Three countries are due to reach Mars in the next two weeks

A small fleet of spacecraft from the United Arab Emirates, China, and the United States will reach Mars this month after launching from Earth last year. The march to the Red Planet marks a marathon of firsts: it's the UAE's first foray into deep space, China's first independent attempt to land on Mars, and NASA's first shot at deploying a Martian helicopter.

The rare convoy of Mars-bound spacecraft launched off Earth in a slim, roughly two-month window last summer when Earth and Mars lined up just right in their orbits around the Sun. This planetary alignment only happens once every two years, and three countries took advantage of it in 2020, just as outer space reemerged as a playground for scientific discovery and displays of national power.

"These governments do these missions for the sake of exploration," Bill Nye, CEO of the Planetary Society (and famously, The Science Guy), told *The Verge*. "As we like to say, there is no business case for exploring the Martian regolith."

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"However, it leads to this extraordinary workforce development in these countries, and this national pride and sense of community that's priceless," he said.

First in line to reach Mars this month is the Emirati Hope orbiter. After launching seven months ago on a Japanese H-IIA rocket, the car-sized Hope probe will arrive in Mars' orbit on February 9th. It will spend nearly two years surveying the

planet’s atmosphere to study daily changes in Martian weather. It puts the UAE on track to be the first Arab nation to deploy an interplanetary probe and join a small group of spacefaring countries that have done the same.

“For the science community, it’s where things start,” Sarah al-Amiri, the deputy project manager for the Emirates Mars Mission, said of Hope’s injection into Mars orbit in an interview. The week Hope reaches Mars orbit, UAE researchers will begin to analyze their first trove of interplanetary data, al-Amiri said.

For about six years, Hope’s mission team of roughly 450 people have been designing and testing the Hope spacecraft. The program has a $200 million budget from the Mohammed bin Rashid Space Centre and has been working with teams at the University of Colorado Boulder, Arizona State University, and the University of California, Berkeley.

As the UAE looks to wean itself off oil dependence, the Hope mission presents a broader opportunity for the country. It’s a chance to figure out how to start a new industry from scratch. “When we say, for example, we’re going to establish a new sector in biotech, how do you go about doing that? This mission provided us a mechanism to go about doing that when we haven’t had it before,” al-Amiri said.

Trailing behind the UAE’s Hope probe is China’s Tianwen-1 spacecraft, which will reach Mars a day later on February 10th. The five-ton spacecraft will hang out in Martian orbit to survey the Utopia Planitia region, where a large deposit of water ice lies beneath the planet’s surface. Three months later, in May, Tianwen-1 will deploy a lander and rover bundled together for a landing at Utopia Planitia — a daring attempt to become the second country to land and operate a rover on the Martian surface.

The first image of Mars captured by China's Tianwen-1 probe on February 5th, 2021.
Photo: China National Space Administration
Tianwen-1 translates to "questions to heaven" or "questioning the heavens." The rover carries a suite of instruments to detect deposits of subsurface water ice, which scientists believe could hold signs of microbial life. By observing Mars from orbit and deploying both a lander and a rover, the mission "will become the world's first Mars expedition accomplishing all three goals with one probe," Ye Peijian, a top scientist at the China Academy of Space Technology, said in a statement.

Later this month, China's Tianwen-1 rover will get some company on the planet's surface. NASA's Perseverance rover, nicknamed "Percy," will touch down on February 18th at the Jezero Crater, the site of an ancient river delta believed to bear traces of past life. Its touchdown location is some 1,600 miles away from China's rover (about the distance between Miami and upstate New York). It's NASA's ninth mission to the Martian surface. Like any robot destined for a Mars landing, Perseverance will endure the infamous "seven minutes of terror" – a blazing dash through Mars' atmosphere for a fully automated soft landing. To mission managers, it's akin to taking your hands off the steering wheel of a $2.4 billion car.

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In that sliver of time, the spacecraft will need to use a combo of parachutes and four propulsive engines to slow itself down from 12,100 mph at the top of Mars' atmosphere to complete stillness on the Martian surface. A 14-minute communication delay between Mars and Earth means Perseverance's wicked descent to the Jezero Crater – an

unpredictable territory with cliffs, vast sand dunes, and large boulder fields – must be fully automated. By the time mission engineers at NASA's Jet Propulsion Laboratory get word that Perseverance entered Mars' atmosphere at around 3:48PM ET, the rover will have already made it to the surface – or crashed on impact.

"These men and women have invested years – YEARS – of their lives into those seven minutes. It's a big doggone deal," Nye said. "And you don't know what's going on on Mars for those seven minutes."

If all goes well, the compact car-sized Perseverance will use its six wheels to spend at least two years traversing the Jezero Crater, using seven instruments to probe for traces of past or present lifeforms. Those tools include a UV laser to scan for organic compounds, an X-ray spectrometer to analyze the chemical composition of Mars rocks, and two microphones to monitor the rover's health and record the windy ambiance of Mars. The rover will also gather cigar-sized samples of Martian soil for a future sample return mission in the works between NASA and the European Space Agency.

"The Martian equivalent of a Wright Brothers moment"
The most ambitious piece of hardware aboard Perseverance is a box-shaped helicopter called Ingenuity, whose test flight "could result in the Martian equivalent of a Wright Brothers moment," said Thomas Zurbuchen, NASA's associate administrator for the science mission directorate. Deploying from the rover's belly, Ingenuity will attempt to fly in Mars' ultra-thin atmosphere. If it is successful, it may mark the first demonstration of vertical rotorcraft on another world. "If the helicopter succeeds its first flight, the Ingenuity team will attempt up to four other test flights within a 30-Martian-day (31-Earth-day) window," Zurbuchen said.

While each mission has its own individual milestones, the fleet of spacecraft is collectively opening a new era in Mars

exploration. With the arrival of these missions, the hunt for signs of off-world life is in full force. UAE, China, and NASA are all racing to gain a better understanding of a world believed to have held life at some point in the distant past or possibly in the present. With Tianwen-1 analyzing potential subsurface lockers of ancient life, Hope scanning the Martian atmosphere, and Perseverance scooping up dirt samples for retrieval, an answer could come soon, Nye said.

“What are the chances that someday evidence of life will be found there?” Nye said. “Very high.”

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