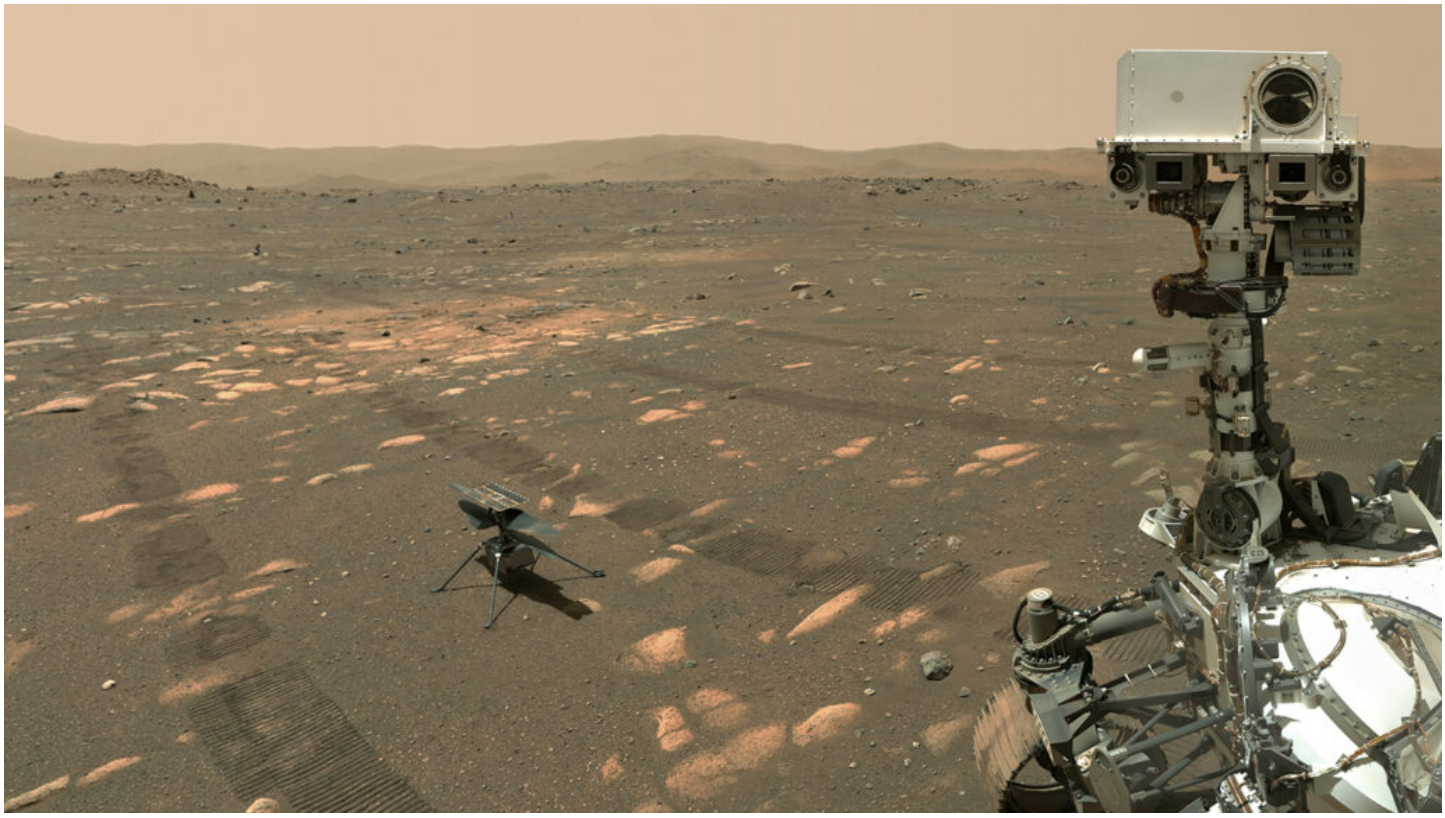
ScienceNews for Students

PLANETS

Noises sound totally different on Mars than on Earth. Here's why

The first sounds measured on the Red Planet have revealed some surprises



Sounds recorded by a microphone on the Perseverance rover (pictured) have revealed more than one speed of sound on Mars.

JPL-CALTECH/NASA, MSSS

By **Stephen Ornes**

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Having a conversation on Mars would be difficult. That's partly because Mars can be really cold, and your teeth may be chattering. But it's also because the Red Planet's thin atmosphere of mostly carbon dioxide doesn't carry sound well. In fact, someone speaking next to you on Mars would sound as quiet as if they were talking 60 meters (200 feet) away.

"It's a pretty drastic difference from Earth," says Baptiste Chide. "You don't want to do it." Better to use microphones and a headset, he says, even at close range. Chide is a planetary scientist at Los Alamos National Laboratory in New Mexico. He and his colleagues shared these new findings about sound on Mars in the May 26 issue of *Nature*.

Chide's team analyzed some of the first sound recordings ever made on the Red Planet. The recordings had been picked up by a microphone on NASA's Perseverance rover. This space robot has been exploring Mars since February 2021.

What Perseverance recorded weren't the sounds of events on Mars. They were noises made when the rover fired a laser at small rocks nearby. That zap created a sound wave — similar to thunder, but on a much smaller scale. Chide and his team studied about five hours' worth of sounds collected in this way.

Laser zaps

These sounds were recorded by NASA's Perseverance rover on Mars, over 160 million kilometers (100 million miles) from Earth. They were created when a rover fired a laser at nearby rocks.

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These data allowed the researchers to measure the speed of sound on Mars — and revealed a surprise. On this planet there's more than one. Within the range of human hearing, high-pitched sounds travel at about 250 meters per second (559 miles per hour). Low-pitched sounds travel slower — about 240 meters per second (537 miles per hour). Those low-pitched waves will travel just a few meters before becoming inaudible. The higher sounds dissipate over even shorter spans.

"For an Earthling, this may be surprising. But it makes sense," says Andy Piacsek. He's a physicist at Central Washington University, in Ellensburg. He was not involved in the new research, but he does study how sound waves move through different materials.

When a sound wave moves through air or a fluid, it adds energy to the molecules around it. Air will gradually move that energy around. This is called the relaxation effect.

For sound waves traveling through air, relaxation depends on the frequency of the sound and the type of molecules in the air. On Mars, the relaxation after a high-pitched sound happens faster than after a low-pitched sound. That's because the atmosphere has low pressure and is mostly made of carbon dioxide.

Explainer: Understanding waves and wavelengths

"This doesn't happen on Earth because the pressure of our atmosphere is so much higher than on Mars," Piacsek says. Plus, Earth's atmosphere is mostly nitrogen. Under those conditions, the relaxation effect is about the same for high and low pitches. So on Earth, all sounds generally travel at about 343 meters per second (767 miles per hour). (To hear how sounds differ between Earth and Mars, visit NASA's Sounds of Mars site.)

If a song were playing from a speaker on Mars, higher sounds would reach a listener before the lower sounds. "Let's say you somehow had a city on Mars, with birds," says Chide. "Birds are too high in frequency. You wouldn't hear them. You would only hear the sounds of the city." The high carbon-dioxide content of the Martian air is to blame, Chide says.

Of course, there aren't birds on Mars — but that's not why scientists study sound on alien worlds. Measuring the speed of sound can give scientists a precise way to study the Martian atmosphere, says Chide. Air pressure, temperature and humidity all affect the speed of sound. So, by measuring changes in the speed of sound over time, Chide says, researchers can learn more about Martian weather. "We can measure temperature in small fractions of time," he says — even day to day.

With Perseverance broadcasting more sounds back to Earth, scientists will be able to study how its soundscape changes over the course of Martian seasons, Chide says. "We're very excited to see how sound behaves during winter and autumn — during every season on Mars."

CITATIONS

Journal: S. Maurice et al. In situ recording of Mars soundscape. *Nature.* Vol. 605, May 26, 2022, p. 653. doi: 10.1038/s41586-022-04679-0.