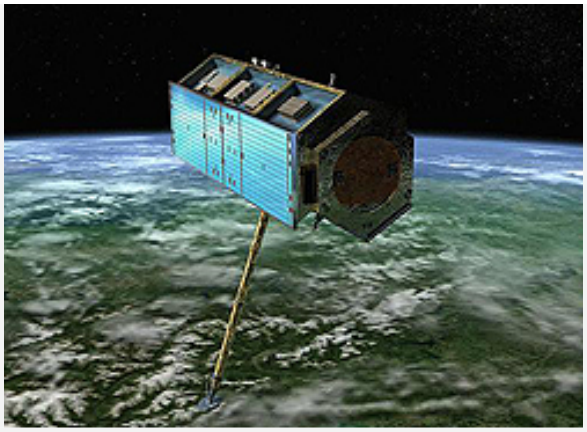
German Aerospace Center

News Archive

Two years of successful operation for Germany's TerraSAR-X, the Earth observation satellite

15 June 2009



Germany's radar satellite TerraSAR-X has now been in service for two years

TerraSAR-X, Germany's Earth observation satellite, was launched on 15 June 2007 and has gone on to have a unique and highly successful track record. In contrast to optical systems, the radar technology on this satellite enables it to record images through cloud and at night, meaning that it is able to operate continuously, right around the clock. TerraSAR-X is Germany's first radar satellite and is, at the same time, the first nationally operated remote sensing satellite, brought into being by a Public Private Partnership (PPP) between the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and Friedrichshafen-based Astrium GmbH. DLR is responsible for planning and carrying out the mission, for controlling the satellite and the radar instrument, and for the scientific use of TerraSAR-X data.

After its launch from the Russian space station at Baikonur, DLR was able to unveil the first TerraSAR-X imagery within just four days. Following this, full commissioning of the satellite and its radar instrument was completed on schedule. This meant that TerraSAR-X was able to commence operational service in early 2008. Since that time, the mission has been characterised by seamless operational performance and production output, in particular with its unique images, which have been employed in a range of scientific and commercial contexts.

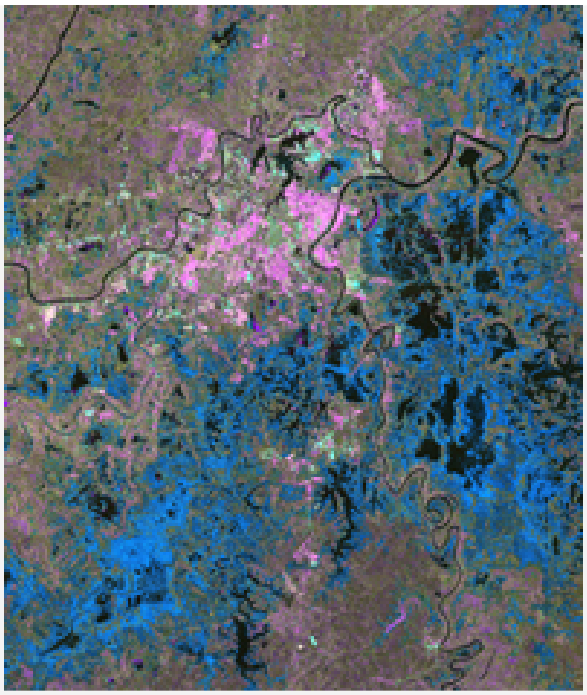
An unbeatable double: TanDEM-X and TerraSAR-X

Animation: TanDEM-X and TerraSAR-X

In October 2009, a virtually identical radar satellite, TanDEM-X, is scheduled to be launched. These two German satellites will then fly in close formation, separated by distances of between 200 metres and a few kilometres, with the new TanDEM-X satellite effectively ‘dancing’ around the TerraSAR-X. This will make it possible to produce unique and hitherto unachievable three-dimensional data products. These data will then be used to create a digital relief model of all land masses on Earth, with a precision never previously achieved.

A successful two-year track record: Satellite imaging data can be superimposed to single-pixel precision

Since the launch of the TerraSAR-X satellite, the mission control centre at DLR has produced about 35 000 radar images of the Earth's surface and has processed somewhere in the region of 50 000 high-quality products for scientific and commercial users. These results have demonstrated the high quality of products from the TerraSAR-X satellite, which, in many respects, actually outperforms the specified requirements. The good standard of geo-localisation precision, accurate to within half a metre (about 20 inches), makes it possible to superimpose two images of the same scene taken at different times fully automatically and with single-pixel precision. Other noteworthy features include the high standard of radiometric precision and the great stability of this radar instrument platform.



Radar data assist crisis management efforts during flooding in Mexico

A large number of scientific and commercial applications achievable through the use of radar technology

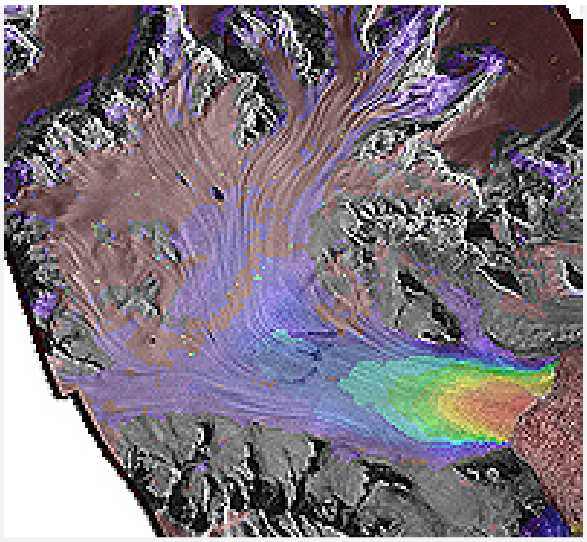
TerraSAR-X radar data can be used for a large number of scientific and commercial applications. The focus of operations is on applications such as agriculture and forestry, land usage and vegetation, the monitoring of urban areas, and cartography. Research into the icecaps and maritime applications also benefit from this data.

Rapid assistance from space when natural disasters occur

TerraSAR-X data have been used on location by international bodies on several occasions in the wake of natural disasters, supporting crisis management efforts. This support includes the mapping of flooded areas and estimates of damage resulting from earthquakes. For example, in early November 2007, several weeks of heavy rainfall caused devastating flooding in the Mexican federal states of Tabasco and Chiapas. About one million people lost their homes, including about half of the entire population of Tabasco.

About 80% of the federal state of Tabasco, a region with a total surface area of some 25 000 square kilometres, lay under water for some of this time. The DLR Centre for Satellite-Assisted Crisis Information (Zentrum für satellitengestützte Kriseninformation; ZKI) supported the Mexican National Centre for the Prevention of Disasters (CENAPRED) by providing satellite imaging maps of the flood areas. TerraSAR-X is capable, irrespective of cloud cover and time of day, of delivering high-resolution images with an accuracy of down to one metre.

Early recognition of changes and climate-related factors in the Antarctic



The Drygalski glacier on the Antarctic Peninsula

With the help of Earth observation satellite TerraSAR-X, scientists have been monitoring the loss of a giant ice bridge on the Wilkins Ice Shelf in Antarctica. The first icebergs broke off from here on 20 April 2009. These TerraSAR-X images show the 'calved' icebergs. The icebergs separated at the fracture zones that have gradually formed over the last 15 years. The high resolution of the TerraSAR-X images makes it possible to monitor deformations in the Wilkins Ice Shelf down to an accuracy of about 100 metres. This information enables glaciologists to describe this deformation more accurately with the help of models. Recently formed cracks are very narrow and therefore cannot be detected by low-resolution imagery of the kind supplied by earlier generations of satellite. High-resolution imagery of the kind supplied by TerraSAR-X is required in order to reconstruct the chronological sequence of events.

Traffic information via satellite, independent of weather and national frontiers – to forecast road congestion and to facilitate route planning

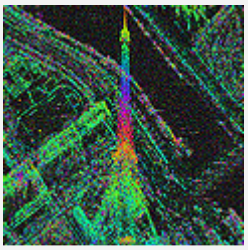
DLR is engaged in a series of tests, scheduled to last for several months, to obtain road traffic information via satellite. TerraSAR-X will be used to observe selected sections of motorway in Germany, Austria and Switzerland, as well as some major highways in California. The aim is to develop a procedure for recording traffic data over large geographical areas without the need for ground-based infrastructure and which enables data to be transmitted rapidly to traffic information services. Compared to the majority of measuring procedures, mostly involved fixed locations, satellites are capable of obtaining up-to-the-minute information, including for roads without measuring points, and to do so irrespective of weather conditions, as well as across national frontiers. This application is not restricted to the detection of traffic jams. It can, for example, be employed to calculate the average speed across sections of motorway and from that to obtain the current journey time required between individual transport nodes. This information can be used by the providers of traffic services to suggest better routes to drivers. Thanks to radar technology, they can do this even during fog, heavy precipitation and the hours of darkness. However, this technology does not make it possible to identify vehicle license plates.

Two additional payloads also in successful operation

The two additional payloads on TerraSAR-X are also working perfectly. The first of these is the Laser Communication Terminal (LCT) built by TESAT while the second is the TOR experiment (Tracking, Occultation and Ranging) supplied by the geo-research centre in Potsdam. The LCT is a technology demonstrator financed by DLR’s Space Agency, which can be used to verify the feasibility of high-speed optical data transmission in space. LCT is the first system that has enabled reproducible data interchange to be achieved between two low-altitude satellites, in this case TerraSAR-X and NFIRE, at speeds of 5.5 gigabits per second.

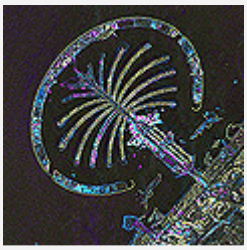
Success story of Germany's radar satellite, TerraSAR-X

Based on the experiences gained during the first two years of operation, the TerraSAR-X mission can be viewed as a success story. Indeed, high levels of recognition and admiration have been expressed by NASA, the US space agency as well as by other national space agencies, including ESA, the European Space Agency. In years to come, further results are anticipated, which look likely to raise the bar even further in terms of scientific and commercial benefits.



Area around the Eiffel Tower in Paris

Tokio River Island



Palm Island, 'The Palm Jumeirah' in Dubai

Second radar satellite – TanDEM-X – scheduled for launch in October, delivering a third dimension to data in formation flight

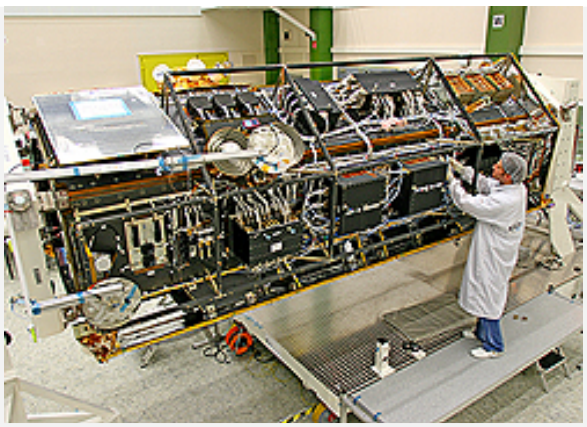
Construction work on the second, virtually identical, satellite – TanDEM-X (**T**erraSAR-X **a**dd-o**n** for **D**igital **E**levation **M**easurement) - has already been completed and the spacecraft is currently undergoing extensive tests at Astrium and IABG in Munich. It is scheduled to launch this October from the Russian space station in Baikonur. The two satellites will fly in close formation to deliver data for digital relief model of all land masses on Earth, with a standard of precision never previously achieved.

About TerraSAR-X

TerraSAR-X is the first German satellite to have been built in the context of a Public Private Partnership (PPP) between DLR and EADS Astrium GmbH. The satellite travels around the Earth in a polar orbit. This enables it to use its active antenna to take new and high-precision X-band radar images of the entire planet. TerraSAR-X operates independently of weather conditions, cloud cover and daylight hours and is capable of supplying radar data with a resolution of down to one metre.

DLR is responsible for the scientific use of TerraSAR-X data, for the planning and execution of the mission and for control of the satellite. Astrium built the satellite, and shared the costs of development and operation. Infoterra GmbH, a subsidiary company of Astrium founded specifically for this project, is responsible for the commercial marketing of TerraSAR-X data.

About TanDEM-X



TanDEM-X in the satellite integration centre

The primary objective of the TanDEM-X mission (**T**erraSAR-X **a**dd-o**n** for **D**igital **E**levation **M**easurement) is to create a global, digital physical relief model. Flying just a few hundred metres apart, these two satellites, TanDEM-X and the virtually identical TerraSAR-X, which has been in space since 2007, constitute the first configurable SAR interferometer (SAR = Synthetic Aperture Radar) in space. A powerful ground segment closely linked to that of TerraSAR-X enables this complex mission to be controlled and rounds off the TanDEM-X system. To cover the entire surface of the Earth, they will fly in a tandem formation together for a period of three years.

DLR is responsible for the commercial usage of TanDEM-X data, for the planning and execution of the mission, for control of both satellites and for generation of the digital relief model. Astrium built the satellite, and shared the costs of development and operation. As is the case with TerraSAR-X, Infoterra GmbH, a subsidiary of Astrium, is responsible for the commercial marketing of TanDEM-X data.

The TanDEM-X project is being carried out on behalf of the German Aerospace Centre (DLR) with funds from the Germany Ministry of Industry and Technology (Bundesministerium für Wirtschaft und

Technologie; BMWi) within the context of a Public-Private Partnership with Astrium GmbH bearing the reference code 50 EP 0603.

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