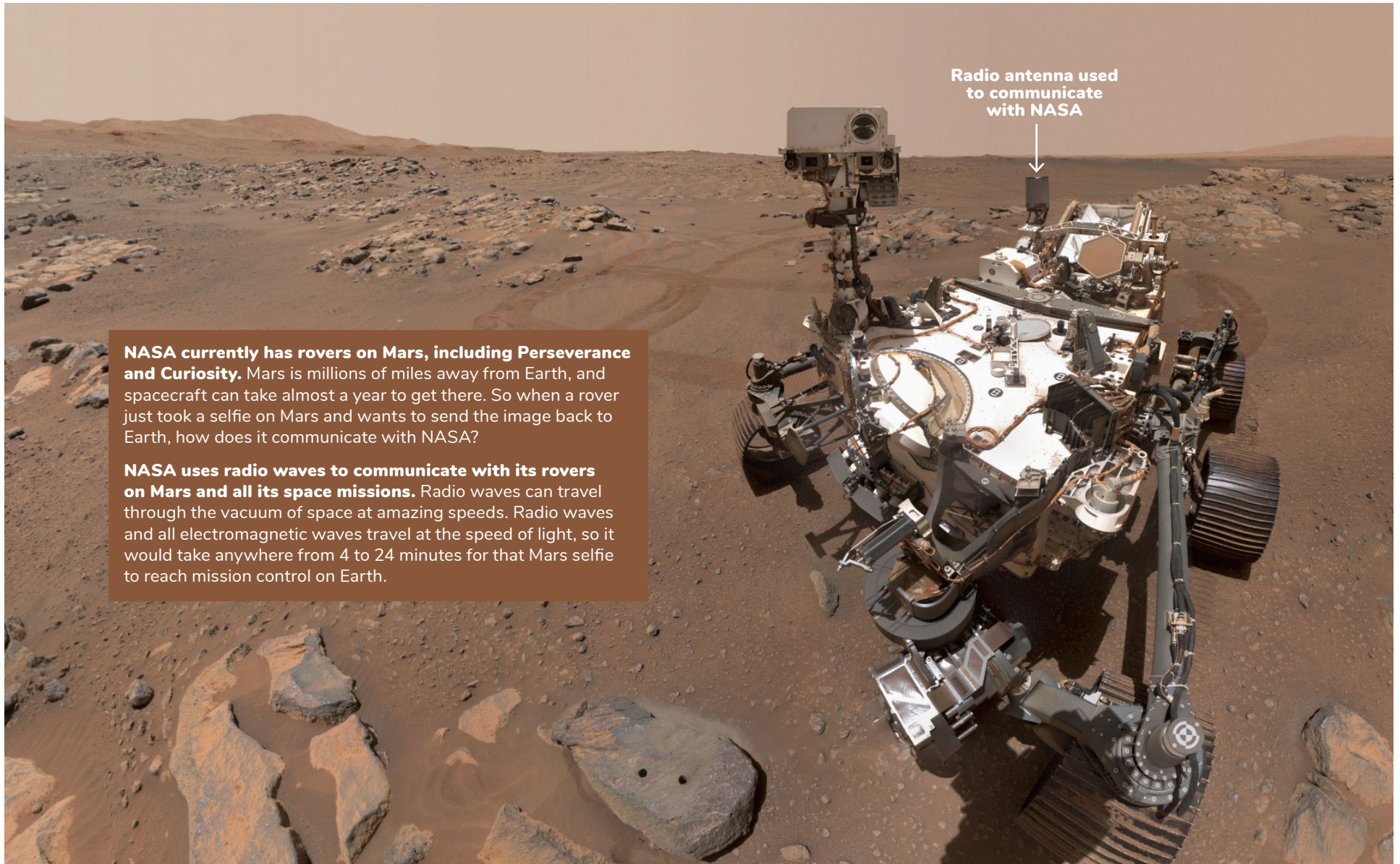


# How Does NASA Communicate with Rovers on Mars?

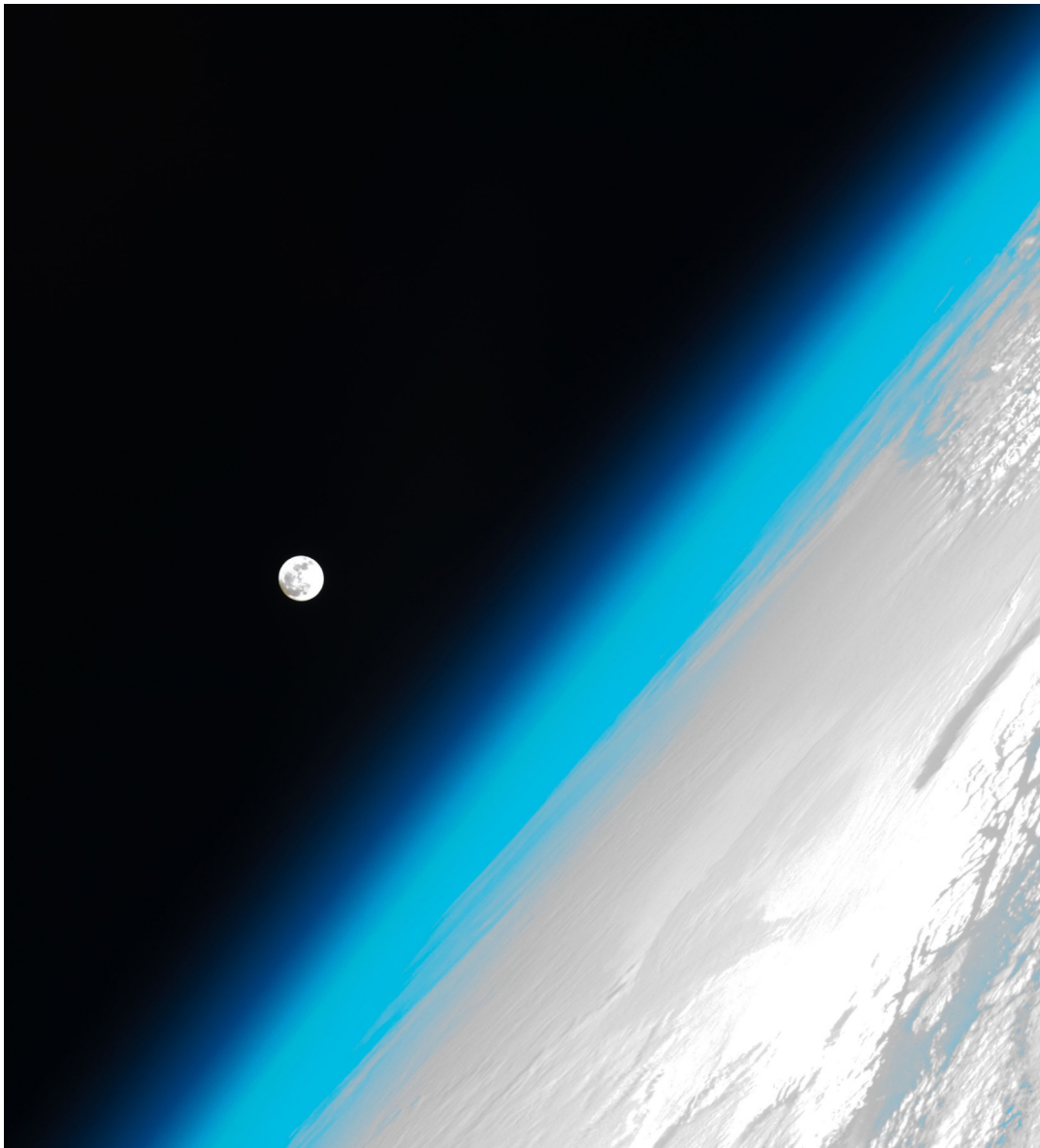


**NASA currently has rovers on Mars, including Perseverance and Curiosity.** Mars is millions of miles away from Earth, and spacecraft can take almost a year to get there. So when a rover just took a selfie on Mars and wants to send the image back to Earth, how does it communicate with NASA?

**NASA uses radio waves to communicate with its rovers on Mars and all its space missions.** Radio waves can travel through the vacuum of space at amazing speeds. Radio waves and all electromagnetic waves travel at the speed of light, so it would take anywhere from 4 to 24 minutes for that Mars selfie to reach mission control on Earth.



# What Is a Vacuum?



NASA

**When you think of a vacuum, outer space may not be the first thing that comes to mind.** Most of us have seen a *vacuum cleaner*, the household tool that uses a fan to suck in air along with dirt and dust. However, scientists use the word *vacuum* to describe a place with little or no matter. That could mean an area of any size with no air, water, rocks—nothing!



So why do we call a vacuum cleaner a vacuum? When the fan inside the vacuum cleaner sucks in air, it creates a *weak vacuum*. While this weak vacuum is not too different from the area outside the vacuum cleaner, it is enough to suck up dirt from your rug.

Space, on the other hand, is a *near-perfect vacuum*. That means there is almost no matter present. To compare, inside a vacuum cleaner you can expect to find 100,000,000,000,000,000 molecules in a volume of about one tablespoon. In most parts of space, you would only find one molecule in the same volume.

