Sentinel-1A – start of a new era in Earth observation

03 April 2014

Mapping flood events, observing oil slicks in the oceans, detecting ice distribution in the sea and measuring ground movements with millimetric precision – just some of the tasks of Sentinel-1A, the new flagship in European Earth observation. The roughly 2.3-ton, four-metre-high, two-and-a-half-metre-wide satellite was launched from the European Spaceport in French Guiana at 23:02 CEST (18:02 local time) on 3 April 2014. The launch of Sentinel-1A also marks the start of the European Union (EU) and European Space Agency (ESA) Earth observation programme called Copernicus. The DLR Space Administration is financing one third of the ESA element of the programme with funds provided by the German Federal Government.

The satellite will undergo a three-month-long commissioning phase before making its first routine data delivery in mid-year. "The radar system on the new European Earth observation satellite is one of the most powerful ever used in Earth orbit for civilian purposes. Using this instrument, which was developed and built in Germany on the basis of decades of experience, Sentinel-1A will be able to observe land and water surfaces day and night, regardless of the weather conditions. This is the start of a new era in remote sensing – consistent data collection is essential for the scientific analysis of global change," emphasised Johann-Dietrich Wörner, Chairman of the DLR Executive Board.

Flying over every point on Earth in 12 days

"With the launch of Sentinel-1A, Copernicus, the Earth observation programme of the European Union and the European Space Agency has begun. Copernicus will provide the basis for an extensive European Earth observation data system. This will create new possibilities that are also relevant for commercial use by German companies," said Gerd Gruppe, DLR Executive Board member responsible for the German Space Administration, after the successful launch.

This has also significantly improved the 'repeat cycle'; it took the environmental satellite Envisat 35 days to fly over every point on Earth once – Sentinel-1A will do it in just 12 days. When it starts working with its identical twin satellite, Sentinel-1B, which is due for launch in 2015, the cycle will be reduced to six days. The result will be new application opportunities, such as documenting oil spills in the oceans or detecting ground movements such as those caused by earthquakes or as a result of mining.

Together, the two satellites will be supporting the monitoring of land surfaces, the marine environment and shipping traffic, as well as the 'ice service' in northern European and polar seas. Each of the two satellites is expected to provide data for at least seven years. ESA's European Space Operations Centre (ESOC) in Darmstadt, Germany, will be responsible for operating the satellites.

Additional test in space – new LCT communications technology

Sentinel-1A has another special payload on board. A new communications technology, the optical Laser Communication Terminal (LCT), is being tested on the Earth observation satellite. The LCT enables much larger quantities of data than before to be sent from space to ground with no time delay. The transfer capacity is around three times as great as with conventional systems. Furthermore, using the data relay system, the transmission period can be increased from 10 to 45 minutes.

As part of this, the European communications satellite Alphasat, which was launched in July 2013, will act as a test station for data transfer using the LCT on Sentinel-1A. Sentinel-1A will

also be also the first client for the planned European 'data highway' in space, the European Data Relay System (EDRS).

Significant German participation in the ESA mission

The heart of Sentinel-1A, the radar system, was built by Airbus Defence and Space in Friedrichshafen, Germany. Germany is a leader in the area of radar technology for satellites and has proven its capabilities during a number of missions, such as Envisat, the Shuttle Radar Topography Mission (SRTM) and the German TerraSAR-X mission DLR's German Remote Sensing Data Center (Deutsches Fernerkundungsdatenzentrum; DFD) will be responsible, among other things, for tasks such as supplying the algorithms for data processing and archiving. The DLR Microwaves and Radar Institute will be responsible for calibrating the radar antenna. The LCT was built by Tesat in Backnang, Germany. The DLR Space Administration is supporting the ESA programme using funds provided by the Federal Ministry for Economic Affairs and Energy (Bundesministerium für Wirtschaft und Energie; BMWi) and the Federal Ministry for Transport and Digital Infrastructure (Bundesministerium für Verkehr und digitale Infrastruktur; BMVI).

The EU / ESA Copernicus programme

With Copernicus – formerly **G**lobal **M**onitoring for **E**nvironment and **S**ecurity (GMES) – the EU and ESA are creating a powerful and sustained Earth observation infrastructure for Europe. Under the programme, the EU is operating satellite-supported information services on land surfaces, oceans, the atmosphere, disaster management, climate change and security. At the heart of these services lie six families of satellites – the Sentinels. They are being developed by the ESA under the GMES Space Component (GSC) programme and will be operated under contract to the EU. Sentinel-2 and Sentinel-3 will follow in the coming years, marking important new milestones in the development of the Copernicus space components. The Sentinel-4, -5 and -6 missions are scheduled for launch towards the end of the decade. Satellite data from third parties, such as data from the German satellites TerraSAR-X, and , will also be incorporated into Copernicus. By enhancing current satellite missions, the Sentinels will be creating the world's most comprehensive and powerful civilian Earth observation system.

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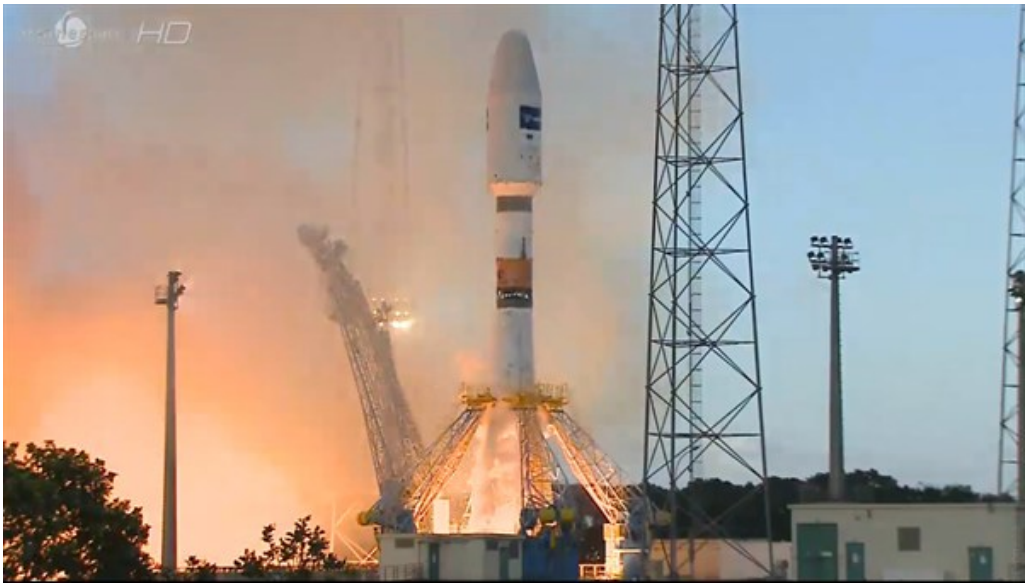
Launch of Sentinel-1A



On 3 April 2014 at 23.02 CEST, a Soyuz launch vehicle carried the Sentinel-1A satellite into orbit.

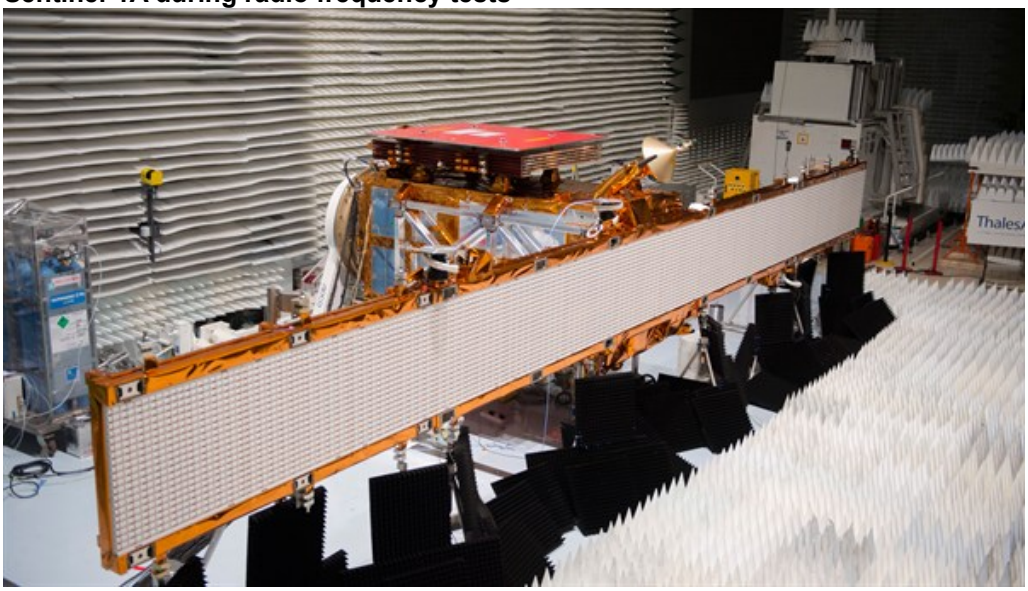
Credit: Arianespace.

Sentinel-1A in orbit

Sentinel-1A is the first satellite of the European Copernicus Earth observation programme. The rounded structure of the LCT is installed at the upper end of the satellite.

Credit: ESA.

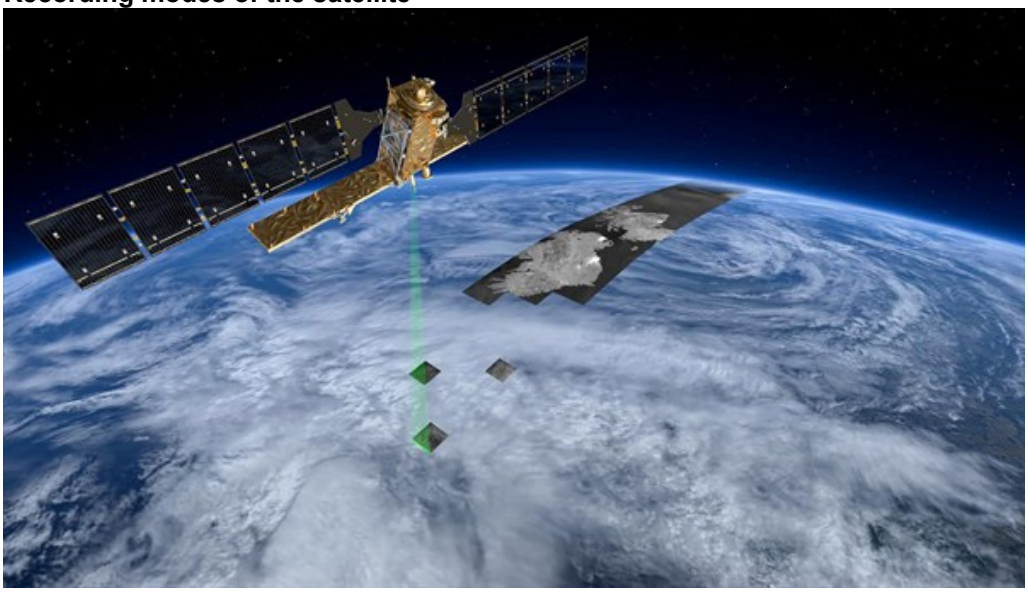
Sentinel-1A during radio frequency tests



In the test chamber, Sentinel-1A is subjected to frequency tests. The 12-metre radar antenna can be seen in the centre of the image.

Credit: ESA.

Recording modes of the satellite



The Sentinel-1A satellite is quite flexible; the SAR sensor will operate in two main modes: Interferometric Wide Swath and Wave. The Interferometric Wide Swath mode is typically used for land surfaces and the Wave mode over oceans.

Credit: ESA.

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