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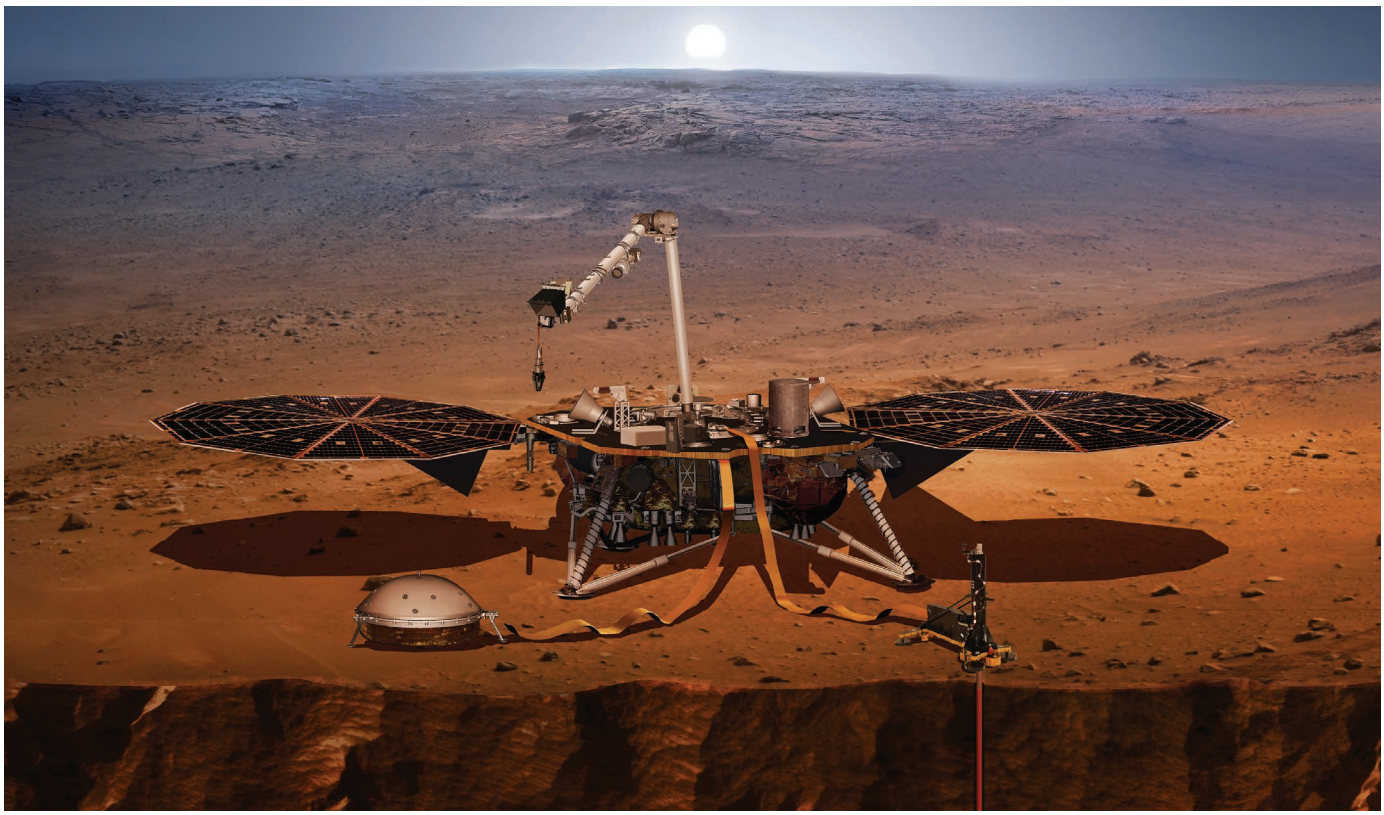

An artist's impression of NASA's Mars InSight lander, which will touch down in November and listen for seismic tremors.

PLANETARY SCIENCE

Mars probe to hunt quakes

NASA's InSight mission will listen for seismic activity to uncover details of the red planet's mysterious core.

BY ALEXANDRA WITZE

A planetary stethoscope will soon be on its way to listen to Mars's heartbeat.

On 5 May, NASA plans to launch its US$994-million InSight spacecraft from Vandenberg Air Force Base in California. The mission's main job will be to place a seismometer on the Martian surface and listen to seismic waves pinging around the planet's interior.

If the effort succeeds, it will mark the first unequivocal detection of tremors known as marsquakes — and explain long-standing mysteries about the planet's inner structure and how it evolved. "There are all these questions about Mars that can only be answered with seismic data," says Bruce Banerdt, a geophysicist at NASA's Jet Propulsion Laboratory in Pasadena, California, and the mission's principal investigator.

"It will be the first geophysical observatory on Mars," adds Ana-Catalina Plesa, a planetary geophysicist at the German Aerospace Center (DLR) in Berlin. "We are all really excited."

On Earth, seismologists use measuring stations scattered around the world to detect seismic waves from distant earthquakes. By tracking how that energy bounces around the planet's interior, researchers can calculate information such as the size of Earth's core.

But no one has yet done this on Mars. NASA tried unsuccessfully with its Viking landers, which launched in 1975. Viking 1 failed to deploy its seismometer. And although the Viking 2 instrument gathered about 2,100 hours of data, all the tremors it detected, with one possible exception[1], were caused by gusts of wind shaking the spacecraft. The seismometer had been mounted on top of the lander rather than in direct contact with Mars's surface.

After InSight lands, it will plop its watermelon-sized seismometer — built by the ▶

French space agency CNES — onto the Martian ground. The instrument will nestle beneath a protective wind shield as its three delicate pendulums measure even tiny tremors. "It is pretty much the most sensitive seismometer that's ever been built," says Renee Weber, a planetary scientist at NASA's Marshall Space Flight Center in Huntsville, Alabama.

MARTIAN MYSTERY

The big question is how many marsquakes it will capture. With no actual data on Martian seismicity, researchers have used maps of geological faults on the planet's surface[2], along with calculations of how its interior has cooled over time[3], to estimate that Mars probably has fewer quakes than Earth but more than the Moon. (Tectonic fractures and Earth's tidal pull trigger moonquakes.)

InSight will land in Elysium Planitia, a safe, flat and geologically boring site near the Martian equator[4]. There, it might measure one local marsquake each year between magnitude 2.7 and 4.2, says Weber. It could also detect bigger marsquakes from regions much farther away, such as the fault-riddled Cerberus Fossae. "Our goal is to collect something like 30 quakes over the mission," says Philippe Lognonné, a geophysicist at the Paris Institute of Earth Physics who leads the seismometer team.

The bigger the marsquake, the more it will reveal about the planet's interior, because only the largest seismic events penetrate all the way to the core. InSight might see one or two such quakes during the two Earth years that NASA hopes to operate the mission.

Marsquake data will help InSight to map the boundaries between Mars's crust, mantle and core. That could reveal the depth to which the planet's primordial magma ocean once churned, and whether Mars ever had anything resembling plate tectonics. Pinning down the size of the Martian core, thought to be roughly half as big as Earth's, would reveal its density and composition[5]. Mars's internal layers represent a record of its first tens of millions of years, says Banerdt. And studying its interior might help to reveal the early history of Earth, which probably went through similar changes soon after it formed.

Meanwhile, a radio-science experiment on InSight will measure how Mars wobbles on its axis, as a way to further understand the core's size. And a heat-flow probe, built by a team at the DLR, will penetrate up to 5 metres beneath the surface to measure how temperature changes with depth and time.

The plan is to land InSight on Mars on 26 November. For Lognonné, who has been trying to get a seismometer to Mars for more than two decades, that day can't come soon enough.

"I'll be much more happy when I get the first data," he says. ■

1. Lorenz, R. D., Nakamura, Y. & Murphy, J. R. *Earth Space Sci.* **4**, 681–688 (2017).
2. Knapmeyer, M. *et al. J. Geophys. Res.* **111**, E11006 (2006).
3. Plesa, A.-C. *et al. Geophys. Res. Lett.* **45**, 2580–2589 (2018).
4. Golombek, M. *et al. Space Sci. Rev.* **211**, 5–95 (2017).
5. Hellfrich, G. *Prog. Earth Planet. Sci.* **4**, 24 (2017).

PUBLIC HEALTH

Trial helps African children

Pre-emptive antibiotic treatment reduces deaths in at-risk kids, but raises fears about the development of drug resistance.

BY AMY MAXMEN

To stem the rise in antibiotic resistance, researchers recommend that people take these drugs only after they are diagnosed with a bacterial infection. But a trial involving nearly 200,000 children in Niger, Tanzania and Malawi went against that guidance in an attempt to save youngsters in regions where as many as one in ten die before their fifth birthday.

The results, published on 25 April in *The New England Journal of Medicine*, suggest that widespread distribution of antibiotics could prevent thousands of deaths (J. D. Keenan *et al. N. Engl. J. Med.* https://doi.org/10.1056/NEJMoa1715474; 2018). But health officials and researchers are wary of starting a massive drug programme on the basis of the results because it would drive antibiotic resistance.

"It goes against dogma at the moment because everyone else is trying to reduce antibiotic use," says Per Ashorn, who specializes in paediatric infectious diseases at the World Health Organization (WHO). The study's results are exciting, he says, but the WHO needs more data to evaluate the approach.

Some officials sound more enthusiastic about the strategy. "As a person who was born in one of the poorest countries in the world, I welcome this," says Samba Sow, the health minister in Mali, where 11% of children die before the age of 5. "My older brother died as a child, more than one of my cousins died as a child — children die here, and they die fast."

Mass drug administration fell out of favour in the late 1960s, after programmes to prevent malaria through the large-scale distribution of a drug called chloroquine backfired. Resistance developed rapidly because thousands of people with insufficient levels of chloroquine in their systems became infected with malaria parasites. Strains that were susceptible to the drug died, but more-resilient ones multiplied. Eventually, chloroquine stopped working.

But opinions on mass drug administration seem to be changing. Since 2012, several African countries have reduced deaths from malaria by pre-emptively treating millions of children during the rainy season. And the WHO now recommends the distribution of some antibiotics to certain populations impacted by neglected

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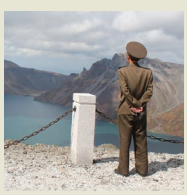

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