Radar satellites aim to create most precise 3D pictures of Earth

June 22 2010, by Lin Edwards

TanDEM-X and TerraSAR-X in formation flight

(PhysOrg.com) -- A German radar satellite TanDEM-X was launched on June 21 by the German Aerospace Center (DLR) to join an identical satellite, TerraSAR-X, which was launched in 2007. The two satellites will fly in formation to create the most detailed 3D pictures of Earth ever obtained.

The 1.3 tonne satellite was launched from Baikonur Cosmodrome in Kazakhstan, atop a converted Russian intercontinental ballistic missile. It is now in a polar orbit about 514 km above the surface and very slightly

inclined to the orbit of the TerraSAR-X.

TanDEM-X, which stands for TerraSAR-X add-on for Digital Elevation Measurement, will travel on a tight helical path around its sister satellite. This is the first time two satellites have orbited in such close formation, with the minimum distance between them at only 200 meters. The pair form the first configurable synthetic aperture radar (SAR) interferometer in orbit around the Earth.

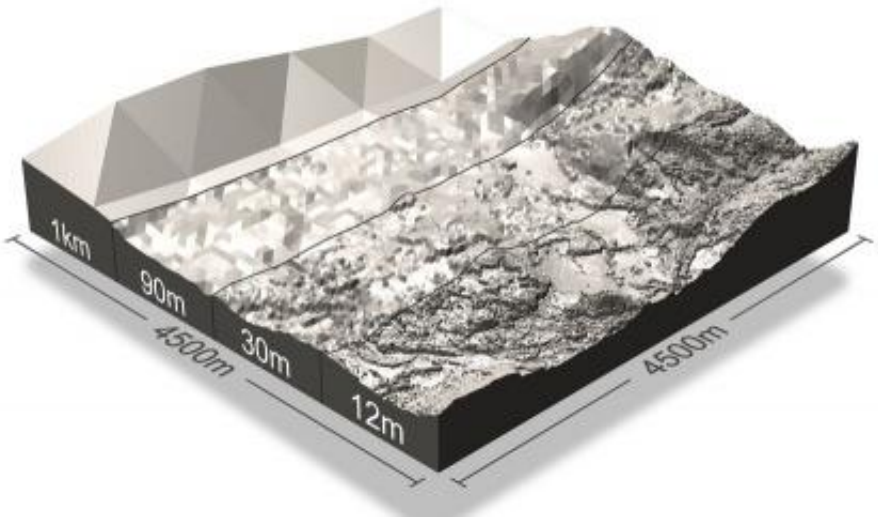
SAR interferometry gives an image of a geographical area from two positions and hence two perspectives, in a similar way to the way we obtain a 3D image from two eyes that are slightly apart. Radar is used because it can "see" through bad weather and does not require good light.

The two satellites will together achieve an accuracy of better than two meters in the variation in height and 12 x 12 meters spatial resolution. Dr Vark Helfritz from Infoterra GmbH, the image processing company, said the aim of the project is to generate a 3D model of the surface of the Earth with greater resolution and quality than is currently available. The model will also be a seamless global model rather than a "patchwork of datasets" fitted together. The entire surface of the Earth, totaling 150 million square kilometers, will be covered several times over three years of operation.

Flying in formation, TanDEM-X and TerraSAR-X

The two satellites will both bounce microwave pulses off the Earth's surface as they orbit. The time taken for the signal to return to the satellite allows the instruments to determine differences in height. Having two satellites orbiting closely together essentially gives them stereo vision, with one satellite operating as a transmitter and receiver and the other operating as a second receiver.

The data is expected to total around 15 terabytes, or the storage capacity of about 200,000 DVDs. The data will be processed at TanDEM-X facilities at O'Higgins in the Antarctic, Inuvik in Canada, and Kiruna in Sweden, and the results will be analyzed by the DLR data center in Oberpfaffenhofen. The global elevation model should be available in around four years' time.



For vast swathes of Earth, at present only rough, inconsistent, or incomplete elevation models are available from different data sources and measurement techniques. TanDEM-X will close these gaps and will provide precise elevation data in a 12-metre grid. This elevation model shows different accuracies: 1 kilometre, 90 metres, 30 metres and 12 metres (TanDEM-X). Credit: DLR.

At the launch, Professor Dr. Johann-Dietrich Wörner, DLR Chairman, said the project will be indispensible for "a great many scientific and commercial avenues of enquiry." The pictures created by the satellite pair could have military uses, allowing jet aircraft to fly at lower altitudes, and civilian uses such as locating natural resources, planning for natural disasters, and allowing mobile phone operators to determine the best locations for their masts. Pictures from TerraSAR-X have already given scientists useful information on the oil spill in the Gulf of Mexico and the eruption of Eyjafjallajökull in Iceland.

The project is a public-private partnership between DLR, Infoterra GmbH, and Astrium GmbH. The 165 million Euros for the project came from DLR (125 million Euros) and Astrium (40 million). The project will make Germany the first country to have a digital elevation model of

the Earth.