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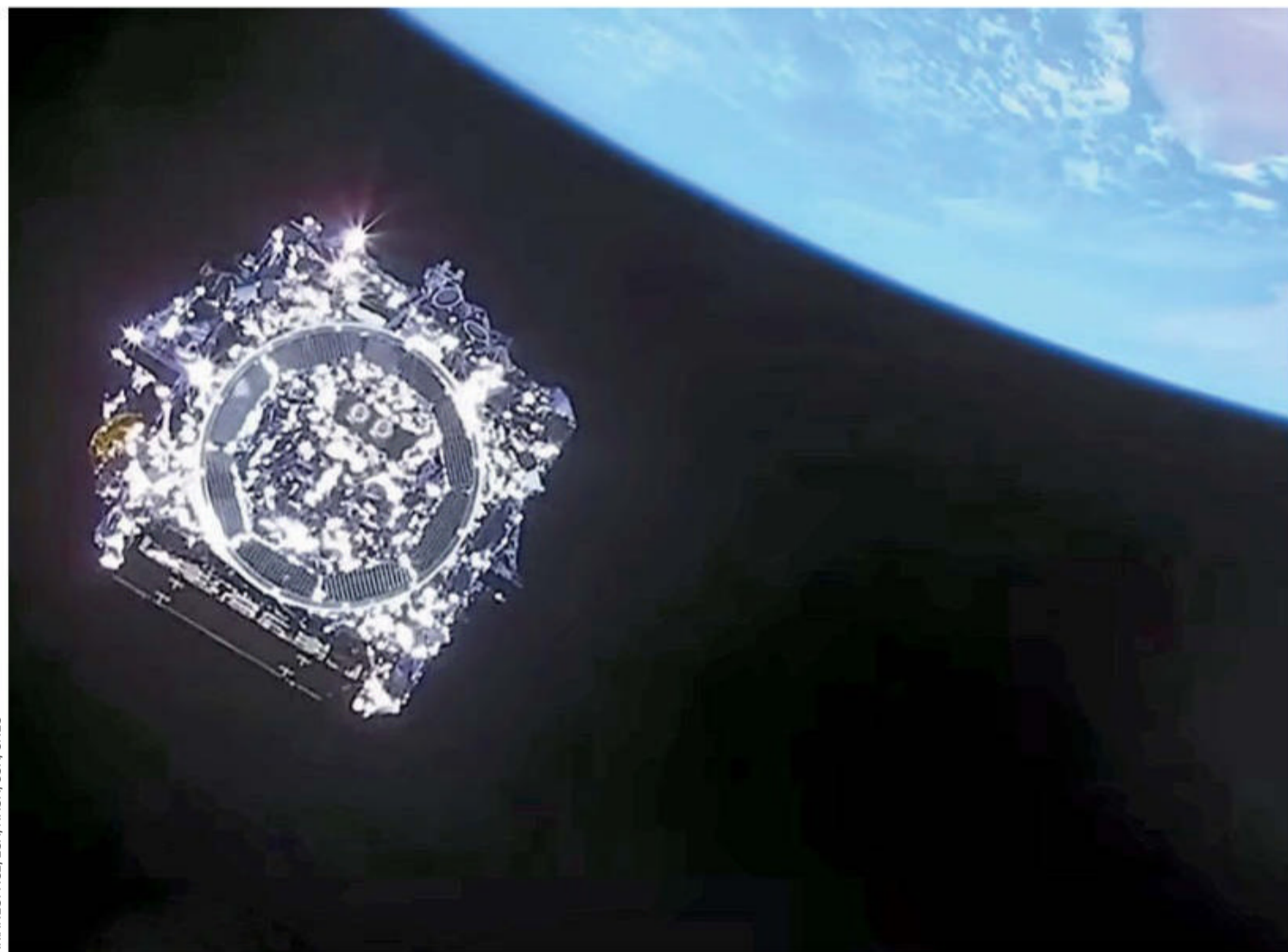


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Space exploration

The Webb takes shape

The James Webb Space Telescope is opening up as it gets ready to reveal the mysteries of the early universe, reports **Alex Wilkins**

AFTER a nail-biting launch on Christmas Day, the James Webb Space Telescope (JWST) has begun its mission to image the birth of the universe.

The JWST blasted off from French Guiana at 12:20 GMT on 25 December on top of an Ariane 5 rocket, folded into a compact cuboid. About 27 minutes later, it separated from the rocket and deployed its solar array, which powers its propulsion and communication systems, as well as scientific instruments.

Its next big manoeuvres were two course-correction burns, firing rocket thrusters to nudge the space telescope towards its correct orbit around the sun, at a gravitationally stable location called L2 about 1.5 million

kilometres from Earth.

The two burns used less fuel than anticipated thanks to the accuracy of the Ariane 5 rocket, which means the JWST will have enough propellant to last “significantly” longer than its expected 10-year operation time, according to NASA engineers. Unlike its predecessor, the Hubble Space Telescope, the JWST will be too far away to service, so any leftover fuel is a bonus.

On 3 January, JWST operators began the spacecraft’s most critical manoeuvre: the unfolding and tensioning of its sunshield, which protects the telescope’s sensitive instruments from the sun’s powerful radiation.

The shield is made of five layers of a lightweight thermal material

called Kapton and is as wide as a tennis court. Deploying it is a multistep process involving more than 140 release mechanisms.

If these don’t execute correctly, the entire mission could be

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in danger, but NASA engineers are confident of success after their numerous rehearsals on the ground.

“I don’t expect any drama,” said JWST project manager Bill Ochs during a press conference on 3 January. “The best thing for operations is ‘boring’. And that’s what we anticipate over the next

The James Webb Space Telescope seen from the Ariane 5 rocket it launched on

three days – to be boring.”

As *New Scientist* went to press, the first three layers of the shield had been deployed and tightened and the rest of it was expected to be tensioned by the end of 4 January. However, the sequence could take longer depending on the data that the JWST’s engineers receive on the ground.

As well as planned manoeuvres, NASA engineers have had to adapt to changing conditions aboard the JWST, like fine-tuning its power systems and accounting for higher than expected temperatures inside the sunshield’s motors due to incident sunlight.

“We’ve had a week to see how the observatory actually behaves in space. It’s not uncommon to learn certain characteristics of your spacecraft once you’re in flight,” said Mike Menzel at NASA’s Goddard Space Flight Center in a statement.

Once the sunshield is in place, the next big task is the deployment of the telescope’s mirrors. First, a secondary reflector will be extended in front of the primary mirrors on 7 January, and then the 6.5-metre-wide primary mirrors will be unfolded on 8 and 9 January.

After the 18 hexagonal, gold-plated beryllium mirrors are fully deployed, the JWST will continue on to L2 by the end of January, if all goes according to plan. The telescope will then have its instruments and systems tweaked for an extra five months before being ready to image the primordial universe.

The JWST will view the cosmos in infrared light, and should be able to see objects that are between 10 and 100 times fainter than those pictured by Hubble, and in detail 10 times as precise. These include the first stars and galaxies, formed hundreds of millions of years after the big bang, and potentially habitable exoplanets, which it will study by investigating their atmospheres. ■