MARS INVASION

Three spacecraft heading to the red planet this year will send back an unprecedented stream of information about the alien world.

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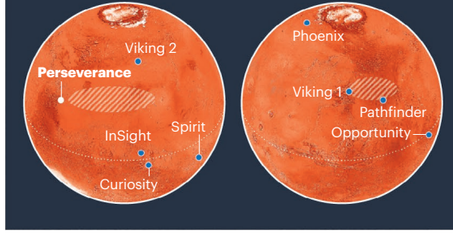
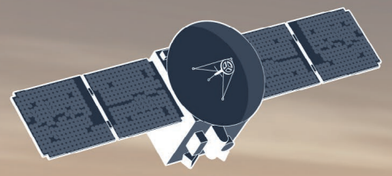
Design by Jasiek Krzysztofiak

Never before will such a diverse array of scientific gear have arrived at a foreign planet at the same time, and with such broad ambitions. Missions from China, the United States and the United Arab Emirates (UAE) will include two orbiters, two rovers, a stationary surface laboratory and even a helicopter. They aim to study everything from Mars's buried water deposits to the top of its atmosphere, with a particular focus on the search for life.

Landing sites

A US rover called Perseverance will land in Jezero Crater, near a delta formed by an ancient river — a prime location for finding signs of past life if it existed. China is considering several landing sites for its Tianwen-1 mission.



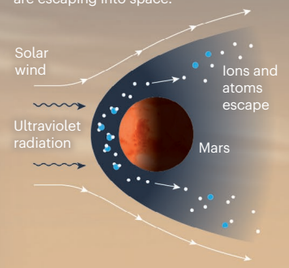


HOPE

The UAE mission will travel around Mars in an elliptical orbit ranging from about 22,000 to 44,000 kilometres. It carries two spectrometers and a high-resolution imager to capture information about how the atmosphere changes over the day and throughout the seasons.

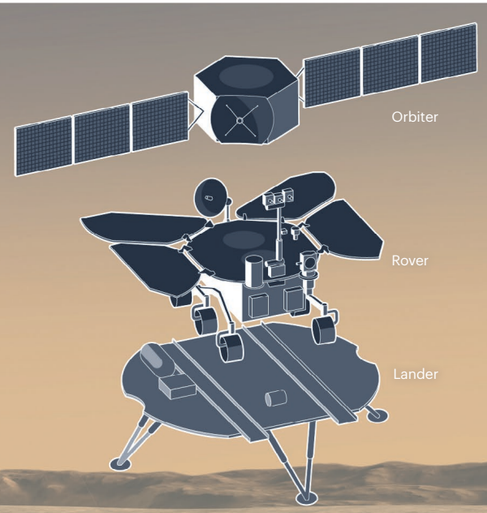
The escaping atmosphere

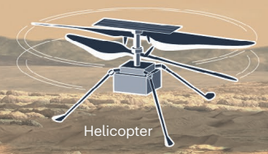
Mars once had a thick atmosphere and a significant amount of liquid water on the surface, but much of the atmosphere has leaked away over billions of years. Hope will assess how oxygen and hydrogen atoms and ions are escaping into space.

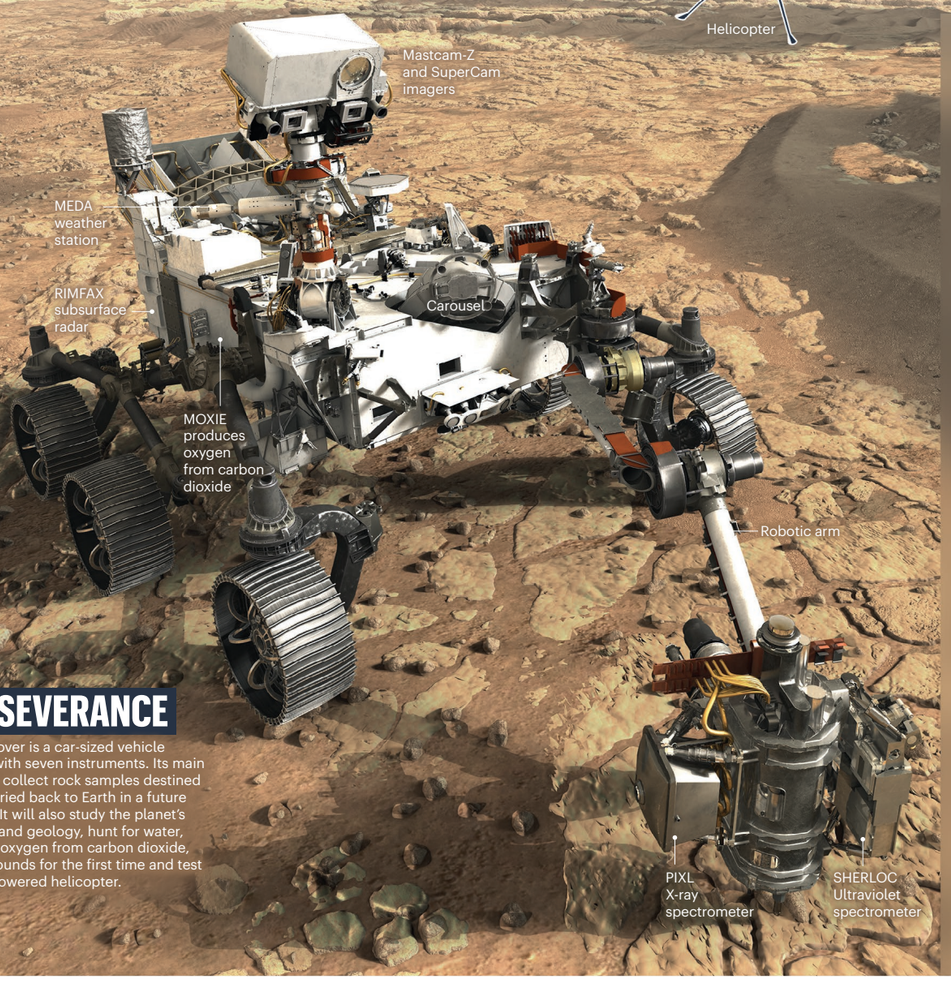


TIANWEN-1

China's pioneering mission to Mars will carry an orbiter, rover and lander — it would be the first nation to achieve all three. Both the rover and orbiter have radar instruments for spotting water and ice on the surface and underground. They will also study the planet's geology and weather.







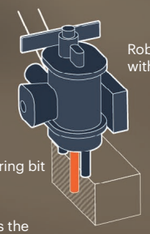
PERSEVERANCE

The US rover is a car-sized vehicle packed with seven instruments. Its main task is to collect rock samples destined to be carried back to Earth in a future mission. It will also study the planet's weather and geology, hunt for water, produce oxygen from carbon dioxide, record sounds for the first time and test a solar-powered helicopter.

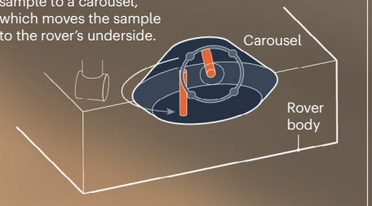
The robot geologist

Perseverance carries 43 tubes to hold rock samples collected and stored by a series of 3 robots. When the samples are eventually returned to Earth, they could provide the first definitive evidence of whether life once existed on Mars.

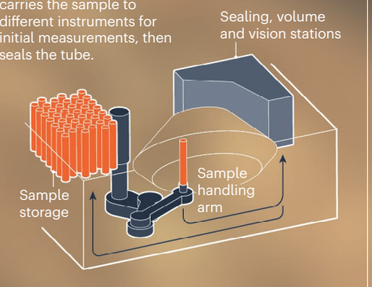
1 The 2.1-metre-long robot arm drills a thin sample of rock.



2 The arm delivers the sample to a carousel, which moves the sample to the rover's underside.



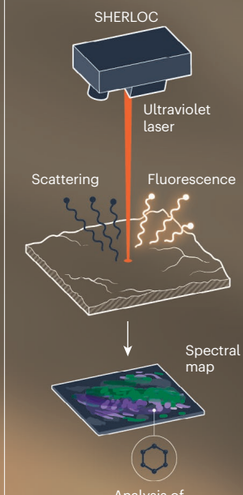
3 A second robotic arm carries the sample to different instruments for initial measurements, then seals the tube.



4 A future mission will aim to retrieve the cached samples and send them back to Earth.

Search for life

Perseverance has several instruments that will hunt for evidence of life. One of those is SHERLOC, which illuminates rocks with an ultraviolet laser and records spectra of the luminescence and reflectance. It can identify the signal of organic molecules and minerals that formed in watery environments.



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Historical Mars missions