TopoSys Streamlines True Digital Orthos and 3-D City Models Creation

TopoSys (Germany) has developed a line of turnkey, Lidar/Imaging systems and software that provides a fast, cost-effective solution to gather, process and generate final deliverables such as true digital orthos and digital 3D city models.

Unlike with conventional ortho-images, true ortho-images correctly project vertical walls of buildings, and rooflines are not offset. To accomplish this, image data is blended with the elevation model through simultaneous acquisition by the TopoSys Lidar/Imaging systems. This capacity to synchronously acquire and record digital image data in four spectral channels-utilising high-point-density Lidar-eliminates leaning edges and allows all captured objects to be computed in their proper positions.

With achievable point densities from between ten to forty points per square meter, plus overlapping measurements and a consistent, specific scan pattern, the precise classification of objects such as buildings, railways, power line cables and other structures becomes routine. The simultaneous acquisition and recording of very accurate, high-point-density digital elevation data, as well as the associated colour information from the imagery, places all captured objects in their spatially correct positions absent leaning edges.

The generation of a 3D city model involves the conversion of aerial Lidar and image data to vector data as a means of generating 3D block models and roof forms. True ortho-imagery is a fundamental building block in the generation of 2D building footprints, which are then extruded to building height and roof shape as defined by Lidar data. Building facades are then superimposed on the models for photorealistic representation and visualisation.
Small- and medium-sized cites are increasingly providing RFPs for 3D city models. These municipalities recognise that Lidar and image data are ideally suited for the creation of accurate 3D city models, thereby positioning buildings and other infrastructure details in their proper places.

The four-band, multispectral true ortho-imagery allows the skilled technician to analyse spectral reflections of vegetation and non-vegetative materials, plus pervious and impervious surfaces, and similar land-use and land-cover dynamics.

All three sensor systems are complemented by TopPIT, the Lidar processing software developed by TopoSys to support hardware-specific pre-processing and streamline data for DEM and true ortho-image production. Output values under TopPIT include LAS, ASCII, and ESRI shape files. It co-registers RGB/CIR imagery together with LiDAR data and uses the DEM to rectify "true" orthophotos in a single flow of production within the TopPIT process.

Image data initially arrives in uncorrected form in individual strips, which are then rectified and geo-referenced with the aid of the elevation model. To create true ortho-images, image data is blended with the elevation model from the Lidar data recorded synchronously with that image data. A presentation in true ortho-image projection is achieved by the use of the digital surface model. Unlike in conventional ortho-images, vertical walls of buildings are projected accurately and rooflines are not offset. These single strips are then radiometrically balanced by way of adjusting the statistical brightness and contrast, and then combined to form a homogeneous image mosaic.

The digital elevation model generated from laser data and RGBI scanner files, synchronised with the flight position data, serve as input for ortho-image computations. In addition to the ortho-image computation of the flight strips, the geocoding of the measurement points is directly performed. This results in a high-resolution ortho-image in the state plane coordinate system, resolution in the range of 0.2-0.5 meters, plus four spectral channels: blue = 450nm-490nm; green = 500nm-580nm; red = 580nm-660nm; and near-infrared = 770nm-890nm. Since the production process is automated, data can be turned around rapidly.