

## News in focus

what evidence led the team to some of its conclusions. The findings don't change the existing, widely held view that the virus originated in animals, Nikolai Petrovsky, an immunologist at Flinders University in Adelaide, told the Australian Science Media Centre. And the assessment goes further than expected because it emphasizes the two hypotheses promoted by the Chinese government. He says there is limited evidence – “beyond relatively weak data already in the public domain” – for the idea that early transmission in China was linked to the ‘cold food chain’, the transportation of frozen goods such as meat. However, he acknowledges that the team might have access to information that is not currently public.

Dominic Dwyer, a medical virologist at New South Wales Health Pathology in Sydney, Australia, and a member of the WHO team, says there is some evidence that the coronavirus could have spread on contaminated fish and meat at Chinese markets, and more details will be included in the written report.

### Lab leak unlikely

Another focus of the WHO's investigation was the idea that the virus leaked from a lab – a scenario that the team found unlikely. Peter Ben Embarek, a food-safety and zoonosis scientist with the WHO in Geneva, Switzerland, who headed the investigation, said at the press conference that the team had conducted extensive discussions with staff at the Wuhan Institute of Virology, which has been at the centre of the speculation, and similar labs nearby. He said a leak is unlikely because the virus was not known to scientists before December 2019.

Dwyer says that the team didn't see anything during its visits to suggest a lab accident. “Now, whether we were shown everything? You can never know. The group wasn't designed to go and do a forensic examination of lab practice.”

The investigation provides context and insight into what was happening in Wuhan, says Jason Kindrachuk, a microbiologist at the University of Manitoba in Winnipeg, Canada. But the divide between the theories of a lab leak and natural origins has grown deeper as the pandemic has progressed and become politicized, he says. “This isn't going to put a nail in the coffin for the debate.”

Much of the investigation centred on the early days of the outbreak in Wuhan and tried to pin down the timing of the city's first infections. The team reviewed health records in the city and surrounding Hubei province from the second half of 2019, looking for unusual fluctuations in influenza-like illnesses and severe respiratory infections, pharmacy purchases for cold and cough medications, and deaths specifically related to pneumonia. It also retrospectively tested some 4,500 patient samples for SARS-CoV-2 viral RNA, and analysed blood samples for antibodies against the virus. The researchers found no evidence that the virus

was circulating in the city before late 2019.

But the lack of clear signals of transmission does not mean that the virus wasn't already established in the community, says Dwyer. The team's analysis was based on limited data and a surveillance system not designed to catch a virus that could spread silently. To assess properly whether the virus arrived earlier, researchers would have to track what was happening in the wider community, not just in health facilities, he says.

And although the investigation team threw its weight behind the animal-origin theory, it didn't identify the kinds of animal that could have passed the virus to people. Ben Embarek said that Chinese researchers had tested many domestic, farmed and wild animals in the country but found no evidence that the virus was present in these species.

The WHO team said that investigations in Wuhan and nearby areas should continue, in particular to track down the earliest cases, which could help researchers to understand how the pandemic started. It recommended analysing older samples from blood banks in the province, including using antibody tests that could turn up traces of infection.

The researchers also said that more studies are needed to improve understanding of the possible role of frozen wildlife in viral transmission, and of whether people can be infected through this route. More testing of animals that could act as reservoirs is also needed, and the search should be broadened beyond China, the group said. Scientists say this is justified, given fresh reports of coronaviruses closely related to SARS-CoV-2 being found in bats in Japan, Cambodia and Thailand.

## RELATION AS FIRST ARAB MARS MISSION REACHES ORBIT

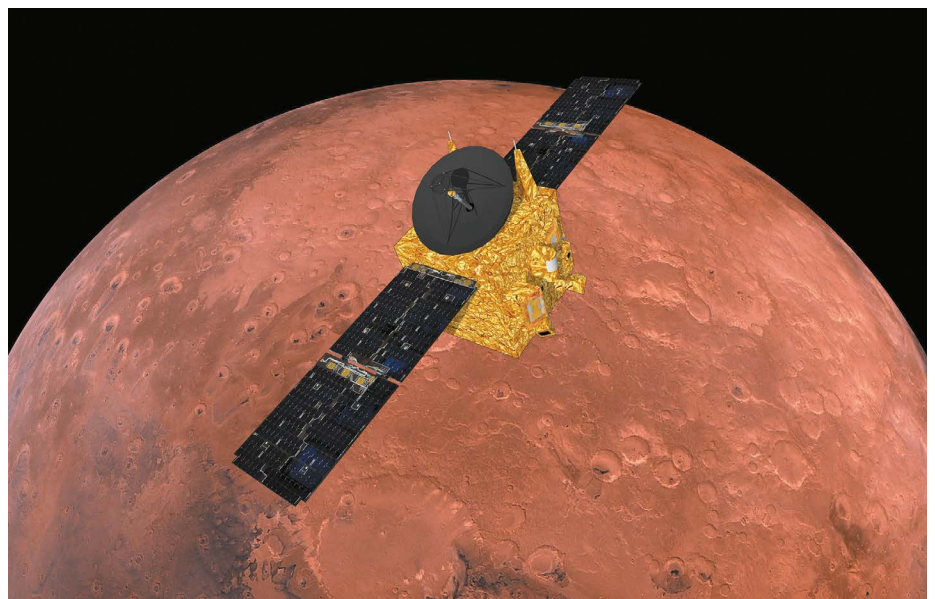
UAE's Hope spacecraft is poised to make pioneering measurements of the Martian atmosphere.

By Elizabeth Gibney

**T**he United Arab Emirates' Hope spacecraft has sent back its first image of Mars, after a 7-month journey to the red planet. It entered Martian orbit on 9 February, making the United Arab

Emirates (UAE) the fifth player to successfully reach Mars, following European, Indian, Russian and US space agencies. Hope is part of the first interplanetary mission by any Arab state.

The US\$200-million probe – called *Amal* in Arabic – was built at the University of Colorado Boulder and at the Mohammed bin



The Hope probe (artist's impression) entered Martian orbit on 9 February 2021.

AXEL MONSE/SHUTTERSTOCK

Rashid Space Centre (MBRSC) in Dubai, by a team of engineers from both institutions and other US partners. Its entry into Martian orbit paves the way for the probe's science mission, during which it will make observations of the planet's atmosphere, across all times and locations.

News of the probe's successful entry into Mars's orbit was greeted by applause in the MBRSC control room. "The past seven years of our lives have revolved around preparing for this moment. And the moment was surreal," says Fatma Lootah, a member of the mission's science team at the MBRSC. "We are very excited for what is yet to come."

With a 27-minute-long burn of its 6 thrusters, the craft slowed from its cruise speed of 121,000 kilometres per hour to around 18,000 kilometres per hour, using up about half of its total fuel supply. To enter orbit after its 494-million-kilometre journey, Hope had to hit a 600-kilometre sweet spot.

It was the "riskiest point" in the project, says Omran Sharaf, project director of the Emirates Mars Mission at the MBRSC.

Engineers were unable to operate Hope remotely from mission control in real time, because signals to the red planet take 11 minutes to travel each way. Instead, the craft acted autonomously, using commands uploaded four days ahead of time. Hope was designed to have "some level of smarts" to cope with surprises during the manoeuvre, says Pete Withnell, programme manager for the mission at the University of Colorado.

### Weather map

The craft is now in an elliptical holding orbit while engineers test and commission its instruments, ready to move into the 'science orbit' from which Hope will begin its mission in earnest in mid-May. This wide, elliptical orbit is what makes the mission special. It will allow Hope's three instruments – a high-resolution imager and infrared and ultraviolet spectrometers – to observe every geographical region of Mars, at every time of day, once every nine days, to create a global map of Martian weather. Such observations have never before been made at Mars.

After processing, the data will be available to the global scientific community without an embargo. The first tranche of data should be released by September, said Sarah Al Amiri, the mission's deputy project manager and science lead, at a briefing ahead of the event. The data will allow researchers to analyse the planet's atmosphere, from dust storms in its lower reaches to its outermost layer, the exosphere from which hydrogen and oxygen escape into space. The data will also help scientists to piece together how activities in the various atmospheric regions influence each other.

Scientists are already analysing data from unplanned, "opportunistic" experiments

during Hope's journey, says Al Amiri. In one, Hope looked across the Solar System at the European Space Agency's BepiColombo spacecraft, which is travelling to Mercury. By observing each other across the same stretch of space, the two craft should have seen the same levels of hydrogen, allowing teams to cross-calibrate their instruments and examine the distribution of hydrogen in the Solar System.

Hope launched from the Tanegashima Space Center near Minamitan, Japan, on 20 July 2020. "This mission has been a bold undertaking by a young nation," says Brett Landin, an engineer at the University of Colorado Boulder, who leads the mission's spacecraft team. "I could not be more thrilled to be a part of this historic endeavour."

The UAE also plans to send a rover to the Moon in 2024.

## ILLEGAL CFC EMISSIONS FALL AFTER SCIENTISTS RAISE ALARM

### Analyses suggest that China has curbed production of an ozone-depleting chemical.

By Jeff Tollefson

**I**llegal emissions of an ozone-destroying chemical once used in refrigerants and foam insulation have almost come to a halt, scientists reported this week, nearly three years after the rogue emissions were first documented. Researchers say the result is a major win for the international treaty that protects the ozone layer.

In May 2018, researchers documented<sup>1</sup> a mysterious spike in atmospheric concentrations of trichlorofluoromethane, or CFC-11, that had begun in around 2013. Production of the chemical had been banned since 2010 under the Montreal Protocol, a legally binding treaty that has been remarkably successful in curbing the use of ozone-depleting substances, so scientists surmised that the sudden increase was probably the result of a new source of illegal emissions. By May 2019, scientists had traced the bulk of the emissions to eastern China<sup>2</sup>. In response to significant international pressure, the country committed to rectifying the problem.

In a pair of studies<sup>3,4</sup> published in *Nature* on 10 February, scientists report that atmospheric concentrations of CFC-11 have dropped precipitously since 2018. Assuming the current trend continues, the damage to the ozone layer from several years of illegal emissions will be negligible, says Stephen Montzka, an atmospheric chemist at the National Oceanic and Atmospheric Administration in Boulder, Colorado, who led one of the studies.

"The treaty did its job," says Durwood Zaelke, president of the Institute for Governance & Sustainable Development, an advocacy group based in Washington DC. "Whoever the offending parties were – including most

definitely China – they got their act together."

China's Ministry of Ecology and Environment did not reply to requests for comment on the latest results and the actions it has taken to halt illegal CFC-11 emissions. The sources of illegal emissions outside China are unknown.

CFC-11 survives in the atmosphere for about 50 years, so, if sources were completely eliminated, global emissions should decline by around 2% annually. But the actual rate is slower, owing to continued emissions from old refrigeration systems and from insulating foam exposed when buildings are demolished. Between 2002 and 2012, CFC-11 emissions fell by around 0.85% a year. But that rate halved – to about 0.4% – after 2013, a sign that around 13,000 tonnes of new CFCs were being pumped into the atmosphere each year, Montzka's team calculated in 2018.

The analysis published last week, using data from two independent global air-monitoring networks, indicates that concentrations of CFC-11 were dropping by about 1% a year by late 2019 – the fastest pace on record<sup>3</sup>.

In a second paper<sup>4</sup>, Montzka and his colleagues used data from air-monitoring stations in South Korea and Japan, along with detailed atmospheric-transport modelling, to show that the rogue emissions from the largest source – in eastern China – have stopped. The study results were consistent across analyses from four research groups and two models, says co-author Luke Western, an atmospheric scientist at the University of Bristol, UK.

1. Montzka, S. A. *et al. Nature* **557**, 413–417 (2018).

2. Rigby, M. *et al. Nature* **569**, 546–550 (2019).

3. Montzka, S. A. *et al. Nature* <https://doi.org/10.1038/s41586-021-03260-5> (2021).

4. Park, S. *et al. Nature* <https://doi.org/10.1038/s41586-021-03277-w> (2021).