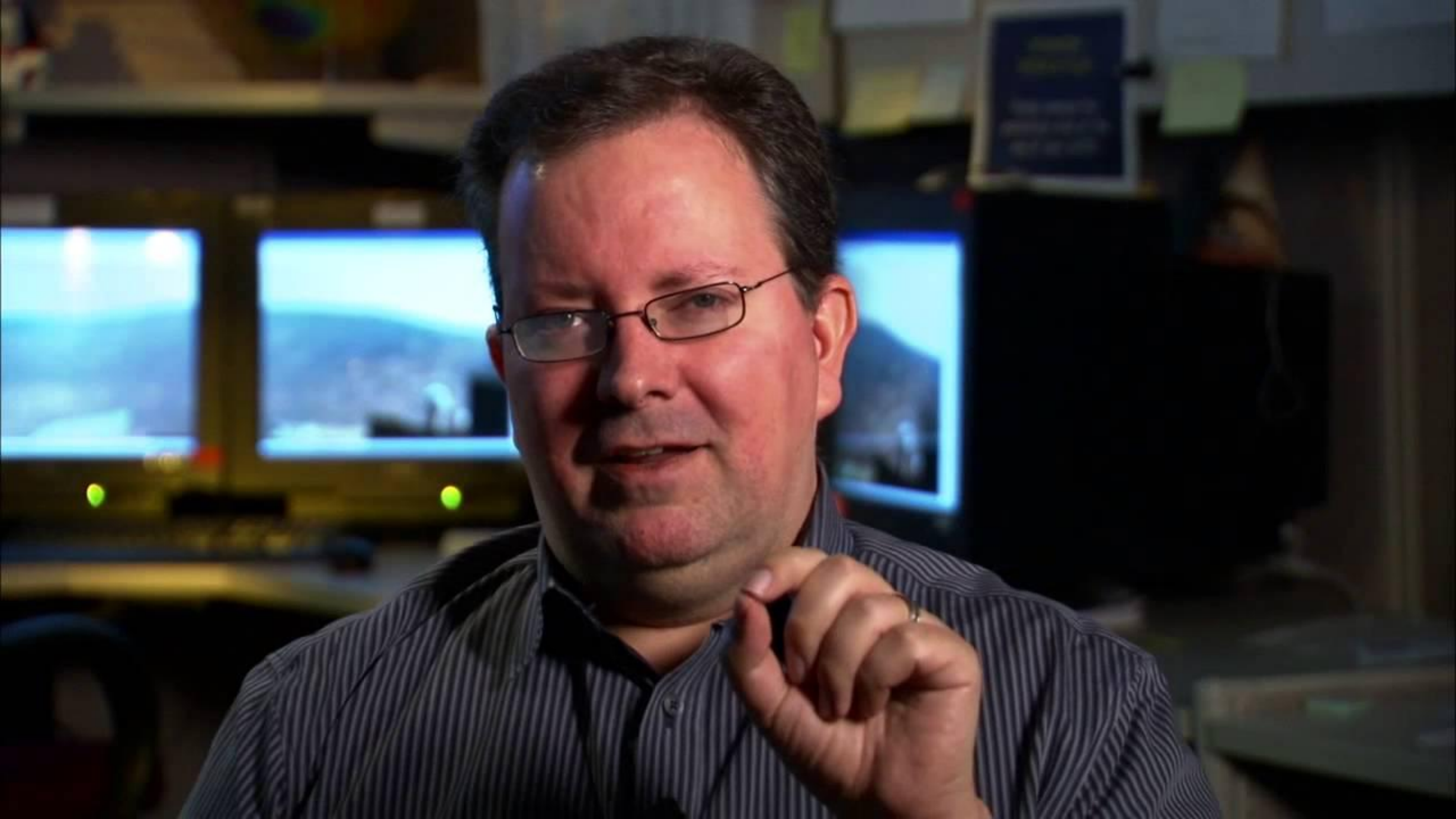

1
00:00:00,000 --> 00:00:05,000
Operating a rover on Mars is tricky even when the rover is working correctly.

2
00:00:05,000 --> 00:00:11,000
But when the rover starts having problems, I takes the ingenuity of the entire team

3
00:00:11,000 --> 00:00:13,000
to try to figure out how to

4
00:00:13,000 --> 00:00:22,000
(music)

5
00:00:22,000 --> 00:00:24,000
Engineers love boring.

6
00:00:24,000 --> 00:00:32,000
Boring means clear skies, no problems, work is a little easier, and scientists get data they want.

7
00:00:32,000 --> 00:00:40,000
But if you want to get an engineer excited, you throw them a curve ball, maybe some danger, maybe an anoma

8
00:00:40,000 --> 00:00:44,000
A heater that's stuck in the 'on' position.

9
00:00:44,000 --> 00:00:47,000
The robotic arm didn't want to unstow.

10
00:00:47,000 --> 00:00:50,000
The real dust storm began.

11
00:00:50,000 --> 00:00:52,000
Got stuck in a dune.

12
00:00:52,000 --> 00:00:56,000
An elevated current in the right front wheel.

13
00:00:56,000 --> 00:00:59,000

A massive dust storm.

14
00:00:59,000 --> 00:01:01,000
We had to learn to drive with broken steering.

15
00:01:01,000 --> 00:01:05,000
The gears were being worn on one side.

16
00:01:05,000 --> 00:01:08,000
We had to get very creative very quickly.

17
00:01:08,000 --> 00:01:16,000
But happily we made it through those challenges, and challenges of difficult terrain, navigating high slopes,

18
00:01:16,000 --> 00:01:20,000
or having to survive the winter by finding places that are safe for the rover to park

19
00:01:20,000 --> 00:01:22,000
and hibernate over the winter.

20
00:01:22,000 --> 00:01:32,000
I think to this day, you say 'dust storm,' and it strikes a little needle of terror into all of our hearts.

21
00:01:32,000 --> 00:01:39,000
It's been a real fun challenge to have problems and try to work out solutions, you know,

22
00:01:39,000 --> 00:01:41,000
discover what we can do, and think about ways we can solve them.

23
00:01:41,000 --> 00:01:43,000
Do diagnostics.

24
00:01:43,000 --> 00:01:44,000
Brainstorming.

25
00:01:44,000 --> 00:01:47,000
Workaround. Workaround. Workaround.

26
00:01:47,000 --> 00:01:49,000
We're coming up with new workarounds to allow this hardware

27
00:01:49,000 --> 00:01:54,000
that's still functioning on the surface of Mars to continue to function,

28
00:01:54,000 --> 00:01:57,000
and return excellent science to the science team.

29
00:01:57,000 --> 00:02:04,000
Every day we're shocked that it's still going. Yet, as engineers

30
00:02:04,000 --> 00:02:08,000
we're going to fight really hard to make sure it keeps going, and going, and going.

31
00:02:08,000 --> 00:02:15,000
The most valuable thing we've learned from these rovers lasting so long is that if something breaks,

32
00:02:15,000 --> 00:02:21,000
you can find, usually, something that will allow you to continue the mission

33
00:02:21,000 --> 00:02:25,000
even though one item on the rover has stopped working.

34
00:02:25,000 --> 00:02:29,000
We can make changes on a rover that's hundreds of millions of miles away.

35
00:02:29,000 --> 00:02:34,000
We make changes on Earth, test them out here, make sure they're going to be good, then send it up to Mars.

36
00:02:34,000 --> 00:02:42,000
A piece of equipment that has not been serviced by human hands in over 10 years is still working.

37
00:02:42,000 --> 00:02:46,000
I don't think your car works that good.

38
00:02:46,000 --> 00:02:52,000

We're going to keep pushing the rover like we were meant to ever since we landed, and see what we can see,