

# New Scientist

December 18-31, 2021

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### ► Space exploration

# The month of Mars: Three missions to the Red Planet

February was an exceptionally busy month for our planetary neighbour, reports **Leah Crane**

**O**VER the course of just 10 days in February 2021, three missions arrived at Mars.

The first was the United Arab Emirates's Hope orbiter, which entered orbit on 9 February. Hope is the UAE's first interplanetary mission. While some of its systems couldn't be tested on Earth, the entry went smoothly.

"It was a once in a lifetime experience – a terrifying one, exhausting, but a very good one," says Omran Sharaf at the Mohammed Bin Rashid Space Centre in Dubai.

**"These missions are complementing each other, technically or scientifically"**

The next day, China's Tianwen-1 mission joined Hope in orbit. Tianwen-1 is an ambitious mission, with an orbiter, lander and rover. After three months of testing instruments and making sure the landing site was free of obstacles, the orbiter released the lander and the Zhurong rover, which arrived at the surface on 14 May, making China the third country to land a rover on Mars.

"These missions are complementing each other, whether it's technically or scientifically, and they will all help us develop the next round of Mars missions," says Sharaf.

The third to arrive at Mars was NASA's Perseverance rover on 18 February. One of its goals is to collect and set aside samples to be

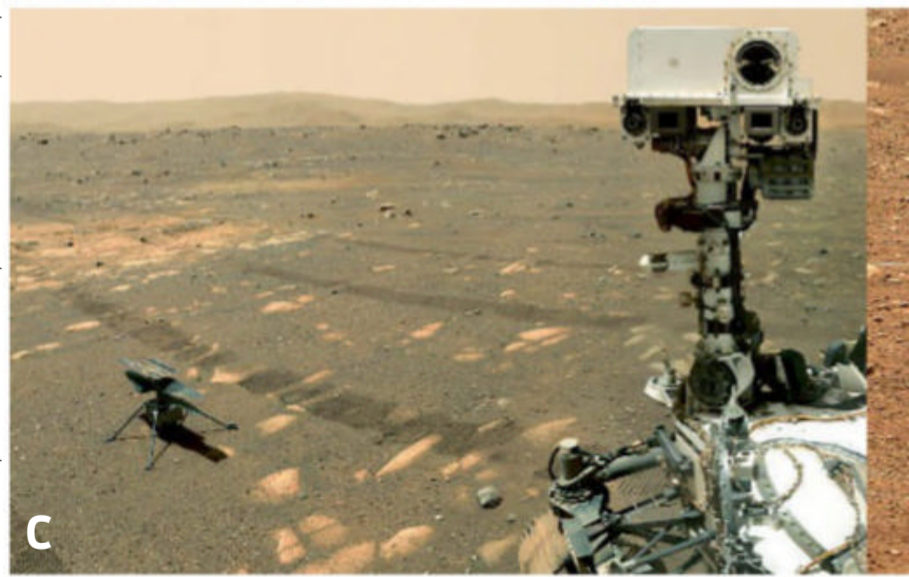
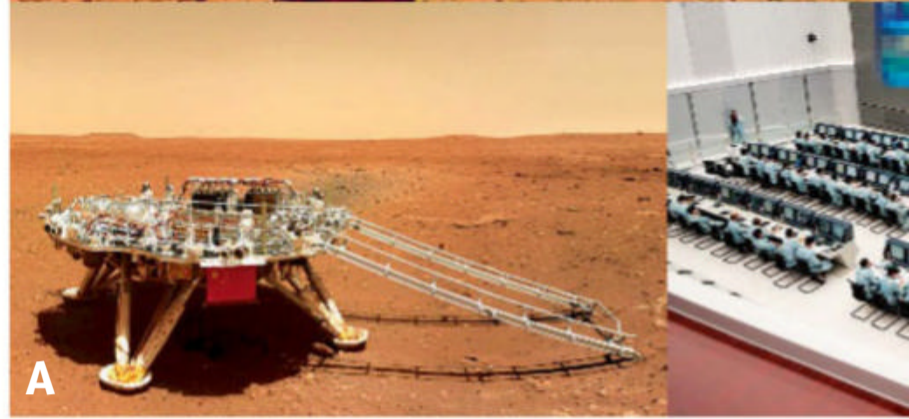
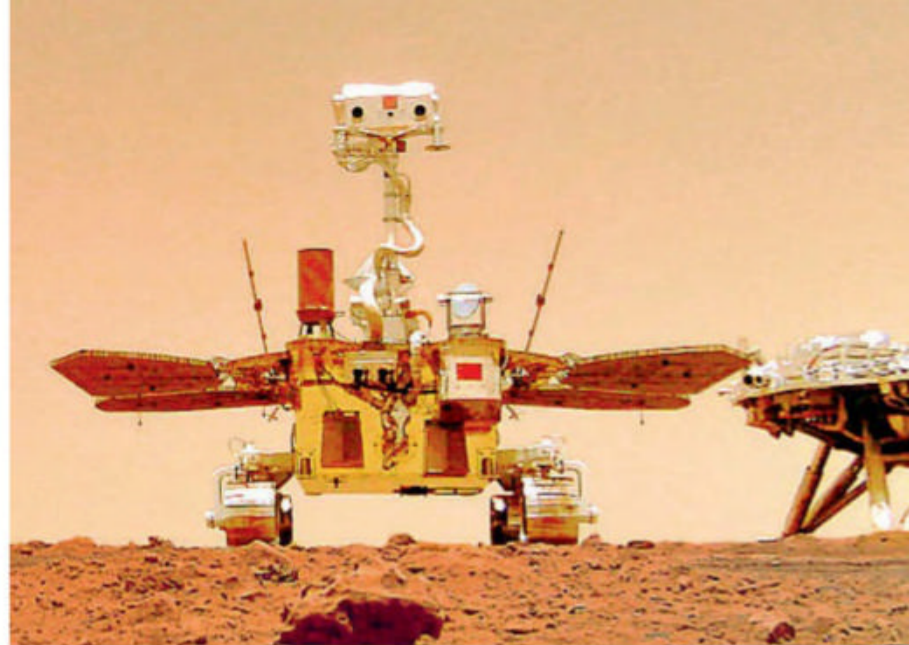
returned to Earth by NASA's next mission to Mars. "Sample return has been a decade away for decades – it's still a decade away, but it's started," says NASA's Ken Farley.

The Perseverance mission also carried the Ingenuity helicopter to Mars, the first drone to fly on another world (see interview, right). It has been remarkably successful – it was originally planned to make five test flights, but it had made 17 by early December, many of which were longer and more complicated than any of the planned tests. "We had orbiters and then landers and then rovers, and now it looks like we can fly as well," says Farley.

Perseverance has found volcanic rocks that appear to have been altered by contact with water, giving us insight into the ancient lake that used to cover its landing site. Zhurong has taken many images of the Martian terrain. Hope has imaged Mars's aurora and seen unexpected structures in the atmosphere.

"While the reasons are not laid down yet as to why we're seeing what we're seeing, it's very exciting," says Hessa Al Matroushi, the Hope mission's science lead.

"At the beginning there's always different puzzle pieces, and as you get more data they start to interlock," says Farley. With all these missions at Mars, the number of puzzle pieces will only increase, each bringing its own set of questions. But as the puzzle grows, our picture of the Red Planet will become clearer. ■



**A: The Tianwen-1 mission. Clockwise from top: The Zhurong rover (left) taking a selfie; Beijing Aerospace Control Centre; Zhurong rover landing platform.**

**B: The Hope mission. The Hope orbiter launch; Illustration of the Hope orbiter.**

**C: The Perseverance mission. The Ingenuity helicopter and the Perseverance rover on Mars; Ingenuity.**





► Interview

## “Nothing will ever top that moment when we announced the flight was successful”

After landing on Mars, Ingenuity became the first vehicle to attempt powered flight on another planet. *New Scientist* speaks to Theodore Tzanetos, the Ingenuity team’s leader

OF ALL the craft that visited the Red Planet this year, perhaps the biggest leap forward was the Ingenuity helicopter. It was shuttled to Mars in NASA’s Perseverance rover and took off on 19 April, making it the first vehicle ever to attempt powered flight on another planet.

The initial flight was a resounding success, as were the four that took place in the following fortnight. After those flights, the small craft was scheduled to end its mission as the rover drove away – but instead it continued to fly. By early December, it had made 17 ever more ambitious jaunts and scouted for Perseverance in the first part of the rover’s mission to explore Mars’s Jezero crater.

Theodore Tzanetos at NASA’s Jet Propulsion Laboratory in California, the leader of the Ingenuity team, told *New Scientist* about the mission’s extraordinary success.

### What was that first flight like for you?

It was exhilarating, in one word. It’s one of those moments in your life when you realise: “Wow, I can’t believe this is really happening and I’m lucky enough to be in this room right now with these people.” Nothing will ever top that moment when we announced the flight was successful.

**I have to say, seeing the shadow of the craft as it took off for the first time was pretty breathtaking, even for someone not involved in the mission.**

The shadows have kind of this mirror reflection effect. It makes



COURTESY NASA/JPL-CALTECH

### Profile

Theodore Tzanetos is the leader of the Ingenuity team at NASA’s Jet Propulsion Laboratory in California

it more real when you see your shadow, like when you see your reflection in the mirror. When you see the blades and the legs and the shadow is projected on the Martian surface, it really brings it home.

### What allowed Ingenuity to outlast its initial mission timeline?

Part of what we will look back on for years to come is that question. We designed it to last 30 sols, or Martian days – we couldn’t afford any extra margin because the air is so thin that we couldn’t carry any additional mass.

That made it difficult to design anything to last on Mars because Mars is very unforgiving – it’s very cold, and the atmosphere is thin. But we’re still running. Eventually, we’ll be able to look back and learn what was the first component to fail, but for now we’re just trying to use the craft as well as we can.

### What has it accomplished so far?

Ingenuity is a technology demonstration. We don’t have a science payload. Our mission was to prove that we can fly – that’s it. We knocked out our first five

flights and we were lucky that the helicopter was still functioning, and we were starting to see a glimmer of the functionality that we could have for a continuing mission.

We were no longer just a technology demonstrator. Then our mission became to continue pushing the limits and learn how to interact with this helicopter on a longer scale, and also to scout for Perseverance. That’s been really rewarding, working with the rover team to figure out what would be the best areas to scout out. That’s something I could have never imagined doing a year ago, when all we cared about was doing our first flight.

### How do you think this concept will be carried forward in future missions now that we know it works?

We have a road map for that and it’s called the Sojourner rover. It was a tech demo [that landed on Mars in 1997], this little rover the size of a microwave, and now we have

**“My dream is to see fleets of spacecraft in the sky on Mars, helping future human explorers”**

Perseverance, which is the size of a car with all of these instruments on it. That’s how I view Ingenuity.

We proved that we can fly, and now we have this ground truth to help us design the future of rotorcraft. My dream is to see fleets of spacecraft in the sky on Mars, potentially helping out future human explorers, but also performing their own science. ■

**Interview by Leah Crane**