

TanDEM-X: Mission Overview and Status

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TanDEM-X (**T**erraSAR-X **a**dd-on for **D**igital **E**levation **M**easurement) opens a new era in space borne radar remote sensing. A single-pass SAR-interferometer with adjustable baselines in across- and in along-track directions is formed by adding a second (TDX), almost identical spacecraft, to TerraSAR-X (TSX) and flying the two satellites in a closely controlled formation. 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). With typical across-track baselines of 200-400m DEMs with 2m relative height accuracy at a 12 m posting will be generated. 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.

DEMs are of fundamental importance for a broad range of scientific and commercial applications. For example, many geoscience areas like hydrology, glaciology, forestry, geology, oceanography and land environment require precise and up-to-date information about the Earth's surface and its topography. Digital maps are also a prerequisite for reliable navigation, and improvements in their precision needs to keep step with the advances in global positioning systems. Beyond the generation of the global TanDEM-X DEM as the primary mission goal, local DEMs of even higher accuracy level 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.

This paper presents the TanDEM-X system and its orbit formation and operational modes, provides a summary of the global acquisition strategy and the predicted DEM generation performance and gives an overview of new SAR techniques and applications which will be demonstrated with this first bi-static SAR formation in space.