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Telecommunications

Amazon successfully launches its prototype Kuiper satellites

Jonathan O'Callaghan

PROJECT Kuiper, Amazon's planned space internet service, kicked off with the launch of its first ever satellites on 6 October. The firm hopes the service will rival SpaceX's Starlink.

A pair of satellites called KuiperSat-1 and KuiperSat-2 launched on a United Launch Alliance (ULA) Atlas V rocket from Cape Canaveral in Florida on 6 October. They are now orbiting 500 kilometres above Earth's surface to test out key components of the Kuiper mega constellation, which is planned to consist of 3200 satellites.

"It's really important to test the satellites before they can launch the rest of the constellation," says Tim Farrar, a satellite communications consultant in the UK. "This is a big step forward that we've been waiting a long time for."

Project Kuiper satellites are designed to connect to remote terminals on Earth, providing internet access in locations that otherwise lack connectivity.

Such space internet has been the goal of several firms in recent years, most notably SpaceX in the US and Eutelsat's OneWeb in the UK. The former has already launched about 5000 satellites and boasts some 2 million users, while OneWeb has nearly 650 satellites in orbit. Amazon is playing catch-up, says Farrar. "They are four or five years behind SpaceX at least," he says.

Amazon has committed to spending $10 billion on Kuiper. Last year, it essentially bought up all the spare launch capacity in the world on every available non-SpaceX rocket – seemingly in an attempt to avoid giving money to its major competitor.

However, the development of many of the rockets that Amazon intends to use, such as ULA's Vulcan Centaur, has been delayed. The hold-up has seen the company turn to the Atlas V rocket to launch its two prototype satellites, despite the rocket being much larger than required. Each KuiperSat is estimated to be more than 500 kilograms in mass, which is too large for most small rockets, but undersized compared with the Atlas V's lifting capacity of 7000 kilograms.

PAUL HENNESY/ANADOLU AGENCY VIA GETTY IMAGES

An Atlas V rocket carrying Amazon's satellites took off from Cape Canaveral, Florida

$10bn

Amazon's planned spending on its space internet project

"There isn't really much on the table that's at an intermediate rocket level," says Jonathan McDowell at the Harvard-Smithsonian Center for Astrophysics in Massachusetts.

Amazon says it will begin production of its full Kuiper satellites later this year and start launching them in the first half of next year, with an early Kuiper service due to roll out in the second half of 2024. Eventually, it plans to offer internet speeds of up to 1 gigabit per second, comparable to that provided by fibre-optic broadband.

The prototype satellites are carrying instruments to test how users on the ground might connect to Kuiper. One satellite will also test out a method to reduce its brightness in the night sky, in order to prevent the future Kuiper mega constellation from being a nuisance to astronomers.

Chris Johnson, space law adviser at the Secure World Foundation in the US, says there are still issues to resolve regarding both the impact of mega constellations on astronomy and managing such large numbers of satellites in orbit to avoid collisions. "Global constellations are here now and the train has left the station," he says. "But that doesn't mean the game is up. These things can still be regulated." ▮

Environment

The growing carbon footprint of satellite internet

Jeremy Hsu

THE space race that is seeing SpaceX, Eutelsat and Amazon launch thousands of satellites capable of providing internet service (see story, left) will carry a significant environmental cost.

Edward Oughton at George Mason University in Fairfax, Virginia, and his colleagues have found that the carbon footprint of each satellite constellation could be 14 to 21 times higher per internet subscriber than the emissions associated with land-based mobile internet. This is primarily because of rocket launch emissions like carbon dioxide and carbon monoxide (arXiv, doi.org/kxj7).

The polluting potential of satellite internet services may be higher than this, though. When the researchers factored in additional rocket launch particles – such as black carbon or aluminium oxide – they calculated that the carbon footprint per subscriber might increase to between 31 and 91 times that of a land-based internet option.

Among the three satellite internet competitors, SpaceX's Starlink generally manages the lowest carbon emissions per internet subscriber – about 31 times larger than terrestrial equivalents – mainly because it has the most customers, so emissions per user are lower.

Amazon's upcoming Project Kuiper constellation may deliver the worst emissions impact of the three, partly because it is expected to use Europe's new Ariane 6 rocket system for many launches. Unlike the SpaceX Falcon 9 rocket used by Starlink and Eutelsat's OneWeb satellites, the Ariane 6 system will use solid fuel propellant that emits more particles like aluminium oxide.

The emissions impact will change over time, partly because of the need to launch replacement satellites, says Martin Ross at the Aerospace Corporation, a non-profit organisation in California. ▮