very important. By analyzing their orbits, we can

28
00:01:50,250 --> 00:01:54,290
learn about our planet's changing size and shape and gravity, and by making

29
00:01:54,310 --> 00:01:58,360
laser measurements, we can look at everything from changes in the height and shape of the oceans

30
00:01:58,380 --> 00:02:02,400
and ice sheets to how the tides work. So, from ancient Egypt to

31
00:02:02,420 --> 00:02:06,430
the hundreds of satellites in orbit today, geodesy continues to have a huge

32
00:02:06,450 --> 00:02:10,450
impact on our lives. And all because somebody, a long time ago,

33
00:02:10,470 --> 00:02:14,540
decided to look down a well.