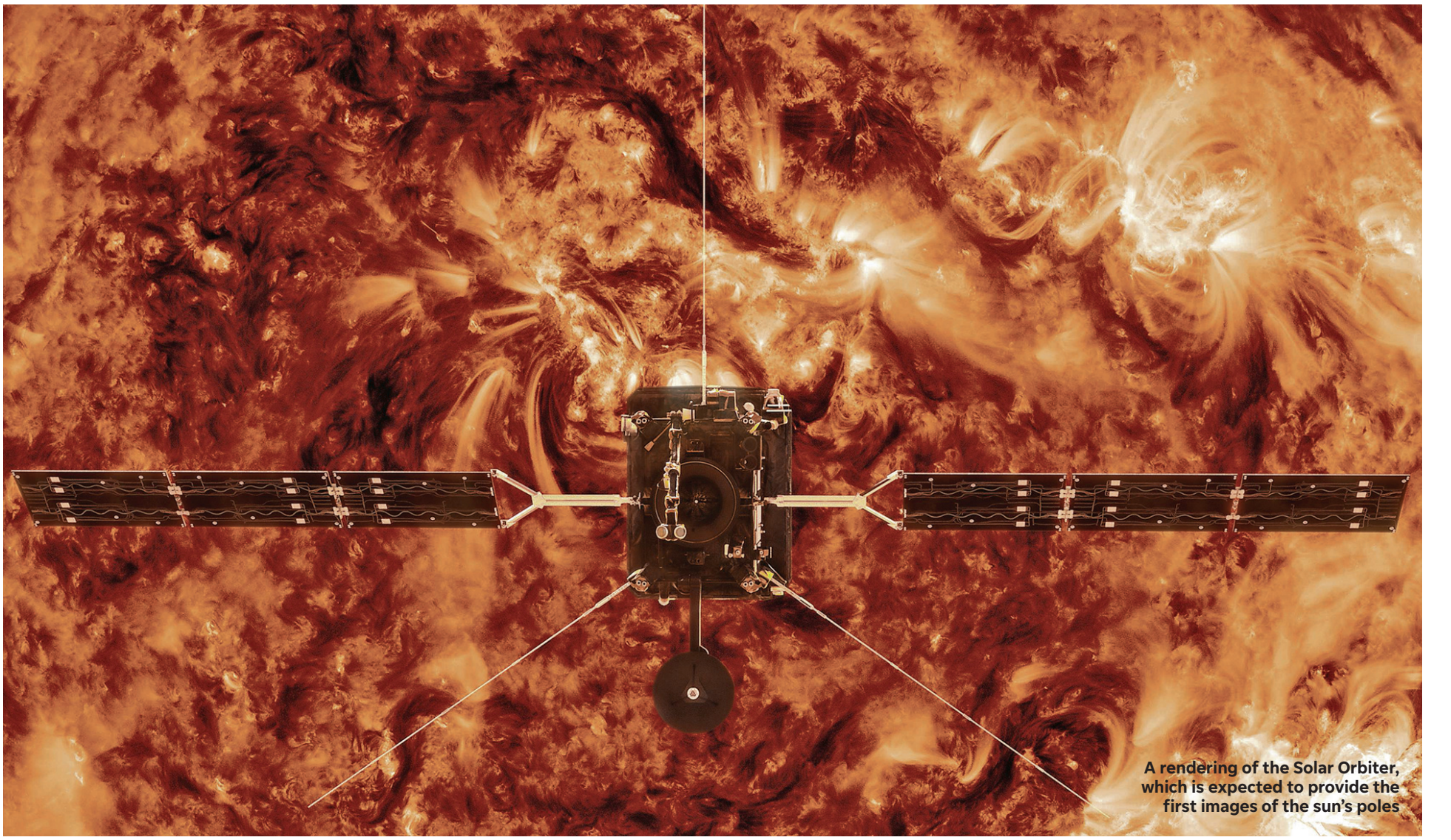
MARS & BEYOND



A rendering of the Solar Orbiter, which is expected to provide the first images of the sun's poles

NASA, ESA ATG MEDIALAB COMPOSITE

Heating Up

NASA's Parker Probe, Solar Orbiter give solar science its day in the sun

By Matt Alderton

IT'S ONE OF THE first lessons parents teach their children: Never look directly at the sun. Doing so can cause serious and sometimes permanent damage.

NASA, on the other hand, has spent more than 60 years pondering what vision it might gain from close study of the sun.

"The sun affects our light and our life here on Earth. It shapes the Earth's magnetic field, which of course protects us from all the sun's nasty radiation. … It really is the key to everything," said Nicola Fox, director of the heliophysics division within NASA's Science Mission Directorate.

CONTINUED »

In every sense of the word, the sun is central to planetary science. And yet, scientists know surprisingly little about how it actually works. That could soon change, however, thanks to two ambitious missions: NASA's Parker Solar Probe and the joint NASA/European Space Agency (ESA) Solar Orbiter.

Launched Aug. 12, 2018, the solar probe mission is named for Eugene Parker, an astrophysicist who discovered the phenomenon of solar wind — a constant stream of solar-charged particles that emanates from the sun's atmosphere, the corona, causing space weather that threatens astronauts and satellites in space, as well as space-dependent systems on Earth, including GPS, radios and even electricity.

One question scientists most want the missions to answer is why the sun's atmosphere can be millions of degrees hotter than its surface.

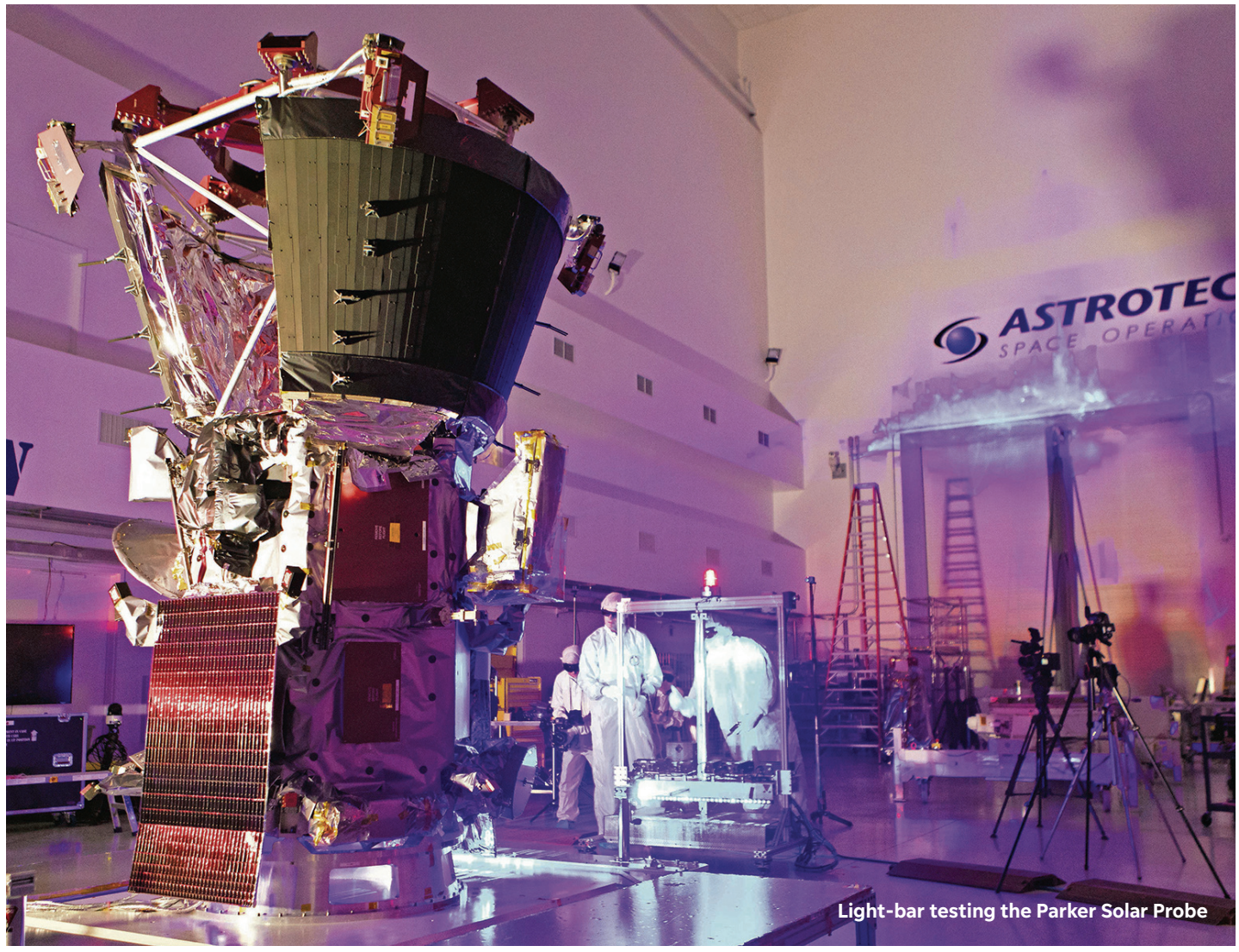
"If a big explosion happens on the sun … we can expect quite a bit of damage to equipment in space and on the ground," explained Nour Raouafi, Parker Solar Probe project scientist. "If this event is really, really big, it can basically stop the power grid."

Parker Solar Probe could help prevent that by giving scientists the means to understand and predict activity in and around the corona. During its seven-year mission, it will fly past Venus seven times, leveraging its gravity to gradually reduce the size of its orbit until it's within 3.9 million miles of the sun's surface — closer than any other spacecraft.

Parker Solar Probe has completed three solar orbits and returned a wealth of data that NASA will summarize in late October in the journal *Nature*.

Although the data wasn't available at press time, Raouafi promised a significant solar shakeup. "What we are seeing in the data so far is a picture that is completely different than what we're used to," he said. "Parker Solar Probe will change our view of the solar wind forever."

That view will be supplemented when NASA and ESA launch Solar Orbiter from Cape Canaveral, Fla., in February. Built in the U.K. and tested in Germany, the spacecraft will fly farther from the sun — 26 million miles — and will capture an entirely new vantage point.



Light-bar testing the Parker Solar Probe

GLENN BENSON/NASA

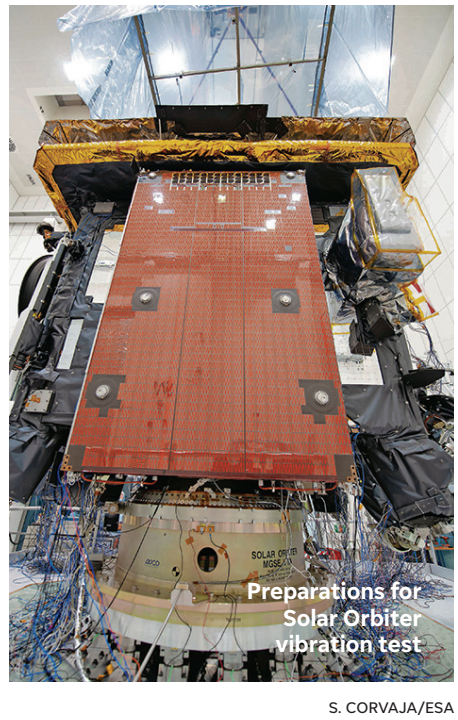
"The most important novelty of Solar Orbiter is its highly tilted orbit," said Yannis Zouganelis, deputy project scientist for Solar Orbiter at ESA. "This will allow the first-ever images of the sun's poles, which many researchers believe hold the key to understanding what drives the constant activity and eruptions on the sun."

Parker Solar Probe and Solar Orbiter were independently conceived and developed, but mission synergies will allow them to work in tandem.

"Although Parker Solar Probe will be bathed inside the solar wind, it is 'blind' with respect to the sun, with no imagers to observe the sun at the same time. Combining measurements taken from both spacecraft at the same time … will greatly enhance the context for Parker Solar Probe to understand what it is flying through," Zouganelis said. "If the Probe is the mission that 'touches' the sun, Solar Orbiter is the mission that sees it."

One of the questions scientists most want to answer is why the corona is so much hotter than the photosphere, the sun's surface. The former can be several million degrees Fahrenheit while the latter is 10,000 degrees Fahrenheit; NASA likens it to a campfire that gets hotter instead of cooler as you retreat from it.

"The atmosphere is blowing away from the sun and out into space, which is the solar wind," said Chris St. Cyr, Solar Orbiter project scientist at NASA's Goddard Space Flight Center. "We have tried to discover how that happens with ground-based methods and space-based telescopes, but Solar Probe and Solar Orbiter are the latest and possibly best chance we have to really understand it."


Preparations for Solar Orbiter vibration test

S. CORVAJA/ESA