

Galileo satellites' last step before launch

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Galileo's new 'Batch 3' satellites will add a further 12 satellites to the 26-strong Galileo constellation already in orbit. Credit: OHB

Europe's Galileo satellite navigation constellation is set to grow. Later this year the first two out of 12 "Batch 3" Galileo satellites will be launched by Soyuz from French Guiana. Their last step on the way to launch is situated beside sand dunes on the Dutch coast: the ESTEC Test Center, which is Europe's largest satellite test facility.

All but two of the 26 Galileo satellites already in orbit underwent pre-flight testing at this 3000 sq. m environmentally-controlled complex, hosting [test equipment](#) to simulate all aspects of spaceflight. The Test Center is operated and managed by [European Test Services](#) for ESA.

All 12 Batch 3 satellites—functionally similar to the Full Operational Capability satellites already in orbit—are scheduled to come here from [OHB](#) in Germany to assess their readiness for space, before heading on to French Guiana.

The first pair of these satellites were already at ESTEC when the COVID-19 pandemic began last year. Testing was briefly interrupted as the Test Center was closed, but resumed once safety measures were put in place.

Testing of this first pair was completed in April, and they are now in storage on site. Two more Galileo satellites have since arrived with another due to join them this month.

Newly-arrived satellites begin by undergoing a two-week immersion in vacuum and temperature extremes that mimic the conditions it faces in space. This 'thermal–vacuum' test takes place inside a 4.5 m-diameter stainless steel vacuum chamber called Phenix. An inner box called the 'thermal tent' has sides that are heated to simulate the Sun's radiation or cooled down by liquid nitrogen to create the chill of Sunless space.



Galileo Batch 3 satellites at OHB in Bremen. Credit: OHB

Another test involves switching on all [satellite systems](#) within the Maxwell Test Chamber, which is fitted with shielded walls blocking out all external electrical signals and spiky, radio-absorbing 'anechoic' material that line the chamber to prevent signal reflections. Kept isolated in this way as though floating in infinite space allows 'electromagnetic compatibility' testing. Each [satellite](#) is switched on to check all its systems can operate together without harmful interference.

Then, once the satellites' solar wings are fitted, which come from [Airbus Netherlands](#) in nearby Leiden, they can undergo 'mass properties testing.' This involves measuring to check their center of gravity and

mass are aligned within design specifications. The more precisely these are known, the more efficiently each satellite's orientation can be controlled with thruster firings in orbit, potentially elongating its working life by conserving propellant.

Each satellite also undergoes acoustic testing in the Large European Acoustic Facility, LEAF, effectively the largest sound system in Europe.

A quartet of noise horns are embedded in one wall of this 11-m-wide, 9-m-deep and 16.4-m-high chamber, generating sound by passing nitrogen gas through the horns, surpassing 140 decibels in all. Accelerometers placed within the satellite checked for potentially hazardous internal vibration during this trial by sound.

Once each satellite's test campaign is over, they are shipped to Europe's Spaceport in French Guiana and prepared for launch. The two tested spacecraft will leave to Kourou in October, to be launched at the end of the year.



A Galileo Full Operational Capability satellite inside the Maxwell test chamber of ESA's Test Centre in the Netherlands. Note its search and rescue antenna, left, and main navigation antenna, covered in silver 'single layer insulation' as it will be in space. Two further S-band telemetry, tracking and telecommand antennas are seen jutting out of the satellite body to its left and right sides. These 9 m-high spike-lined walls enclose the hushed interior of the chamber, isolating the satellite from all external influences to assess its electromagnetic compatibility. Once its main door is sealed, the metal walls of the chamber form a 'Faraday Cage', screening out external electromagnetic signals. The 'anechoic' foam pyramids covering its interior absorb internal signals—as well as sound—to prevent any reflection, mimicking the infinite void of space. The satellite's systems are then switched on to detect any harmful interference as its various elements operate together. Credit: ESA/OHB–S. Bury

Summer 2020 saw the start of construction of a new 350 sq. m

cleanroom for the ESTEC Test Center. Most of the time the ESTEC Test Center has several other test items as well as Galileo satellites within its walls simultaneously.

Complex planning and traffic management are necessary to ensure every project get access to the facility they need at the time they need it. So sufficient room is required to accommodate the different customers and allow their movement between [test](#) facilities.

Galileo is currently the world's most precise satellite navigation system, serving more than two billion users around the globe.

Provided by European Space Agency

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