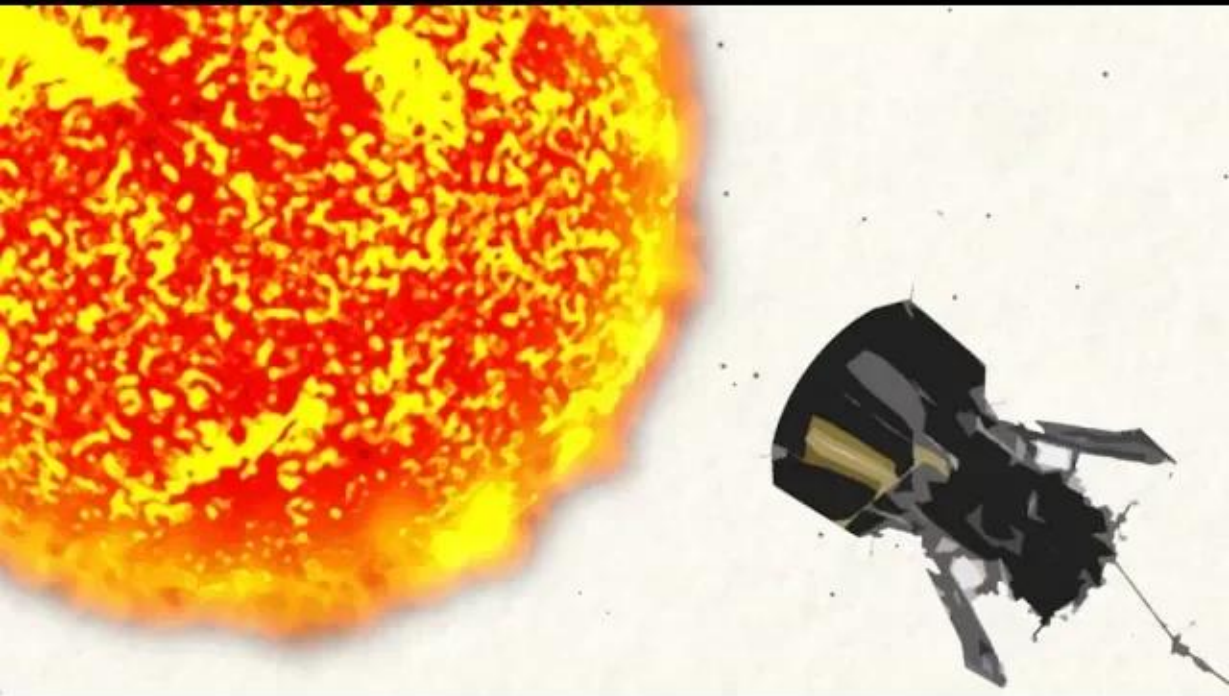

1
00:00:01,760 --> 00:00:04,040
NASA's Parker Solar Probe will soon fly closer

2
00:00:04,040 --> 00:00:08,160
to the Sun than any spacecraft before it-about 4 million

3
00:00:08,160 --> 00:00:12,270
miles from the visible surface. But getting that close to the Sun

4
00:00:12,270 --> 00:00:16,370
requires some fancy orbital mechanics. It takes 55 times

5
00:00:16,370 --> 00:00:19,640
more energy to go to the Sun than it does to go to Mars.

6
00:00:20,480 --> 00:00:24,600
Why is it so hard to get to the Sun? The answer is related to why

7
00:00:24,600 --> 00:00:28,690
Earth doesn't just fall straight into the Sun, despite the strong gravitational

8
00:00:28,690 --> 00:00:32,790
attraction. Earth, and everything on it, is traveling very

9
00:00:32,790 --> 00:00:36,810
fast-about 67,000 miles per hour-in a direction that is

10
00:00:36,810 --> 00:00:40,880
basically always sideways relative to the Sun. If you launch a

11
00:00:40,880 --> 00:00:45,010
rocket from Earth, straight toward the Sun, it won't lose that sideways speed,

12
00:00:45,010 --> 00:00:49,140
and so it will miss the Sun. The only way to get the rocket

13
00:00:49,140 --> 00:00:53,300

to go right into the Sun is to cancel all that sideways motion. Leave

14
00:00:53,300 --> 00:00:57,430
even a little bit and it will miss the Sun and enter a new orbit.

15
00:00:57,430 --> 00:01:01,560
To cancel Earth's motion, you have to launch the spacecraft backward as fast as Earth

16
00:01:01,560 --> 00:01:05,710
is hurtling forward. But 67,000 miles an hour is really

17
00:01:05,710 --> 00:01:09,870
fast. Spacecraft have to go upward at only 25,000 miles

18
00:01:09,870 --> 00:01:13,980
an hour to escape Earth. Getting to Mars only requires a bit

19
00:01:13,980 --> 00:01:18,100
more speed: 29,000 miles an hour. New Horizons,

20
00:01:18,100 --> 00:01:22,180
which NASA sent rushing out to Pluto, managed 36,000 miles

21
00:01:22,180 --> 00:01:25,740
per hour, or a little more than half what it would have to hit the Sun

22
00:01:25,740 --> 00:01:29,900
instead. Since Parker Solar Probe plans to fly past the Sun,

23
00:01:29,960 --> 00:01:34,600
it doesn't need to cancel out all of Earth's sideways speed, but it does need to remove

24
00:01:34,600 --> 00:01:38,690
53,000 miles per hour of it. That's why it's using one of the most

25
00:01:38,690 --> 00:01:42,880
powerful rockets available and additional gravity assists from Venus

26
00:01:42,880 --> 00:01:46,970
over a period of several years. In this case, rather than speeding up

27
00:01:46,970 --> 00:01:51,070
the spacecraft as in a typical gravity assist, Venus slows down its

28
00:01:51,070 --> 00:01:55,090
sideways motion, so the spacecraft can get close to the Sun.

29
00:01:55,090 --> 00:01:59,180
When it finally does make its closest approach to the Sun, Parker Solar Probe

30
00:01:59,180 --> 00:02:03,200
will have lost much of its sideways speed, but gained a great deal of overall

31
00:02:03,200 --> 00:02:07,310
speed, thanks to the Sun's gravity. Parker Solar Probe will hurtle

32
00:02:07,310 --> 00:02:11,470
past the Sun at 430,000 miles an hour-

33
00:02:11,470 --> 00:02:15,660
the very first human-made object to get that close.