Case Study

Change Detection

Reliable Construction Monitoring with TerraSAR-X

Challenge

In 2011, the construction of Belo Monte Dam (upon completion this will be the third largest dam in the world), commenced in the state of Pará in Brazil. The dam is intended to be a complex of three dams retaining the water of the Xingu River in two large water reservoirs covering nearly 1,000km^2.

In the case of such a construction project located in a difficult area, and of a large extent, frequent on-site monitoring can be challenging, time-consuming and costly. Satellite imagery can be utilised to monitor this broad area and deliver information on the construction progress and changes such as forest clearance, levelling works, construction of access roads, storage and housing facilities, thus complementing on-site observations. Due to the location of the construction site (in the Amazon rainforest) monitoring with optical satellite imagery can frequently be hindered by cloud-coverage particularly in the rainy season.

Large construction projects need to be regularly monitored to ensure operational safety, effectively manage the progress of the project (particularly if subcontractors are involved), fulfil regulatory obligations and assess any potential environmental impact.

Additionally political and social instability or danger from local wildlife can make systematic observation of the site necessary.

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Solution & Results

The Geo-Intelligence experts of Airbus Defence and Space tasked the high-resolution TerraSAR-X satellite to regularly record data in different imaging modes over the Belo Monte Dam area. Thanks to the sensor's weather independence, frequent revisit capacity and high geo-location accuracy, TerraSAR-X is ideally suited for change detection and monitoring of remote and cloud-covered areas.

The TerraSAR-X data acquired was analysed applying Amplitude Change Detection methodologies. For this, images with identical acquisition geometry recorded at different dates are combined in a colour composite: Areas not affected by changes remain black and white, areas subject to change are highlighted in colour. StripMap imagery with 3m resolution and a scene size of 1,500km^2 provided a broad overview of larger scale changes of the water channels and reservoirs, infrastructure construction works and large excavation areas. Staring SpotLight acquisitions from TerraSAR-X were then utilised to zoom-in on the areas with significant changes to investigate these in more detail. This imaging mode with the highest commercially available resolution of up to only 25cm, allows the mapping, monitoring and analysis of very small scale changes. The analysis of the Staring SpotLight data applying Amplitude Change Detection techniques revealed a wealth of detail about the construction works (building of worker's housing, material and tools storage) and related activities (excavations, vehicle movement) as well as changes to the surrounding environment (vegetation change due to water table change, clear cuts).

Benefits

• Reliable information from the smallest detail to the full picture
• TerraSAR-X's unrivalled geo-location accuracy supports highly precise change detection and monitoring

• Automated processing techniques enable rapid and cost-effective solutions
• Improved monitoring frequency with the upcoming TerraSAR-X / PAZ constellation (2015)
• Ideal complementarity with optical imagery
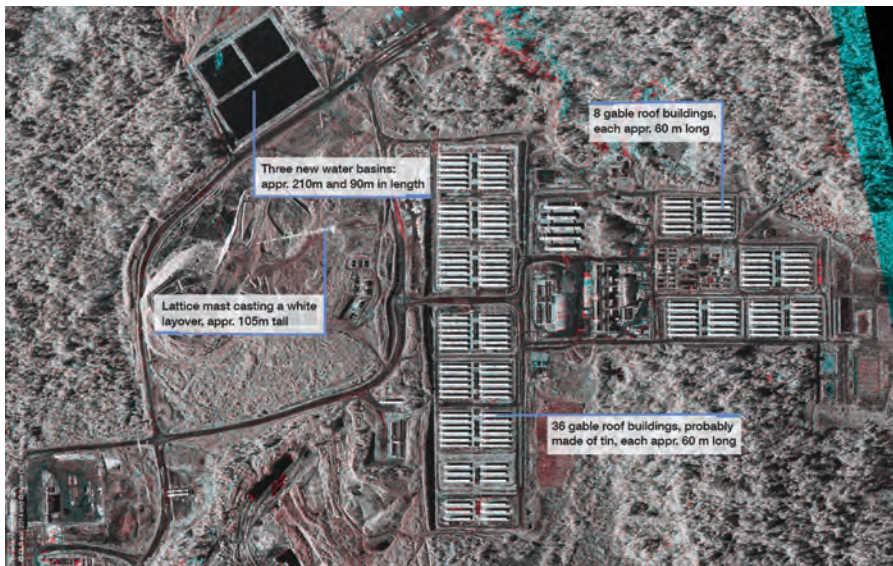
Analysis of construction of workers housing and infrastructure buildings in TerraSAR-X Staring SpotLight imagery

Challenge Change detection and monitoring of activities in difficult, remote and hazardous areas

Solution & Results TerraSAR-X data provides timely and accurate terrain information for wide-area overview as well as detailed small-scale observation

Benefits TerraSAR-X based observation of the progress and impact of activities supports a targeted monitoring approach reducing the need for on-site inspections and facilitates informed decision making with reduced costs

Applicability

TerraSAR-X data facilitates the reliable monitoring of construction projects - independent of location and weather conditions - thus supporting operational safety and informed decision making. TerraSAR-X data can also deliver valuable information for other stages of civil engineering projects such as feasibility or design studies, risk or environmental impact modelling as well as resource management.

For further information about our services for Change Detection, contact us at:
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