

## **The TerraSAR-X/TanDEM-X Program (Inaugural Lecture)**

M. Zink, S. Buckreiß

Microwaves and Radar Institute, German Aerospace Center (DLR), 82234 Oberpfaffenhofen, Germany,  
(manfred.zink@dlr.de, Tel.: +49 (0)8153 28 2356)

After the successful participation in the Shuttle missions SIR-C/X-SAR and SRTM, the first national SAR mission TerraSAR-X opened a new era in the German Space Programme and provided a major push for our R&D activities on high resolution X-band SAR. TerraSAR-X will be launched in June 2007 will supply high-quality radar data for purposes of scientific observation of the Earth for a period of at least five years. At the same time it is designed to satisfy the steadily growing demand of the private sector for remote sensing data in the commercial market. In this spirit, the proposal to add a second, almost identical spacecraft (TDX), to TerraSAR-X (TSX) and to fly the two satellites in a closely controlled tandem formation building a single-pass SAR-interferometer with adjustable baselines in across- and in along-track directions was born. With typical across-track baselines of 200-400m DEMs according to the High Resolution Terrain Information (HRTI)-3 standard will be generated. TerraSAR-X and TanDEM-X are being implemented in a public-private partnership between the German Aerospace Centre (DLR) and EADS Astrium GmbH.

TSX features an advanced high-resolution X-Band Synthetic Aperture Radar based on the active phased array technology which allows the operation in Spotlight-, Stripmap- and ScanSAR Mode with various polarizations. It combines the ability to acquire high resolution images for detailed analysis as well as wide swath images for overview applications. In addition, experimental modes like the Dual Receive Antenna Mode allow for full-polarimetric imaging as well as along-track interferometry, i.e. moving target identification. TDX has SAR system parameters which are fully compatible with TSX, allowing not only independent operation from TSX in a mono-static mode, but also synchronized operation (e.g. in a bi-static mode). The HELIX concept provides a save solution for the close formation flight with vertical separation of the two satellites over the poles and adjustable horizontal baselines at the ascending/descending node crossings. Beyond the generation of a global HRTI-3 DEM as the primary mission goal, local DEMs of even higher accuracy level (HRTI-4) and applications based on Along-Track Interferometry (ATI) like measurements of ocean currents, sea ice drift and glacier flow are important secondary mission objectives. Along-track interferometry will also allow for innovative applications to be explored and can be performed by the so-called dual-receive antenna mode on each of the two satellites and/or by adjusting the along-track distance between TSX and TDX to the desired value. Combining both modes will provide a highly capable along-track interferometer with four phase centers. The different ATI modes will e.g. be used for improved detection, localisation and ambiguity resolution in ground moving target indication and traffic monitoring applications. Furthermore, TanDEM-X supports new SAR techniques, with focus on multi-static SAR, polarimetric SAR interferometry, digital beam forming and super resolution.