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elevation

The XYZs of Digital Elevation Technologies

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Geospatial solutions

GPS WORLD

Image courtesy of Intermap Technologies

ADVANSTAR COMMUNICATIONS

project showcase

When the *Geospatial Solutions* staff issued a call for participation in this Project Showcase, we were thrilled with the results. We selected the following entries for publication as they most succinctly demonstrated the benefits of elevation data and the diverse areas in which such data can be applied.

DTMs for Thames Flood Model

The escalating cost of rebuilding after floods has prompted the insurance industry to seek improved tools for calculating flood risks. British companies insuring properties in England's Thames River valley now rely on a large-scale flood risk–assessment model based on elevation data acquired by airborne interferometric synthetic aperture radar (IFSAR).

Our proprietary IFSAR system, developed in Englewood, Colorado, proved particularly adept at floodplain mapping, primarily because of its simultaneous acquisition of digital elevation models (DEMs) with 1-meter vertical accuracy at a 5-meter posting and orthorectified imagery with 2.5-meter resolution.

While both of these datasets provide key inputs for flood models, IFSAR also appealed because it can acquire data for nearly 2,000 square kilometers per day, which contributes to a low cost-per-kilometer price tag. The acquisition rate results from our system's high operating altitude, above 20,000 feet, and radar's ability to operate in darkness and clouds.

IFSAR was ideal for mapping the flood-prone Thames River. Insurance companies had used flood models for decades to calculate flood risk and to work with local authorities in minimizing flood hazards. With development growing along the river, the insurance industry hired Willis, a London-based risk-consulting firm, to create a more accurate model in 1998.

Regional assessment models with the desired detail were lacking because there had been no cost-effective source of highly accurate elevation data for an area as large as the Thames floodplain, roughly 14,000 square kilometers. Willis considered several cutting-edge technologies as sources of elevation data.

Commercial satellite imagery did not offer the desired resolution and required two passes on different days to collect the stereo-imagery needed for elevation extraction. LIDAR was attractive for its accuracy and one-pass *Z*-value acquisition, but its economics were not feasible for such a large geographic area.

Our system not only satisfied both the data quality and financial parameters, but it also provided orthoimagery. Willis was able to generate land-cover maps from the radar images and derive surface roughness coefficients, important variables in flood models.

The system operates by emitting microwave radar pulses that reflect off the ground and return to the device. Two onboard antennas record the reflected beams. By measuring the phase difference in the return signals between the antennas and combining it with GPS-derived aircraft position data, the system determines elevation values for each ground point at 5-meter spacing. Coregistered radar imagery is also generated in the process.

To create the above flood model — which is centered on Hyde Park and the Thames River — Intermap draped a colorized radar image over a shaded relief of a digital surface model.

Because IFSAR collects point data for all surface features, such as trees and houses, we were able to apply our proprietary bare-earth processing software to the Thames data to strip away these features. The resulting DEM product, a digital terrain model (DTM), contained only elevation points for the ground surface, a necessity in flood modeling.

We are currently collecting 158,700 kilometers of high-resolution terrain elevation data for all of England and Wales and some of Scotland, all part of the NEXTMap Britain Program that will provide customers with highly accurate DEMs, including digital surface models (DSMs) and DTMs.

The ground surface will be modeled in detail, as an elevation point will be provided every 5 meters. The whole country will be covered using technology that provides a 1-meter vertical resolution. In urban and selected flood-prone areas, a second set of mapping data will be provided using our newest technology, which produces a vertical accuracy of 50 centimeters.

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