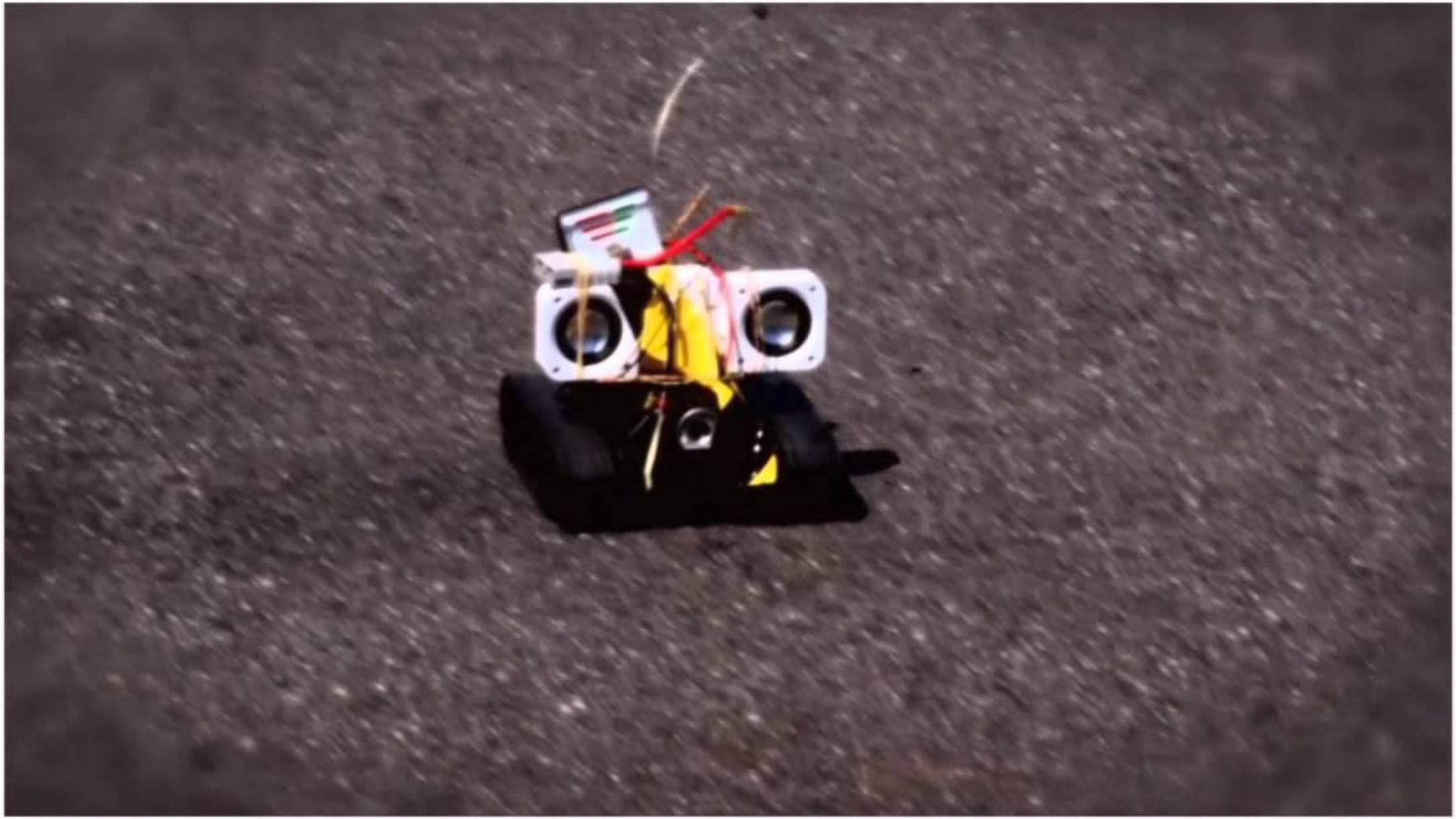

1
00:00:00,010 --> 00:00:04,010
Music.

2
00:00:04,030 --> 00:00:08,040
Mikulski: Over here is the picture taken

3
00:00:08,060 --> 00:00:12,070
after the servicing mission and this is what the new

4
00:00:12,090 --> 00:00:16,090
1994 Wide Field Planetary

5
00:00:16,110 --> 00:00:20,110
Camera picture will show us. The pictures

6
00:00:20,130 --> 00:00:24,130
are remarkable. The science that will come from the

7
00:00:24,150 --> 00:00:28,140
pictures are of historical significance.

8
00:00:28,160 --> 00:00:32,150
Postman: Just from seeing that one picture, you knew that this was going to be

9
00:00:32,170 --> 00:00:36,190
a revolutionary telescope.
[Boom]

10
00:00:36,210 --> 00:00:40,230
Heckman: Using Hubble to study

11
00:00:40,250 --> 00:00:44,270
the evolution of galaxies, we exploit the fact that a telescope

12
00:00:44,290 --> 00:00:48,300
in astronomy acts like a time machine. When we look at the most

13

00:00:48,320 --> 00:00:52,320
distant objects in the universe with Hubble, we're actually looking far back into

14
00:00:52,340 --> 00:00:56,340
time. The light has taken something like ten to twelve billion years

15
00:00:56,360 --> 00:01:00,360
to reach Earth when we look at the most distant galaxies.

16
00:01:00,380 --> 00:01:04,390
Postman: Hubble's ability to provide very crisp images,

17
00:01:04,410 --> 00:01:08,400
far crisper and cleaner and clearer than any other telescope,

18
00:01:08,420 --> 00:01:12,450
allows you to see what these things look like. They're not

19
00:01:12,470 --> 00:01:16,490
just fuzzy blobs of light.

20
00:01:16,510 --> 00:01:20,550
Ferguson: What we're trying to do is piece together the history of

21
00:01:20,570 --> 00:01:24,580
galaxy evolution, from the very very earliest galaxy

22
00:01:24,600 --> 00:01:28,610
which we can see, which now we're getting within about a billion years of the big bang

23
00:01:28,630 --> 00:01:32,630
all the way to the present.

24
00:01:32,650 --> 00:01:36,640
Postman: The other thing that Hubble allowed us to do is get very precise

25
00:01:36,660 --> 00:01:40,660
measurements of the colors of these galaxies and

26
00:01:40,680 --> 00:01:44,670
those colors tell us about the kind of stars

27
00:01:44,690 --> 00:01:48,710
that are in the galaxies and how old those stars are.

28
00:01:48,730 --> 00:01:52,760
Music.

29
00:01:52,780 --> 00:01:56,800
Ferguson: There are sort of two ways of thinking about a redshift:

30
00:01:56,820 --> 00:02:00,830
There's the Doppler Effect.
[Music]

31
00:02:08,880 --> 00:02:04,860
Music.

32
00:02:08,900 --> 00:02:12,890
Music

33
00:02:12,910 --> 00:02:16,900
Ferguson: So objects that are moving

34
00:02:16,920 --> 00:02:20,960
toward you if that were happening in light,

35
00:02:20,980 --> 00:02:25,000
the light would be shifted to the blue, if it's moving away from you it would be shifted to the red.

36
00:02:25,020 --> 00:02:29,050
In cosmology, there's another aspect, the whole universe

37
00:02:29,070 --> 00:02:33,080
is expanding and that's essentially stretching the light on its way from

38
00:02:33,100 --> 00:02:37,130
the distant object to us, and that really allows you to

39
00:02:37,150 --> 00:02:41,170
determine where in the universe the objects you're seeing are because you're measuring

40
00:02:41,190 --> 00:02:45,180
essentially that stretching factor.
Heckman: It's not like we're

41
00:02:45,200 --> 00:02:49,200
invent a better toothpaste or solve the energy crisis, we're doing

42
00:02:49,220 --> 00:02:53,210
things that are at the frontiers of knowledge.
Postman: One of the great things

43
00:02:53,230 --> 00:02:57,260
is about being able to study this history of galaxies

44
00:02:57,280 --> 00:03:01,310
is it not only tells us about what the cosmic history of

45
00:03:01,330 --> 00:03:05,350
formation of stars and galaxies is, but it also can

46
00:03:05,370 --> 00:03:09,380
tells us stuff about our own galaxy's past

47
00:03:09,400 --> 00:03:13,410
and its potential future as well.
Heckman: I think

48
00:03:13,430 --> 00:03:17,440
people just have a powerful urge to understand their origins.

49
00:03:17,460 --> 00:03:21,460
Ferguson: How did we get here?

50
00:03:21,480 --> 00:03:25,480
What was before the Earth? What was before the Sun?

51
00:03:25,500 --> 00:03:29,490
Those kinds of simple questions that are startlingly hard