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WEEKLY March 27–April 2, 2021

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Space exploration

A view from Mars's surface...

The Perseverance rover has sent back pictures and audio, and zapped some rocks

Leah Crane

SINCE NASA's Perseverance rover landed on Mars on 18 February, it has been doing as much research as it can during the testing phase of its scientific instruments. That has involved driving short distances and taking pictures of the rocks near the landing site.

"So far, all of this has been going exceedingly well,"

"If I heard sounds like these while I was driving my car, I'd pull over and call for a tow"

said Ken Farley at NASA's Jet Propulsion Laboratory (JPL) in California, during a presentation at the virtual Lunar and Planetary Science Conference on 16 March. "We've had no major technical issues."

The rover's first drive on 4 March – which lasted 33 minutes and covered about 6.5 metres – demonstrated that it can, in fact, rove, and the other tests are going smoothly as well, he said.

Perseverance has a microphone, which has allowed us to hear the Red Planet for the first time. It recorded more than 16 minutes of audio as it drove around on Mars on 7 March.

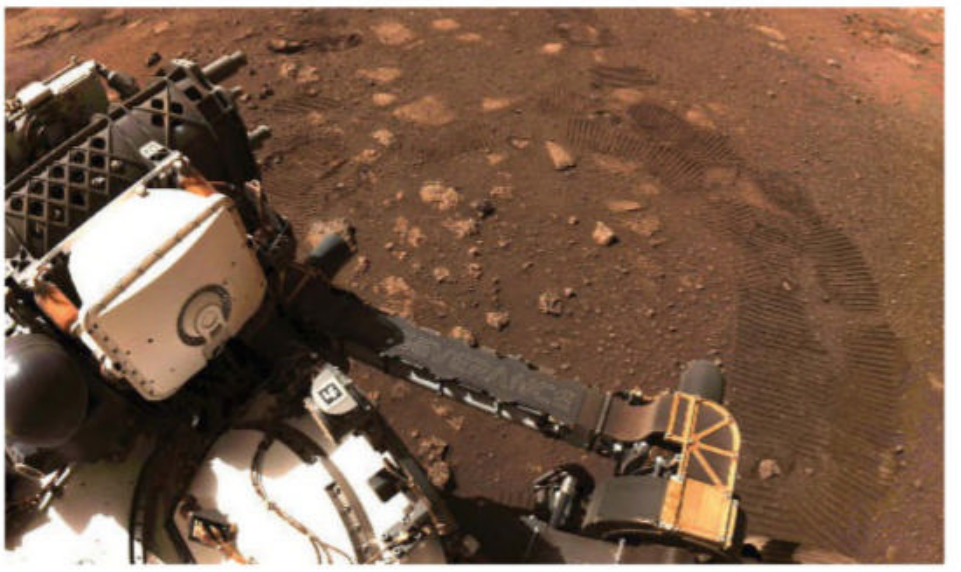
"If I heard these sounds driving my car, I'd pull over and call for a tow," said Dave Gruel at JPL in a statement. "But if you take a minute to consider what you're hearing and where it was recorded, it makes perfect sense."

However, one of the high-pitched scratching noises in the recordings was unexpected and NASA engineers are now trying to figure out what is causing it.

Perseverance has also zapped several of the rocks near its landing site with its laser to determine their chemical compositions. They are similar to basaltic rocks on Earth, and some of them also appear to have water locked up in their molecular structure.

Many of the nearby rocks contain visible holes, some of which were probably bored by wind, whereas others may have been sculpted by flowing water.

All of these findings are exactly what scientists expected. Basalts form from molten rock and we knew that Jezero crater, where Perseverance landed, ought to have volcanic rocks that were once covered by the lake that used to fill the crater.



NASA/JPL-CALTECH

Rover tracks in the Martian dirt after Perseverance drove around on 4 March

One of the images taken during testing even showed a Martian dust devil – a rotating column of dust – moving across the surface. These are common on Mars – most of the spacecraft we have sent there, including the Viking landers in the 1970s, have spotted them at some point.

Perseverance's next major task will be to test Ingenuity, the small helicopter that the rover carried to Mars in its belly. For that, Perseverance will drop Ingenuity off, drive a short distance away and attempt to take a video of the helicopter as it lifts into the Martian air.

After Ingenuity's test flights, which are expected to happen this spring, the rover will be free to drive further afield and begin its science phase in earnest. At that point, it will begin searching for signs of ancient life and take samples to be returned to Earth by a mission planned for 2026. ▮

Geology

...and a deeper look to measure the size of its molten core

WE ARE starting to understand Mars's heart. NASA's InSight lander has used seismic waves bouncing around the interior of the planet to measure the size of its molten core.

Since landing on Mars in 2018, InSight has measured more than 500 marsquakes, most of them relatively small. When these quakes occur, the lander measures two types of seismic waves – those that skim near the surface and travel in a relatively straight line between the quake and the lander, and those that bounce around within the planet before reaching the detectors. It records the intensity of the waves in a graph called a seismogram.

The InSight team found that many of the records of marsquakes included a set of seismic waves with a shape that suggested they bounced off the boundary between the planet's mantle and its core. These arrived about 500 seconds after the first surface tremors.

Using that time difference and the directions from which the various waves arrived, the team calculated that Mars's core has a radius of about 1810 to 1860 kilometres, said Simon Stähler at the Swiss Federal Institute of Technology in Zurich. He presented this work on 18 March at the virtual Lunar and Planetary Science Conference.

That size is at the high end of the range of estimates calculated in previous work, which implies that the core may be less dense than we thought, Stähler said.

This may mean that Mars's interior is richer in relatively light elements, such as oxygen, than researchers had realised.

"So far we did not peer into the core itself, but now we know where in the seismogram to look," said Stähler. "On top of that, we can search for signs of a potential, if unlikely, solid inner core."

However, all of the InSight lander's measurements so far are consistent with previous studies that suggest the core is entirely molten. ▮

Leah Crane