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Nasa

Nasa's new rocket is the last hurrah for US space agency's old ways

As the costly Space Launch System prepares for its first mission, the industry is already moving into the next era



Nasa's Space Launch System at the Kennedy Space Center in Florida. The agency has put the cost of each Artemis mission at \$4.1bn
© Joe Skipper/Reuters

Richard Waters in San Francisco YESTERDAY

If Nasa's giant Space Launch System rocket lifts off from Florida's Kennedy Space Center as planned on Monday, it will become the first vehicle in 50 years capable of carrying humans to the Moon.

For the commercial [space industry](#), it could signal something even more significant: the end of the line for the US space agency's old way of doing business, and the start of a new era for commercial and international co-operation in space.

The SLS, which stands as high as a 30-storey building and is more powerful than the Saturn V rockets that carried Apollo missions to the Moon, is a monument to grand space ambition. Nasa has a two-hour launch window, starting at 08:33 local time (13:33 BST).

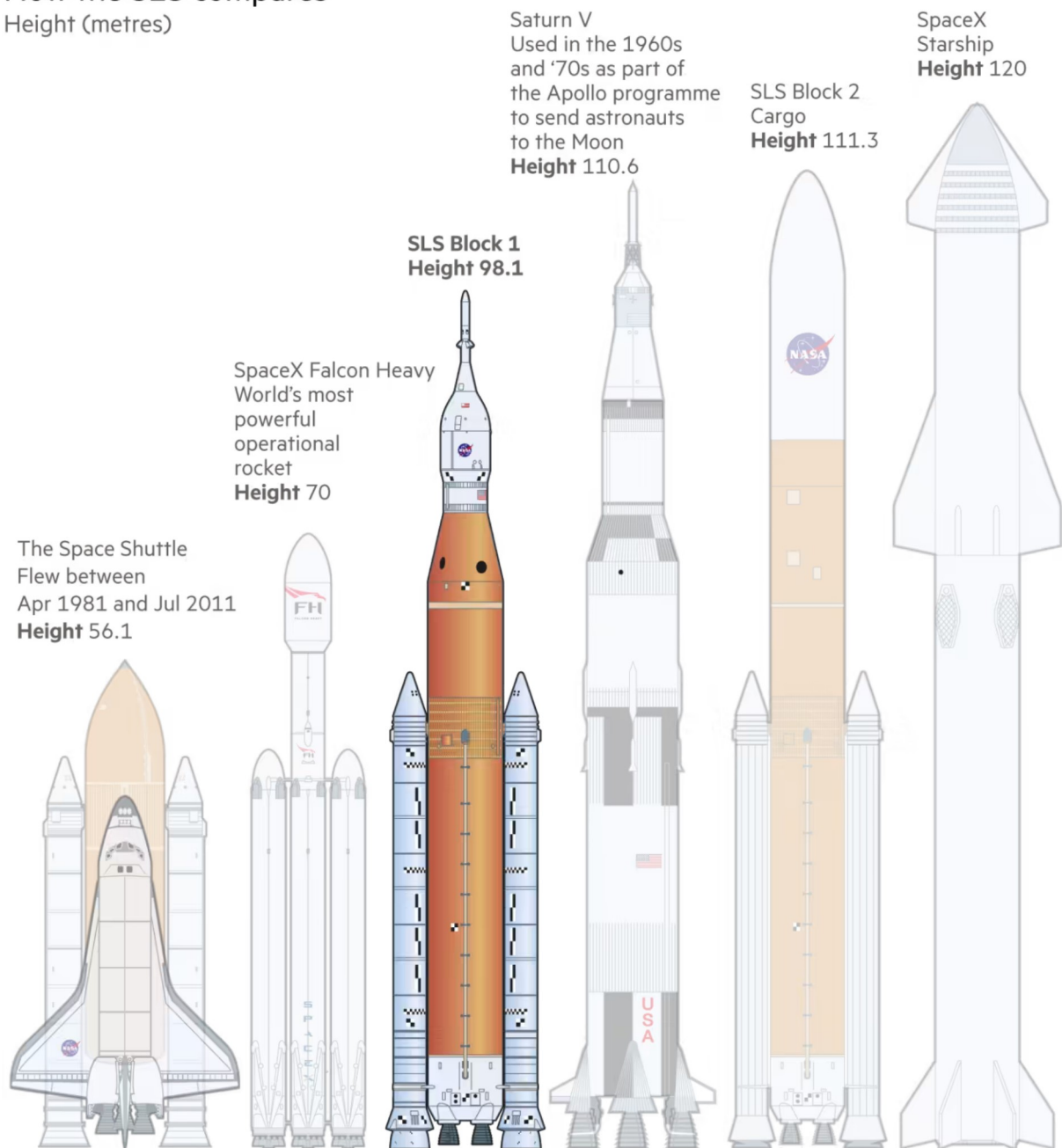
It has taken 11 years to get to the launch pad — almost twice as long as the Saturn V — and, [according to a Nasa auditor](#), will have cost US taxpayers \$29.5bn by 2025. It is the centrepiece of the \$93bn Artemis programme, which was created to take humans back to the Moon by 2025 and, in the longer term, act as a springboard for reaching Mars.

Yet even before SLS leaves the ground for the first time, the epitaphs are already being written. Lacking the reusability that has brought down launch costs at Jeff Bezos's Blue Origin and Elon Musk's SpaceX, the rockets are expected to take launch

BEZOS'S BLUE ORIGIN AND ELON MUSK'S SPACEX, THE ROCKETS ARE EXPECTED TO TAKE LONGER TO BUILD AND COST MORE THAN THE HEAVY-LAUNCH SYSTEMS STILL UNDER DEVELOPMENT AT COMMERCIAL RIVALS.

How the SLS compares

Height (metres)



Sources: Nasa; SpaceX Graphic by Bob Haslett © FT

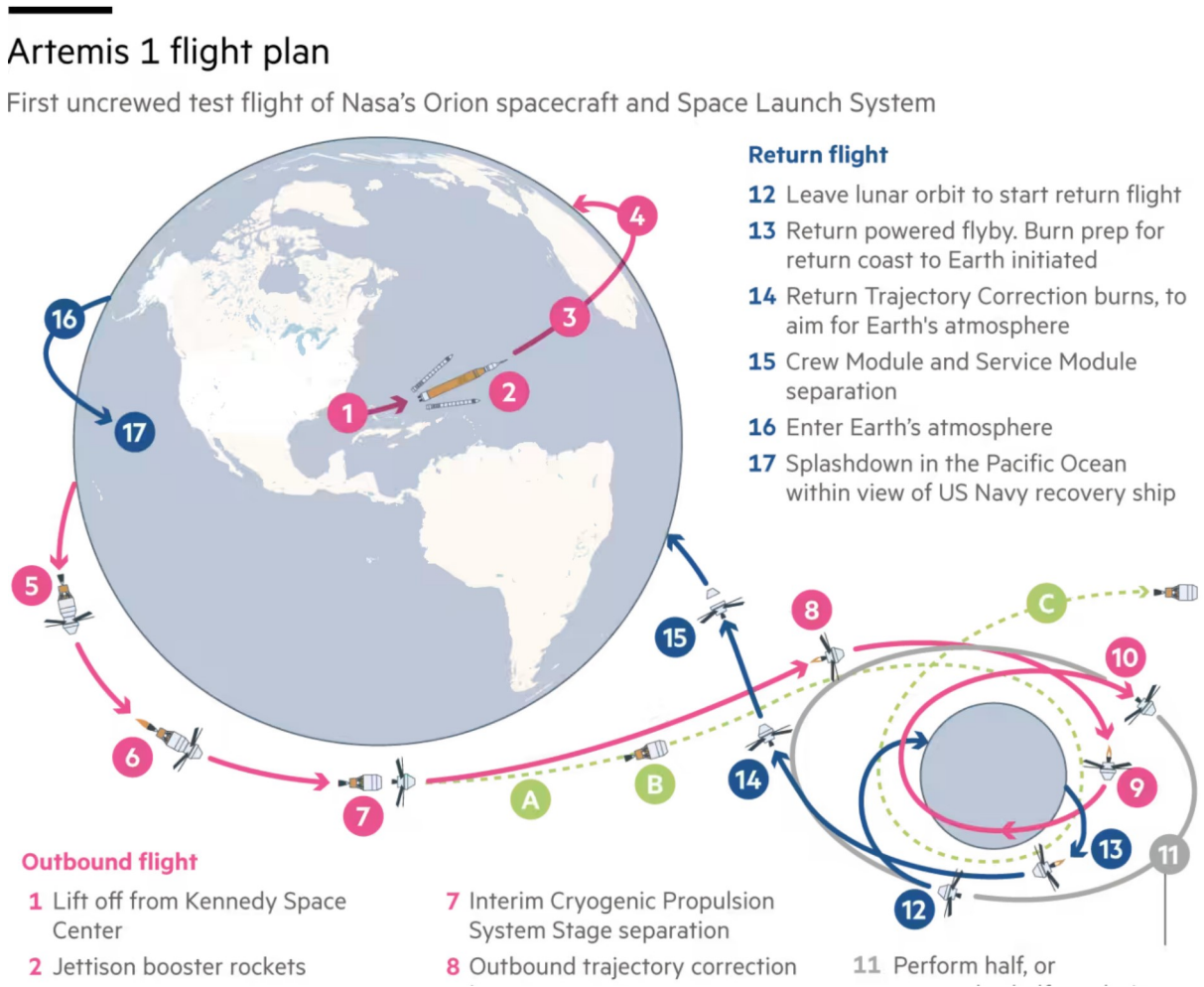
Nasa's plans call for the SLS to take flight only about once every two years, at a cost of \$2.2bn each time. With another \$1bn going to Lockheed Martin to build the Orion spacecraft that sits on top of the SLS, the agency puts the total cost for each Artemis mission at \$4.1bn.

The “unjustifiable cost and low launch rate” meant the US was likely to turn to cheaper alternatives when they were available, said Laura Forczyk, a US space analyst. Like others, she described SLS as a “monumental achievement” — while at the same time predicting that it was “unlikely to be the workhorse” for US space exploration for long.

[Nasa](#) is coming to a similar view, even though Boeing, the main contractor, says it is working on ways to bring down the cost of future SLS launches. The agency’s auditor wrote late last year that in order to put its manned space flight programme on a secure long-term footing, it would have to turn to cheaper commercial alternatives to SLS.

These are likely to include several heavy-launch rockets that employ varying degrees of reusability to bring down their cost. SpaceX’s Starship, Blue Origin’s New Glenn and the Vulcan rocket being developed by United Launch Alliance, a joint venture between Boeing and Lockheed Martin, are all awaiting their first test flights.

Nasa has scheduled four missions for the SLS, with the third due to take humans to the Moon. After that, it is unclear whether the rocket will ever fly again.



- 3 Main engine cut off
- 4 Perigee raise manoeuvre
- 5 Earth orbit with systems check and solar panel adjustment
- 6 Trial lunar injection burn, approximately 20 mins

- burns
- 9 Outbound powered flyby, 60 mins from the Moon and targets the lunar orbit
- 10 Lunar orbit insertion

one-and-a-half revolutions of the Moon 38,000 nautical miles above the surface

ABC

ICPS deploys a total of 10 CubeSats

Sources: Nasa; SpaceX Graphic by Bob Haslett © FT

The cost and delays to Artemis partly reflect political reversals on the way to reaching a final plan. The Obama administration scrapped the earlier Constellation programme to return to the Moon, before the Trump White House set the current course more than six years later.

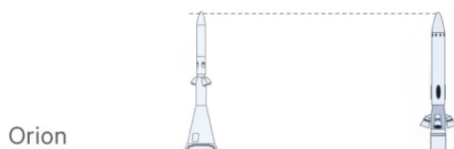
It was different to the 1960s when the US launched its Saturn V rockets within six years as it raced to put a man on the Moon. With SLS, “it was kind of a backwards approach”, said Greg Autry, who in 2016 worked on the Nasa review team that laid out the plan to return to the Moon. Worried about losing ground to China and Russia, Congress pushed Nasa to build a heavy-lift launch system and only later came up with a use for the rocket, he added.

The politics of giant space projects also served to inflate costs, as politicians fought to win parts of the work for their own constituents — an “inevitable part” of the process, said Autry. Similar considerations also affected important decisions about the design of the rocket, as powerful senators such as Alabama’s Richard Shelby sought to protect the jobs tied to existing programmes in their states.

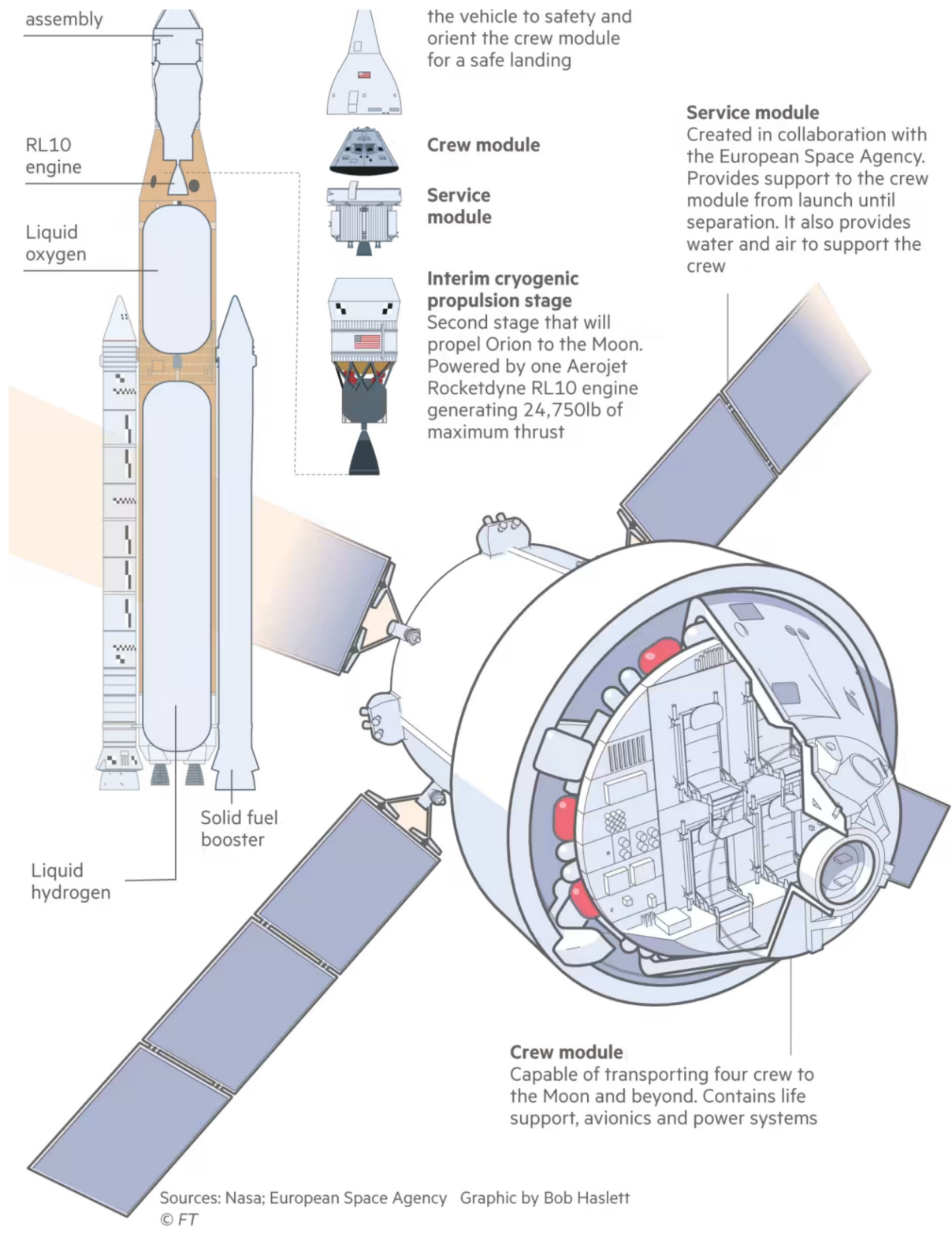
Despite calls to make parts of the rocket reusable to save money, the design for SLS followed a more traditional plan. It also called for repurposing parts of the Space Shuttle programme, including the shuttle’s engines, which was projected to reduce technology risk and save money. This backfired, with costs soaring as the engines were rebuilt from the ground up

Above all, SLS stands as a testament to the way Nasa has operated for most of its existence. It was built under a cost-plus arrangement where Nasa retains control and reimburses contractors for their costs.

Main assembly



Launch abort system
Positioned on a tower on top of the crew module and can activate within milliseconds to propel



Nasa administrator Bill Nelson called cost-plus contracts such as this “the old way of doing business” when he [testified before Congress in May](#). While not commenting specifically on SLS, he said that such arrangements encouraged companies to bid low to win contracts, which left Nasa with no alternative but to meet heavy cost overruns.

The agency has already had a taste of the alternative. Without a rocket of its own to turn to, it has used a fixed-price arrangement to pay SpaceX to carry US cargo and

astronauts to the International Space Station. The commercial conditions under which SpaceX operates create heavy incentives for it to hold down expenses. A Nasa official estimated that SpaceX's Falcon 9 rocket cost less than \$400mn to develop, and that Nasa would have spent 10 times that to build the rocket under a cost-plus system.

If the Artemis programme turns out to be the last hurrah for an old way of handling giant space projects, it also gives a glimpse of what the future of space exploration may look like. It includes several elements under different variations of a fixed-price contract, including a commission for SpaceX to build a lunar lander. Blue Origin protested against that agreement, and Nasa is now looking at awarding a contract for a second lander.

Other parts of Artemis that operate under fixed-price arrangements include a series of contracts with private companies to carry equipment to the lunar surface, and a commission for a lunar "gateway" — a craft that will sit in lunar orbit and be used as a way station to landing on the Moon.

Projects such as these represent new forms of partnership between the private and public sectors and should provide a solid foundation for the commercial space industry, according to Autry. "Nasa is evolving rapidly," he added. "Nasa is not a transportation company or a regulatory agency. They're a science and research institution."

In another sign that Artemis points to a new direction for US space development, the project has relied on the backing of several international space agencies, including the European Space Agency, which has built a module that will provide back-up systems to the Orion spacecraft.

The international involvement showed that the geopolitical motivations behind Artemis were very different to the cold war space race that led to the Apollo Moon landings, said Forczyk. She added that it showed that the US was trying to build a broader international alliance to support long-term human space exploration, while also putting together a coalition to counter Chinese and Russian ambitions in deep space.

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