For the first time, an ESA deep space antenna controlled two spacecraft with one dish

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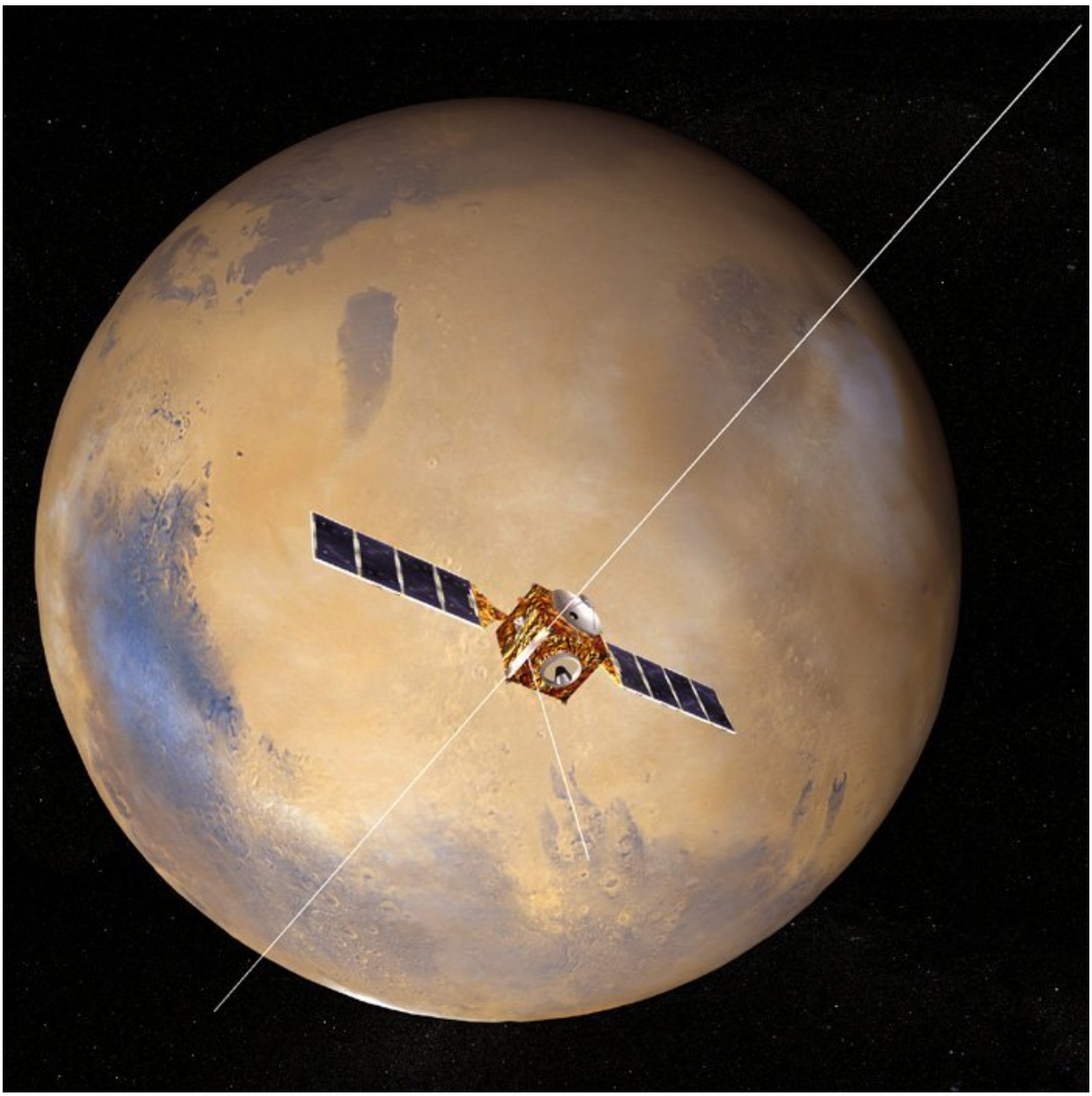

Mars Express in orbit around Mars with the MARSIS antenna unfurled. Credit: European Space Agency

For the first time, an ESA deep space antenna has sent commands to two ESA spacecraft, simultaneously, at the Red Planet.

Late on Thursday 30 January, the 35-meter New Norcia dish in Western Australia 'spoke' to Mars Express and the ExoMars Trace Gas Orbiter (TGO).

Talking with two voices at two different frequencies ensured the signals sent didn't interfere with each other.

The successful test is an important step in increasing the flexibility of ESA's Estrack network of antennas across the globe, to find, control, or receive data from missions across space.

Deep space conversations

The vast majority of conversations between Earth and space involve one antenna on the ground, one spacecraft in orbit or out in the Solar System, and signals at a particular frequency going between the two.

In cases where several spacecraft are located in one part of the sky (all in orbit around Mars for example), it's possible for an antenna to see all of these spacecraft at once.

As ESA ground stations have four receivers, they can in principle receive data from up to four spacecraft simultaneously.

This technique, called "Multiple Spacecraft Per Aperture," or MSPA, is used routinely by ESA's Estrack and NASA's Deep Space networks.

Credit: A. Cardesín/ESA

However, MSPA only works one way. While it allows the ground station

to receive data from multiple spacecraft, it can only speak to one at a time.

That is, until now.

Estrack gets chatty

Ground stations are built with two transmitters, pieces of equipment used to generate and transmit electromagnetic waves (light) carrying messages or signals. Normally, stations send signals using only one transmitter at a time, and the other is there as back up in case the first breaks down.

The recent test with the New Norcia ground station, the first of its kind, saw the deep dish use both transmitters at the same time to control Mars Express and ExoMars TGO.

Normally, these two Martian orbiters receive their command signals in very similar frequencies, known as the "X-band," between 8–12 GHz, but from different stations or using one station at different times.

However, Mars Express can also receive signals in the "S-band," at a frequency of approx 2.8 GHz, which until now has been saved for emergencies.

The perfect alignment of events; two spacecraft close in the sky, able to receive telemetry signals at different wavelengths, and a deep space station able to send both telecommand signals simultaneously, made it possible to combine MSPA with "Multiple Uplink per Aperture" (MUPA), in an ESA first.

Map showing locations of ESA tracking (Estrack) stations as of 2017. Note this map is representational only and not all locations are shown with complete accuracy. Blue indicates core ESA-owned stations operated by the Estrack Network Operations Centre (NOC) located at ESA's European Space Operations Centre (ESOC), Darmstadt, Germany. Orange indicates Augmented Estrack stations, procured commercially and operated on behalf of ESA by commercial entities. Green indicates Cooperative Estrack stations owned and operated by external agencies, but regularly providing services to ESA missions on an exchange basis. The ESA tracking station at Perth, Australia, was retired from service in December 2015. The ESA stations at Villafranca and Maspalomas, Spain, were transferred to industry in 2017. Credit: European Space Agency

Why now?

Historically, there hasn't been a need to use one dish to command multiple simultaneous missions, as there wasn't such a demand on the

antennas.

However, ESA's global network of antennas, Estrack, is running at peak capacity, meaning that the antennas can't fully serve the needs of all missions until the network capacity is increased.

Deep space missions have the added problem that they require large antennas, of which there are only three (for now) in the network, located in Australia, Argentina and Malargüe.

For many years, Mars Express was one of only three spacecraft orbiting Mars. Now, the Red Planet has seven such orbiters, operated by various space agencies, with more on the way.

ESA's control center has a team dedicated to ensuring all missions get sufficient ground station time. By working out new ways of sharing ground stations, we allow more users to access current resources while new antennas are being built.

Provided by European Space Agency

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