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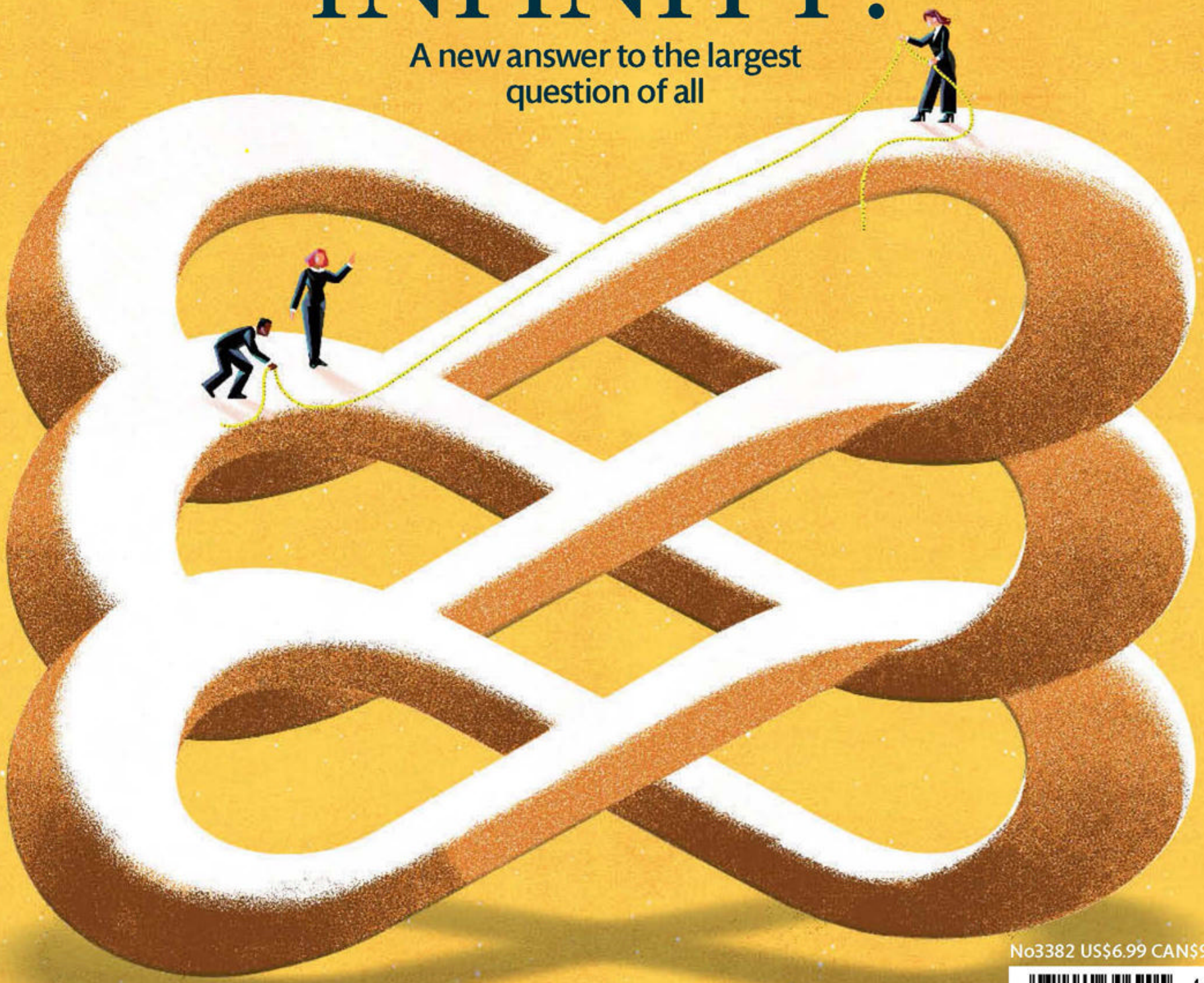

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Is Amazon going to dominate space? Its massive order for rocket launches over the next five years has gobbled up much of the global market, but it could spur new opportunities, says **Paul Marks**

A MULTIBILLION-dollar booking of satellite-launching rockets has suddenly made Amazon one of the busiest space-flight operators. Will the tech giant's attempt to corner much of the launch market quash the ambitions of smaller satellite operators or could this light the fuse on a new generation of rocket firms?

On 5 April, Amazon astonished the space industry by revealing that it had placed the biggest set of orders for orbital rockets in space-flight history, buying 83 launches over the next five years to place more than 3000 of its Project Kuiper internet satellites into low Earth orbit, at a rumoured price of $10 billion.

Like SpaceX and OneWeb, Amazon is hoping to provide global internet connectivity, but the firm is currently way behind its competitors. "Kuiper is playing catch-up to [SpaceX's] Starlink and OneWeb, which are already mid-way deployed," says Greg Sadlier, a London-based analyst at consultancy Know.space.

But the sheer size of the rocket orders Amazon has placed – with United Launch Alliance, Arianespace and Blue Origin – is raising questions over just how much launch capacity will remain for other would-be satellite operators. Sanctions following Russia's invasion of Ukraine have seen Soyuz rockets ruled out for satellite launches by Western firms – even OneWeb, formerly carried on Soyuz, is now being flown by SpaceX – so for those not booked on SpaceX Falcon 9 flights, what are the options?

"If Amazon has kind of absorbed most of the launch capability, what's left for everybody else? Where do other operators go to launch their systems?" asks Hugh Lewis, a space scientist at the University of Southampton in the UK. This could be of particular concern for operators wanting to replace remote sensing and Earth observation satellites at the end of their lives, he says.

One option could be to buy a ride on rockets launched by the Japanese or Indian space agencies, but this generally only works if customers are happy for their satellites to be placed in the same orbit as the primary payload, which is usually dictated by the government. China also has its own rockets, but generally solely offers ride-shares to domestic firms.

Yet all is not lost. A raft of companies are developing a new generation of rockets designed to launch smallsats – those in the sub-1500-kilogram range. The NewSpace Index, which tracks smallsat launchers, lists more than 180 potential vehicles, though more than 80 per cent are still in the concept or development stages.

Companies entering the smallsat rocket fray include start-ups Astra and ABL Space Systems in the US, and Orbex and Skyrora in the UK. Amazon is already involved in this arena as well: it is set to launch two test versions of its Project Kuiper internet satellites on an ABL Space Systems RS1 rocket later this year.

So through its massive launch order, Amazon may have done the smallsat rocket-makers a favour by forcing other operators to seek a ride elsewhere. It is now up to these emerging businesses to come up with the goods. "They will need to rise to the supply challenge to meet that demand," says Sadlier. ▮

An artist's impression of a United Launch Alliance rocket

AMAZON

Female wētās have two sets of genitals and eat ejaculate

FEMALE short-tailed ground wētās, a cricket-like insect found in New Zealand, consume male ejaculate after sex to give them enough energy for parenting.

Darryl Gwynne and Jessica Browne at the University of Toronto in Canada also recently discovered that the mating success of female *Hemiandrus pallitarsis* depends on the size of their secondary genitals.

To mate, a male and female wētā first drum their abdomens on leaves to signal readiness. Things then get weird when they pair off, due to the female's two sets of genitals. Her primary genitals receive and store sperm, while her secondary genitals help collect extra ejaculate in the form of a "food gift".

The secondary genitals are shaped like a bent elbow with a forked tip, and the male uses his genitals to grab onto them while he deposits the extra ejaculate on her abdomen. This doesn't contain any sperm but is full of nutritious proteins. After mating, the female eats it. Gwynne believes the insects do this to sustain themselves for the next six months while they go underground to care for their eggs.

"She doesn't eat at all during this time, probably because there's no food underground and she can't leave her eggs in case a natural enemy comes and does something nasty to them," he says.

The team collected 58 females from two sites on New Zealand's North Island and found through the DNA of their stored sperm that those with longer secondary genitals had mated with more males (bioRxiv, doi.org/hpqp).

"There's no food underground and she can't leave her eggs in case a natural enemy comes"

"Males may prefer to mate with females that have longer secondary genitals because it signals they're of higher quality and able to provide better maternal care, which leads to more offspring," says Browne.

Unfortunately, females don't receive much of a reward for the six months they spend devoting themselves to their offspring. Once their young go off into the world, females promptly die. ▮

Alice Klein