German Aerospace Center

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TanDEM-X sends its first images in record time

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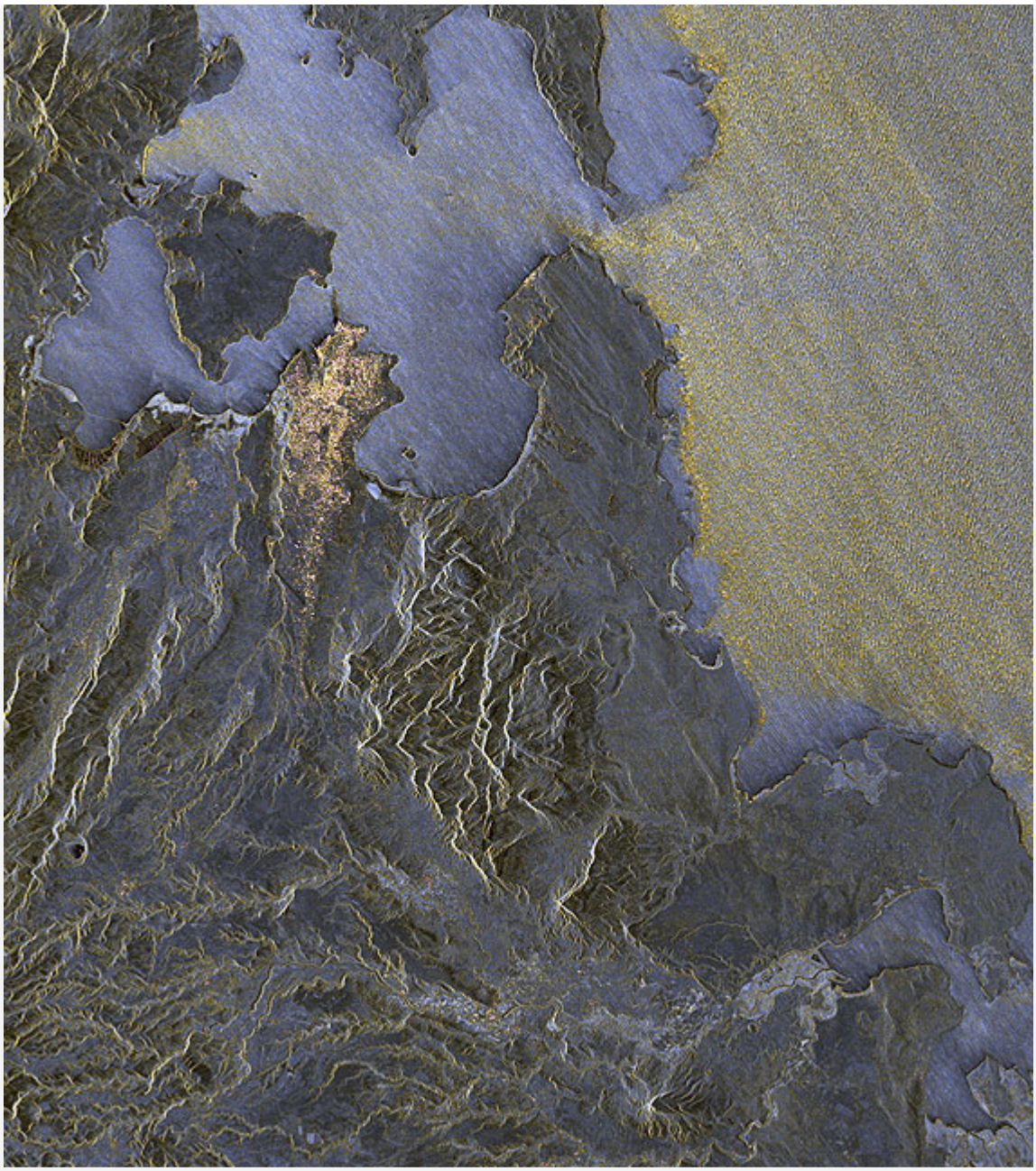
Radar satellite views of Madagascar, Ukraine and Moscow

Already, with its first image acquisitions, TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurement) has surpassed its twin satellite, TerraSAR-X. On 24 June 2010, only 3 days and 14 hours into the mission, the satellite sent its first image data back to Earth. The transmission was received by the German Aerospace Center (Deutsches Zentrum fŸr Luft- und Raumfahrt; DLR) ground station at Neustrelitz and processed to produce images. TanDEM-X looked down from an altitude of more than 500 kilometres above northern Madagascar, Ukraine and Moscow.



Madagascar seen from space

Even the ups and downs of the waves in the Indian Ocean – coloured pale yellow on the image – are charted by TanDEM-X as it flies over at a speed of seven kilometres per second. The change in the waves at the entrance to the Diego Suarez Bay is clearly visible. The water in the bay itself, on the shore of which the provincial capital, Antsiranana, can be recognised, is very flat – in contrast to the undulating ocean – and reflects the radar signals from TanDEM-X more uniformly. The area of valleys to the south drains the volcanic cone of Ambre-Bobaomby into the Indian Ocean.

Radar view of fields and forests

The data were received yesterday afternoon at around 16:55 hrs. “We have broken the world record that we set with TerraSAR-X,” says project leader Manfred Zink from DLR’s Microwaves and Radar Institute. At that time, the first reception occurred after four and a half days. For TanDEM-X, the team was ready to download data just three days and fourteen hours after the launch, which took place at 04:14 on 21 June 2010.Eight gigabytes of data reached the Neustrelitz ground station of the German Remote Sensing Data Center (Deutsche Fernerkundungsdatenzentrum). Before this, the flight dynamics team had exactly predicted the route of TanDEM-X and had derived the commands for controlling the attitude of the satellite, which were used by the instrument operations team.

Reservoirs, fields and a moving train in Ukraine

The image of Ukraine shows how a radar satellite perceives fields and forests. The satellite imaged a reservoir near the River Donets, a tributary of the Don. Forests and agricultural land surround the reservoir. These areas are worked differently, and thus exhibit differences in the way they reflect radar signals. This variable surface structure is revealed in the image by different brightness levels and colours. East of the smaller reservoirs near the centre of the image, a moving train is visible as a bright, curved line. From the offset of the train on the tracks, seen from space, it is even possible to calculate its speed.

Moscow from 500 kilometres above

At the centre of the image is Moscow’s Sheremetyevo Airport, about 30 kilometres northwest of the city centre. Terminal One, to the north, was opened on 8 November 1959 and now serves mainly domestic flights. Terminal Two, in the south, was built for the Summer Olympic Games in 1980 by German companies following the design of the terminal at Hanover Airport. Today, it deals with international flights. The two runways are clearly visible. Because the flat concrete surfaces reflect the radar signals away from the satellite, the paved areas are shown as black lines. To the north of Moscow, there are major reservoirs such as the Pirogovskoye Reservoir and the Uchinskoye Reservoir.

Moscow from 500 kilometres high

Mission milestones

“That's a neat milestone,” says a satisfied Michael Bartusch, TanDEM-X Project Manager at the DLR Space Agency in Bonn. He accompanied the satellite during transportation to Baikonur; for the launch, he sat in DLR’s German Space Operations Center (GSOC) in Oberpfaffenhofen. “With the image, we have the proof that the radar satellite works without problems.” "But of course, now we have had experience with TerraSAR-X.

With the end of the launch and early orbit phase this weekend, the TanDEM-X team begins the first part of the commissioning phase, during which the satellite is ‘put through its paces’. “It takes about three months to prepare it for operational use,” says Bartusch. By the end of July, the two satellites will be brought within 20 kilometres of one another. In October, is will be another, unique milestone: the satellites will fly in formation with a distance of only some 200 metres separating them as they orbit the Earth. This marks the second part of the commissioning phase, during which the approach and control of both satellites is in focus.

Teamwork by the two satellites

As soon as the satellites begin to record data as a combined ‘pair of eyes’, the ‘complex interactions’ begin, says project leader Michael Bartusch. The design of their orbits prevents the satellites from colliding but they must also be prevented from illuminating one another with their radar signals. “If TerraSAR-X and TanDEM-X illuminate one another during formation flight, there is a possibility of damaging the instruments at this short range.” The first official three-dimensional image acquisition by the twin satellites will occur in January 2011. “Then we will begin with measurements of the entire Earth and the generation of the elevation model.”

Public-private partnership

DLR is responsible for the scientific use of TanDEM-X data, the planning and execution of the mission, the control of the two satellites, and the production of the digital elevation model. Astrium built the satellite and is sharing the costs for its development and use. As for TerraSAR-X, Infoterra GmbH, a subsidiary of EADS Astrium, is responsible for the commercial marketing of TanDEM-X data.

The German Aerospace Center (DLR) is implementing the TanDEM-X mission with funds from the German Federal Ministry of Economics and Technology in the form of a public-private partnership with Astrium GmbH.

Contact

Manuela Braun
Deutsches Zentrum für Luft- und Raumfahrt (DLR) - German Aerospace Center
Corporate Communications
Tel: +49 2203 601-3882
Fax: +49 2203 601-3249
E-Mail: manuela.braun@dlr.de

Michael Bartusch
German Aerospace Center
Space Administration, Earth Observation
Tel: +49 228 447-589
Fax: +49 228 447-747
E-Mail: Michael.Bartusch@dlr.de

Dr.-Ing. Manfred Zink
German Aerospace Center
Microwaves and Radar Institute, Satellite SAR Systems
Tel: +49 8153 28-2356
Fax: +49 8153 28-1449
E-Mail: manfred.zink@dlr.de

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