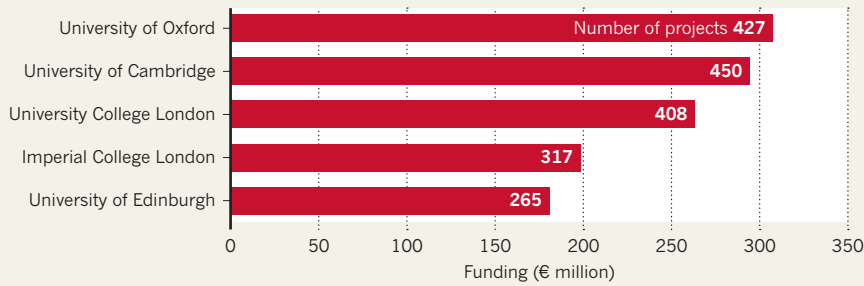


BREXIT'S HIGH STAKES

Many UK universities stand to lose tens of millions of euros in research funding from EU framework programmes. These are the top five UK universities in terms of income from the Horizon 2020 programme.



► recipients of grants from the European Research Council must spend at least 50% of their time at a host institute in the EU or associated country. So, continental outposts could help UK researchers to continue to access those grants, even if their country ceases to officially receive them.

Palmowski says that stable alliances with continental partners might also help UK universities to safeguard EU-funded research collaborations and student exchanges. The idea that fruitful research relations built over decades might go to pieces is “dismaying and heartbreaking”, says James Conroy, vice-principal for internationalization at the University of Glasgow, which hopes to establish such partnerships.

OXFORD AND BERLIN

Of several alliances launched in recent months, a partnership between the University of Oxford and four institutions in Berlin is so far the most comprehensive. Established at the end of 2017, the Oxford–Berlin Research Partnership is mainly financed by the Berlin state government and private sponsors. This year, the alliance launched a pilot call for

proposals and made €10,000–30,000 available in seed grants, with the intention of raising additional third-party funding. Any faculty members of the five institutes can apply. A second call is to be announced next month. Crucially, the partnership will serve as Oxford's legal entity in Germany, and will provide an administrative office at the university clinic Charité in Berlin for visiting researchers. That means, at least in theory, that some Oxford-based researchers might be able to access EU funding. Berlin has also promised to provide space for visiting Oxford scholars in its Natural History Museum.

The likely cost of running the partnership will be around €800,000 a year, says Alastair Buchan, a pro-vice-chancellor and head of Brexit strategy at Oxford and director of the university's Berlin office. And he estimates that this will further enable many millions of euros of research projects and activity. “We're finally doing what we should have done since the day the UK joined the EU in 1973,” says Buchan. “We took the freedom to collaborate without restrictions for granted. It was only when the Brexit referendum came along that we began to realize

that we must insure against the future.”

Oxford and Berlin will both benefit from the partnership, says Steffen Krach, state secretary for higher education and research in the Berlin state government. “Obviously, future access to EU funding for joint research is part of the motivation for Oxford to set up shop here, and quite legitimately so,” he says. “But we can also learn a lot from Oxford and their success in scouting international talent. Science in Berlin will doubtless benefit in terms of research output and reputation from lively exchange with one of the best universities in the world.”

ACADEMIC ALLIANCES

A host of other similar partnerships are at various stages of development. Institutions involved include the University of Warwick and Northumbria University in Newcastle, as well as the University of Glasgow. Last month, Imperial College London announced an expansion of its long-standing research-and-education partnership with the Technical University of Munich in Germany. “We're naturally interested in any mechanism that allows us to continue fruitful collaborations we have established with European partners over the decades,” says Maggie Dallman, vice-president of Imperial College.

EU funding is one way of easing collaboration, but any mechanism to keep doors open in science must be transparent, says Dallman. “We are not seeking to find opaque backdoor routes to getting European funding,” she says. “It's ultimately all about doing more research of a higher quality with an outstanding partner.”

Conroy says: “Brexit will not leave UK universities unaffected, but we managed to live through turmoil before.” He adds: “No matter how difficult the political crisis is, we will see to it that our faculty and students, and society at large, continue to get the best possible scholarship and science.” ■

PLANETARY SCIENCE

Mars scientists push for ‘mega-mission’

Experts want NASA's next rover to harvest rock at two sites.

BY ALEXANDRA WITZE

NASA's next Mars rover — the first to gather rock samples meant to come back to Earth — should dream big and visit as many places on the red planet as possible, scientists concluded on 18 October.

The rover's stops would probably include some combination of Jezero crater, once home to river deltas and a lake; Northeast Syrtis,

which contains some of the most ancient rocks on Mars; and Midway, a compromise option located between the two (see ‘Road Trip’). Project scientists have proposed visiting both Jezero, for the river and lake sediments that might retain signs of past life, and Midway, for the ancient rocks. The two are about 28 kilometres apart — so visiting both would be ambitious but achievable.

“The community prefers a mega-mission,”

says Bethany Ehlmann, a planetary scientist at the California Institute of Technology in Pasadena. “If we're going to do sample return, it has to be a sample cache for the ages.”

The Columbia Hills region, which NASA's Spirit rover explored between 2004 and 2011, ranked much lower in the scientists' poll despite having silica deposits similar to those formed by hot springs. “Everybody sort of thought we should go to a new place,” says Matthew Golombek, a Mars scientist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena.

The decision about where to send the 2020 rover ultimately rests with NASA's science chief, Thomas Zurbuchen, who will choose in the coming months. “I would be excited about any sample back,” says Meenakshi Wadhwa, a planetary scientist at Arizona State University in Tempe. “But we have the luxury of being able to choose between good sites.”

SOURCE: NASA/JPL

Slated to launch in July 2020, the US\$2.4-billion rover will be the first from any nation to collect Mars rocks and stash them for a future mission that would bring them back to Earth. The geology of the landing site has to be intriguing enough — and the potential for scientific discoveries there great enough — to make the mission worth the investment.

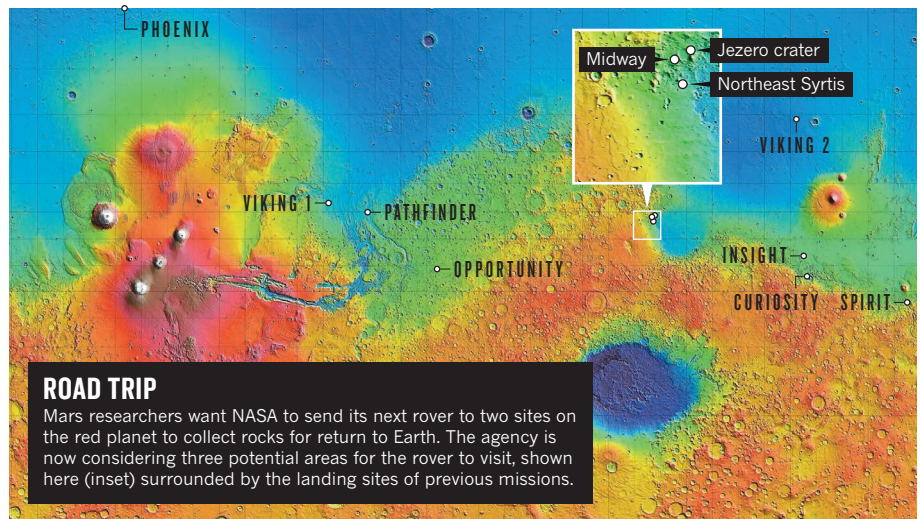
NASA has not planned how it would retrieve the rocks collected by the 2020 rover. But the agency gathered Mars experts in Glendale, California, from 16 to 18 October to hash out the merits of four finalists for the landing site.

Jezero, Northeast Syrtis and Midway came remarkably close to one another in votes by 169 scientists at the workshop. The researchers ranked the sites using several criteria, such as the potential of samples collected at each site to answer crucial scientific questions about Mars.

The idea of visiting Jezero and then Midway — or the other way around — emerged in the past year as mission scientists debated how to get the most out of the rover's journey. "It is ambitious as heck," says John Mustard, a planetary scientist at Brown University in Providence, Rhode Island. Midway's ancient rocks are similar to those at Northeast Syrtis and near the rivers-and-lake system at Jezero.

Sending a rover to Jezero and Midway would mean gambling that the vehicle would last long enough to reach both sites. Its primary mission is 1.25 Mars years (2.35 Earth years); during that time, it is expected to travel roughly 15 kilometres. That would get the rover around most of the Jezero site, if it started there, and possibly even to the crater's rim. But it would then face a trek across dunes to Midway.

NASA's Curiosity rover, the agency's biggest and most powerful so far, has travelled more than 19 kilometres since it landed on Mars in 2012. The engineers developing the 2020 rover



expect it to be able to travel faster than Curiosity, in part because of new technology that improves its ability to navigate on its own.

One major question is how many rock samples the rover will collect, and from where. The 2020 rover is equipped with 42 sample tubes, 5 of which will be reserved as spares. That leaves 37 tubes to be filled with the most precious extraterrestrial rocks ever collected.

"Sooner or later, somebody is going to have to decide whether these samples are worth bringing back," project scientist Ken Farley, of JPL, told the meeting. "I don't want to fail because we have not been ambitious enough."

At the workshop, project scientists laid out options for what might fill those 37 tubes. These include chunks of lake deposits from Jezero, fragments of enormous blocks of rock at the crater rim there and samples of the ancient rocks at Midway. The nuclear-powered rover has several possible paths by which

to navigate the 28 kilometres of dune fields between Jezero and Midway. Driving that distance would take an estimated 401 Martian days, says deputy project scientist Katie Stack Morgan at JPL.

Still unknown is where the rover might stash its precious samples. One possibility is that it could collect two similar sets of samples at Jezero, depositing one there and carrying the other on to Midway, Farley told the meeting. That would leave open the possibility of retrieving the samples at Jezero if something went wrong with the rover on its way to Midway. Other researchers back a Midway-to-Jezero journey, to get the ancient rocks first.

NASA has not yet decided whether or how it might fetch the samples, although it has tentative plans for a mission in the late 2020s. "We're actually serious about bringing these samples back," Zurbuchen told the meeting. "That's what we're here for." ■

ETHICS

A moral map for AI cars

Survey reveals global variations in ethical rules of the road for autonomous vehicles.

BY AMY MAXMEN

When a driver slams on the brakes to avoid hitting a pedestrian crossing the road illegally, she is making a moral decision that shifts risk from the pedestrian to the people in the car. Self-driving cars might soon have to make such ethical judgments on their own — but settling on a universal moral code for the vehicles could be a thorny task, suggests a survey of 2.3 million people around the world.

The largest-ever survey of machine ethics¹, published this week in *Nature*, finds that many

of the moral principles that guide a driver's decisions vary by country. For example, in a scenario in which some combination of pedestrians and passengers will die in a collision, people from relatively prosperous countries with strong institutions, such as law enforcement, were less likely to spare a pedestrian who stepped into traffic illegally.

"People who think about machine ethics make it sound like you can come up with a perfect set of rules for robots, and what we show here with data is that there are no universal rules," says study co-author Iyad Rahwan, a computer scientist at the Massachusetts

Institute of Technology in Cambridge.

The survey, called the Moral Machine, laid out 13 scenarios in which someone's death was inevitable. Respondents were asked to choose who to spare in situations that involved a mix of variables: young or old, rich or poor, more people or fewer.

People rarely encounter such stark moral dilemmas, and some critics ask whether the scenarios posed in the quiz are relevant to the ethical questions surrounding driverless cars. But the study's authors say that the scenarios stand in for the subtle moral decisions that drivers make every day. The findings reveal ►