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Space

SpaceX aims to stop comms blackouts

A trick with satellites could let spacecraft re-enter Earth's atmosphere without losing radio contact

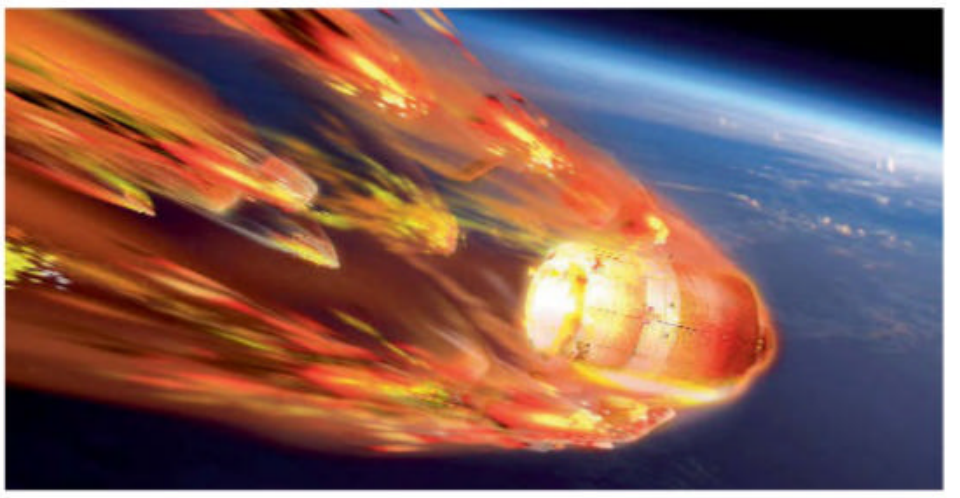
Mark Harris

SPACEX is about to test a system aimed at overcoming the communications blackout spacecraft go through when they re-enter Earth's atmosphere.

Almost every vehicle that has returned to Earth has suffered a break in communications during re-entry as the atmosphere slows it down. The same friction that decelerates the craft also heats the air below it until this ionises into a glowing, conductive plasma. This forms a sheath around the spaceship that blocks radio frequency signals to Earth.

Blackouts last several minutes, during which the fate of any people on board is unknown. Astronauts leaving the International Space Station on SpaceX's Crew Dragon capsule can lose communications for 7 minutes.

The problem isn't limited to spacecraft. Any vehicle going at speeds above Mach 5 will have similar issues, including hypersonic missiles. Radio blackouts could complicate their guidance and abort functions.



ESA–D. DUCROS, 2014

Capsules entering Earth's atmosphere get surrounded by hot plasma

"Instead of trying to punch signals through hot plasma, SpaceX will send them up to satellites"

Now, SpaceX thinks it might have a solution. Instead of trying to punch communication signals through hot plasma down to the ground, it will send signals up to its orbiting satellites instead.

Sometime in the next few months, one of the firm's 70-metre-tall Falcon 9 rockets will blast off from Cape Canaveral in Florida with a Starlink system on its second stage. This won't be another SpaceX satellite to join the approximately 5300 it already has in orbit, but a standard user terminal to access them.

According to a document filed with the US Federal Communications Commission, the experiment will start once the Falcon 9 deploys its commercial payload and will run until the second stage burns up on re-entry.

The success of a similar idea for NASA's 37-metre-long space shuttle hints the technique could work for SpaceX, at least in some situations. From the late 1980s, the space shuttle avoided re-entry blackouts by connecting to a NASA satellite.

But that satellite was in a distant geostationary orbit, so seemed fixed in the sky because its orbital velocity matched Earth's speed of rotation. The Starlink satellites are in much closer low-Earth orbits, where their orbital velocity whips them across the sky in minutes. This means the Falcon system will have to switch from one satellite to another in quick succession.

Even if the experiment works on the Falcon rocket, it may not translate to the smaller Crew Dragon capsule, which is only about 8 metres long, says Richard Ziolkowski at the University of Arizona. "Plasmas are notoriously fickle in the sense that if you have a little change in shape, you get pretty large changes in the plasma."

SpaceX hasn't responded to a request for comment. ▮

Energy and fuels

Huge deposit of hydrogen gas found deep below Albania

THE largest flow of natural hydrogen gas ever seen has been measured deep in an Albanian mine. It could help us work out where to find deposits of this clean fuel.

"The bubbling is really, really intense," says Laurent Truche at the University of Grenoble Alpes in France, who measured the gas in a pool of water nearly a kilometre underground. "It's like a Jacuzzi."

Companies are searching worldwide for deposits of natural hydrogen as a source of clean fuel, but data on large accumulations is sparse. Most claims about vast deposits rely on extrapolation, rather than direct measurements.

So, Truche and his colleagues descended into the Bulqizë chromite mine in Albania, where hydrogen gas seeping out of the rocks has caused several explosions. The mine is located within an exposure of iron-rich rock, known as an ophiolite. Water is known to react with such rock to generate hydrogen in other places, such as Oman.

The researchers found that the gas bubbling from the pool was more than 80 per cent hydrogen, with methane and a small amount of nitrogen mixed in. It was flowing

F-V. DONZÉ

The Bulqizë chromite mine in Albania, where hydrogen seeps up through the rock

at a rate of 11 tonnes per year, almost an order of magnitude greater than any other flow of hydrogen gas measured from a single point on Earth.

The researchers modelled geological scenarios that could produce such a flow and found the most likely was that the gas was coming from a deeper reservoir of hydrogen accumulated in a fault beneath the mine. Based on the fault's geometry, they estimate the reservoir contains at least 5000 to 50,000 tonnes of hydrogen (*Science*, doi.org/mgbs).

The find supports the idea that much more hydrogen is stored underground, says Geoffrey Ellis at the US Geological Survey. "We really should be looking deeper." ▮

James Dinneen