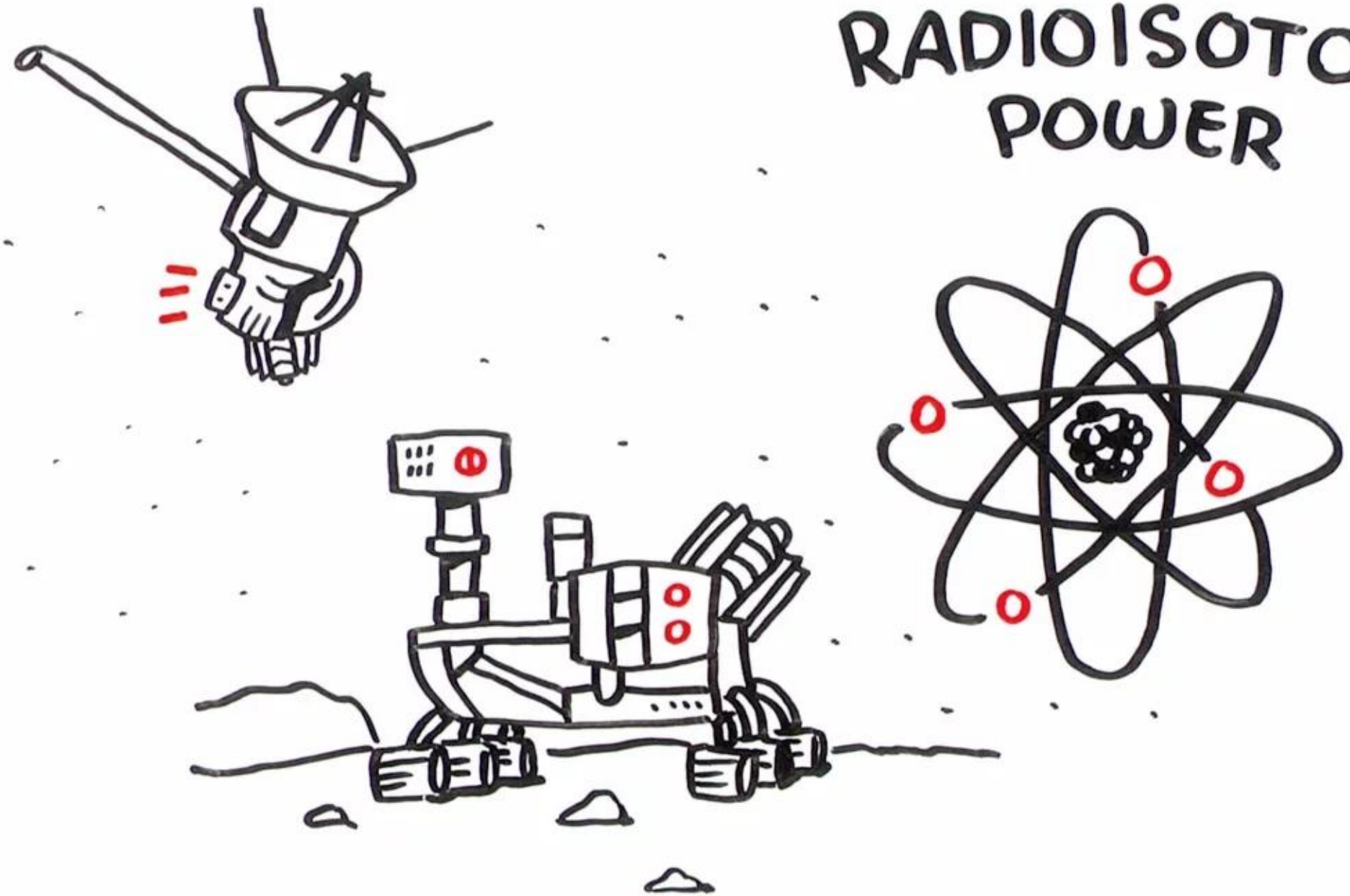
RADIOISOTOPE POWER



1
00:00:00,333 --> 00:00:08,474
■

2
00:00:08,507 --> 00:00:11,711
If you want to drive a rover on
Mars, you have to keep in mind

3
00:00:11,744 --> 00:00:13,980
there's no gas station
for millions of miles

4
00:00:14,013 --> 00:00:16,916
and there's no outlet
to plug into for power.

5
00:00:17,884 --> 00:00:19,986
That's why NASA's
Curiosity rover on Mars

6
00:00:20,019 --> 00:00:22,989
--and other NASA spacecraft
that explore the solar system--

7
00:00:23,022 --> 00:00:27,160
use something called
"radioisotope power."

8
00:00:27,193 --> 00:00:29,328
A radioactive substance
releases heat

9
00:00:29,361 --> 00:00:31,964
as it breaks down or decays.

10
00:00:33,232 --> 00:00:35,668
A system that converts that
heat into electricity is called

11
00:00:35,701 --> 00:00:38,337

a radioisotope power system.

12
00:00:38,370 --> 00:00:40,506
These systems get fancy names.

13
00:00:40,539 --> 00:00:44,077
Curiosity's power system
is called an "MMRTG":

14
00:00:44,110 --> 00:00:47,847
multi-mission radioisotope
thermoelectric generator.

15
00:00:47,880 --> 00:00:51,617
MMRTGs are reliable
and last a long time.

16
00:00:51,650 --> 00:00:54,253
NASA's Jet Propulsion
Laboratory is working with

17
00:00:54,286 --> 00:00:56,556
the Department of Energy
on ways to make them

18
00:00:56,589 --> 00:00:59,025
even more powerful and capable.

19
00:00:59,058 --> 00:01:01,661
So researchers want to
make the next generation

20
00:01:01,694 --> 00:01:03,696
of radioisotope
power systems,

21
00:01:03,729 --> 00:01:05,531
the eMMRTG.

22

00:01:05,564 --> 00:01:08,301
The "e" stands for "enhanced."

23
00:01:09,435 --> 00:01:11,304
The new thermoelectric
technology in development is

24
00:01:11,337 --> 00:01:13,806
based upon materials
called skutterudites.

25
00:01:13,839 --> 00:01:16,375
They are a part of a
family of compounds

26
00:01:16,408 --> 00:01:19,378
with many heavy atoms
and complex structures.

27
00:01:19,411 --> 00:01:22,115
Skutterudites conduct
electricity like a metal but

28
00:01:22,148 --> 00:01:25,184
insulate against heat
the way glass does.

29
00:01:25,217 --> 00:01:27,086
At the same time
they can generate

30
00:01:27,119 --> 00:01:29,155
sizable electrical voltages,

31
00:01:29,188 --> 00:01:32,758
just what engineers need to
convert heat into electricity.

32
00:01:34,059 --> 00:01:37,163
Engineers use this material in

devices called thermocouples,

33
00:01:37,196 --> 00:01:40,099
which are used to
generate electricity.

34
00:01:41,333 --> 00:01:44,737
One of the thermocouple's
shoes is hot and one is cold.

35
00:01:44,770 --> 00:01:47,573
This heat, transferred across
a big temperature difference,

36
00:01:47,606 --> 00:01:49,208
makes electrical charges flow

37
00:01:49,241 --> 00:01:50,743
from the hot shoe
to the cold shoe

38
00:01:50,776 --> 00:01:53,146
and produces an
electrical voltage.

39
00:01:53,179 --> 00:01:56,616
And this generates
useful electrical power.

40
00:01:57,884 --> 00:02:00,019
If these materials were put
in the same kind of generator

41
00:02:00,052 --> 00:02:02,021
that's on the Curiosity rover,

42
00:02:02,054 --> 00:02:03,489
with some small tweaks,

43

00:02:03,522 --> 00:02:06,759
the generator could be up
to 25% more efficient.

44
00:02:06,792 --> 00:02:10,596
After 17 years a spacecraft
could have 50% more power

45
00:02:10,629 --> 00:02:12,532
than with the current design.

46
00:02:12,565 --> 00:02:16,035
That means a spacecraft with
an eMMRTG could fly longer

47
00:02:16,068 --> 00:02:19,205
and do more science
during its lifetime.

48
00:02:20,339 --> 00:02:23,576
This kind of research
could help us on Earth, too.

49
00:02:23,609 --> 00:02:26,245
For example, some of the
heat that gets wasted

50
00:02:26,278 --> 00:02:30,216
when you drive your car could be
reused and put back into the car

51
00:02:30,249 --> 00:02:33,786
to charge the battery
or power electronics.

52
00:02:33,819 --> 00:02:35,488
JPL is collaborating with

53
00:02:35,521 --> 00:02:38,624
leading U.S. materials

scientists to design and study

54
00:02:38,657 --> 00:02:39,926
even more advanced

55
00:02:39,959 --> 00:02:43,529
high-temperature
thermoelectric materials.

56
00:02:44,697 --> 00:02:46,732
The next time you need to
replace your car battery,

57
00:02:46,765 --> 00:02:48,334
think about how
NASA's spacecraft

58
00:02:48,367 --> 00:02:50,403
can't replace their batteries.

59
00:02:50,436 --> 00:02:53,172
But as we improve
radioisotope power systems,

60
00:02:53,205 --> 00:02:56,209
they can go for longer and
longer--powered by heat,