and supplies are the second-largest expense for his research, after paying wages. Lapen says that his costs are likely to increase because the US tariff list includes equipment or parts his team needs, such as electrical motors that drive centrifuges.

Priscilla Cushman, a dark-matter physicist at the University of Minnesota in Minneapolis, says that research deans at US universities should be scrutinizing the list to see whether the taxes will affect their facilities.

SCIENCE SQUEEZE

The tariffs could also cause havoc for large-scale experiments, such as the ADMX dark-matter detector at the University of Washington in Seattle, which is under construction. The project's lead scientist, physicist Leslie Rosenberg, is worried that the equipment his team needs to build experiments — such as tools for power generation and distribution, and machinery that has Chinese electrical components — could be subject to the latest tariffs. "Anyone can see the tariff list, but an official must determine whether any particular procurement falls under the tariff," he says.

Rosenberg thinks that the United States' overall research capability will probably decline under the tariffs.

But other researchers aren't worried. Roberto Refinetti, a biopsychologist who studies biological clocks at Boise State University in Idaho, uses some small Chinese-manufactured equipment for his work, such as infrared motion detectors for monitoring rodents. He doesn't think that the tariffs on Chinese goods will significantly increase the cost of his research, because he purchases that type of equipment infrequently.

The White House and the Office of the United States Trade Representative did not respond to *Nature*'s request for comment on researchers' concerns.

In China, the tariff dispute could increase the cost of standard reagents used in laboratory and medical devices that scientists import from the United States. Ruibang Luo, a bioinformatician at the University of Hong Kong who collaborates with researchers on the mainland, says that if the Chinese government interprets some tariff items literally, the taxes could apply to a broad range of US-made reagents and research devices, including some DNA sequencers.

But Yu Zhou, a researcher at Vassar College in Poughkeepsie, New York, who studies science and technology development in China, says that the tariffs would not have a significant effect on research projects and experiments in China. She says that is because some universities have large enough budgets to absorb increased costs. Researchers could also share more equipment than they do now, or use goods made domestically and from countries other than the United States.

Brian Xu, a toxicologist for the scientific consulting firm ACTA in Washington DC, which works with businesses in China, agrees that China's proposal to place tariffs on US chemicals and scientific equipment is unlikely to have a major effect on Chinese research. He notes that scientists there import only a small amount of US-made chemicals, and that infrequently replaced scientific equipment from other countries, such as Japan and Germany, is of comparable quality and cost.

But the latest round of tariffs might not be the last. On 18 June, Trump threatened to impose additional tariffs on Chinese goods if the country does not rescind its tariffs and create a more balanced trade relationship with the United States. ■

SPACE

Japanese mission reaches unexplored asteroid Ryugu

Hayabusa-2 will release four landing probes before touching down to collect samples.

BY DAVIDE CASTELVECCHI

After travelling for three and a half years, the Japanese spacecraft Hayabusa-2 this week makes its final approach to the asteroid Ryugu. The probe will release landers on the space rock's surface later this year and bring a precious sample back to terrestrial labs in 2020. It is already giving planetary scientists their closest-ever view of a mysterious kind of asteroid.

The Japan Aerospace Exploration Agency (JAXA) last week released grainy pictures from a distance of around 300 kilometres away, revealing that Ryugu — an asteroid of a common but little-studied type — looks similar to a spinning top.

This week, a much more detailed picture, from 40 kilometres away, showed a surface strewn with large boulders. Hayabusa-2 will continue to inch towards the asteroid until it is about 10 kilometres away, which JAXA expects will happen around 27 June. Ryugu's orbit cuts between those of Earth and Mars.

"From a distance, Ryugu initially appeared round, then gradually turned into a square before becoming a beautiful shape similar to fluorite, known as the 'firefly stone' in Japanese," project manager Yuichi Tsuda said in a 25 June statement.

Launched in December 2014, the probe is a follow-up to — and near-clone of — Hayabusa, which explored the asteroid Itokawa starting in 2005. Hayabusa was the first mission to return an asteroid sample to Earth. Ryugu is about 1 kilometre across — around 3 times wider than Itokawa but one-quarter the size of the comet 67P/Churyumov–Gerasimenko, which the European Space Agency's Rosetta probe visited between 2014 and 2016.

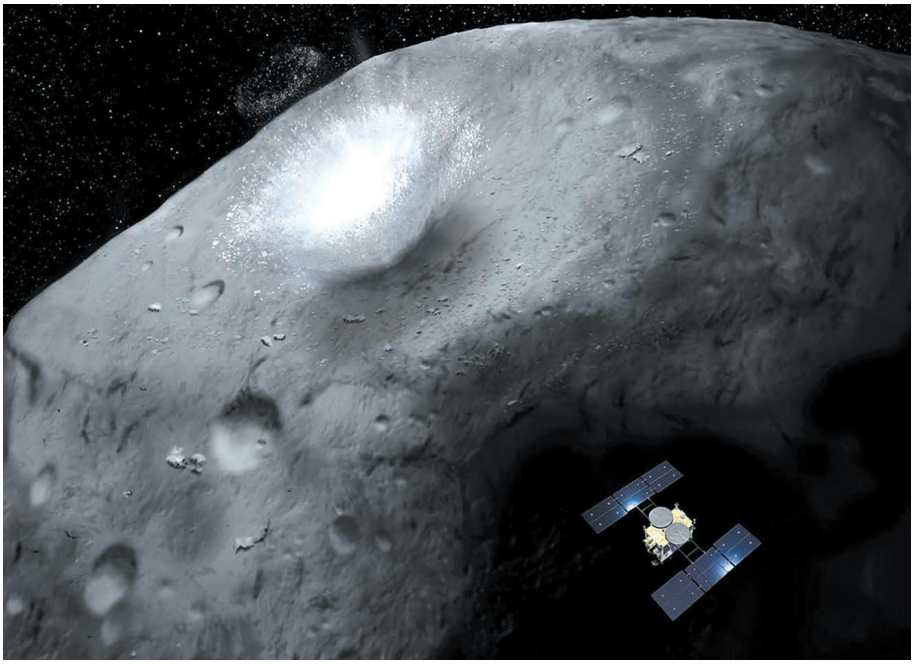
"Ryugu initially appeared round, before becoming a beautiful shape similar to fluorite."

Ryugu is a 'C-type' asteroid, which has a darker surface than does Itokawa. In 1997, a NASA mission called NEAR Shoemaker made a fly-by of a C-type asteroid from a distance of more than 1,000 kilometres. Hayabusa-2 is the only spacecraft to have come this close to a C-type asteroid, says Lucy McFadden, a planetary scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

"We don't know much about C-type asteroids," says McFadden. But they are expected to have a composition similar to that of the early Solar System. In particular, Hayabusa-2 will determine whether the darkness of Ryugu's surface is due to it being rich in carbon — as is often assumed — or to small, metallic particles such as magnetite.

Chemical and isotopic analyses of the rock — to be done in space by Hayabusa-2's landers and then in terrestrial labs — could help to explain the origins of Earth and, particularly, its water. Many researchers think that Earth's oceans formed from a bombardment of water-rich asteroids or comets.

Among the first measurements Hayabusa-2 made was one of Ryugu's rotational period, or time it takes to make one turn on its own ▶



JAXA

An artist's impression of Hayabusa-2.

axis, which is about 7.5 hours. This is good news, because a much faster rotation could have made it harder to approach the surface, says mission manager Makoto Yoshikawa of JAXA's Institute of Space and Astronautical Science in Sagamihara. But its shape was surprising, he says, because it has a bulge around the equator, something that is usually associated with much faster-spinning objects, Yoshikawa adds.

Hayabusa-2's most important task right now is to pinpoint its own position using laser ranging so that it can manoeuvre accordingly. "We want to know the exact distance of the spacecraft to the asteroid," Yoshikawa says. Also crucial is to map the asteroid surface using its on-board camera and infrared spectrometer. Temperature variations will hint at the composition of the surface. All of these data will be crucial for deciding where to release MASCOT, the shoebox-sized lander that will probe the asteroid, and the three other small probes carried by the mothership.

"We will use the information we get from the mother spacecraft to do landing-site selection," says MASCOT payload manager Stephan Ulamec of the German Aerospace Center in Cologne. Ulamec was also project manager for Philae, a probe that Rosetta released onto the surface of 67P/Churyumov–Gerasimenko. That approach took several hours because Rosetta was orbiting the comet and Philae had to spiral down to its surface.

Hayabusa-2 will simply hover over Ryugu — using its own gentle ion engines to counteract the asteroid's gravitational attraction — and release MASCOT straight down. Some time in October, the lander will make a soft touchdown. After MASCOT settles on the surface, an internal mechanism will straighten the lander up so it can use its on-board instruments and communicate with Hayabusa-2.

MASCOT carries no solar panels and its batteries are expected to last only a few hours. The team will meet in Toulouse, France, in mid-August to make the final selection for the landing site of MASCOT and its companions.

Meanwhile, Hayabusa-2 will make its own, brief soft landings to collect samples of the asteroid's surface. Then, in late 2019, it will head back to Earth, a journey expected to last a year. Compared to the more daring manoeuvres to reach the asteroid's surface, the current part of the mission is relatively low risk, says Yoshikawa. But as the craft approaches Ryugu, his team has already kicked into high gear, he adds: "I do not have much time for sleep." ■

CLIMATE CHANGE

Methane leaks from US gas fields dwarf official estimates

Latest study suggests that emissions could be coming from faulty equipment.

BY GIORGIA GUGLIELMI

Methane leaks from the US oil and gas industry are 60% greater than official estimates, according to an analysis of previously reported data and new airborne measurements.

Because methane is a potent greenhouse gas, scientists say that the unaccounted-for emissions could have significant impacts on the climate.

The analysis[1], published on 21 June in *Science*, is one of the most comprehensive looks yet at methane output from US oil and gas production, and reinforces previous studies that suggested emissions outpaced government estimates. That research prompted the government to develop regulations that would restrict methane emissions from oil and gas production — rules that US President Donald Trump is now attempting to roll back.

The latest study shows that the US oil and gas supply chain emits about 13 million tonnes of methane, the main component of natural gas, every year. That's much higher than the US Environmental Protection Agency (EPA) estimate of about 8 million tonnes.

This discrepancy probably stems from the fact that the EPA's emissions surveys miss potential sources of methane leaks, such as faulty equipment at oil and gas facilities, says study leader Ramón Alvarez, an atmospheric chemist at the Environmental Defense Fund, a non-profit group in Austin, Texas.

Methane warms the planet 80 times as much as carbon dioxide does over the first 20 years after it is released. And atmospheric methane contributes to about 25% of global warming, Alvarez says. "That's a significant amount."

If left unchecked, he says, methane emissions from the oil and gas industry could erode the potential climate benefits of using natural gas, which releases much less CO_2 and other toxic pollutants than coal does when it is burned.

The latest study comes one year after the EPA announced a delay of the rule that would restrict methane emissions produced by oil and gas drilling operations. The policy,