High-resolution geospatial collection

CASE STUDY

Military deploys airborne, high-resolution geospatial collection system to support tactical operations

Customer: U.S. Army, Topographic Engineering Center

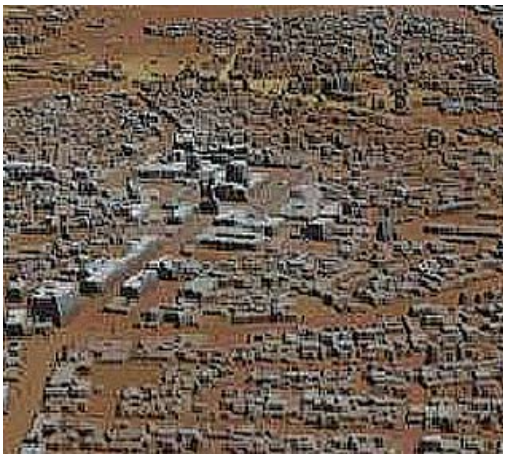
Industry: Defense Operations

Background
The Topographic Engineering Center (TEC) is a branch of the U.S. Army tasked with research and development for the U.S. Army Corps of Engineers. Topographic engineering specialists at TEC are involved in programs that support the collection, processing, and delivery of high-resolution topographic and geospatial data for tactical missions such as intelligence, surveillance, and reconnaissance (ISR), disaster relief, and humanitarian efforts.

The challenge
Today's military operations demand the best resources for comprehensive situational awareness and decision support. Up-to-the-minute data that provides intelligence on terrain and field conditions is critical to mission planning, rehearsal, and execution. Consequently, the U.S. Army has a vested interest in deploying reliable tools for protecting ground forces against unanticipated hazards on common operational routes. This is of the utmost importance to ensure that food, water, fuel, and supplies are transported safely.

The opportunity
Through extensive research and development funded by various programs, TEC provides resources to assist troops during active operations. The staff has many years of experience both on the front lines, and working in the geospatial data production environment. Therefore, they are well positioned to develop and update workflows as needed, employing the latest technology and equipment such as light detection and ranging (LIDAR), high-resolution cameras, and sophisticated software applications.

The solution
In 2004, to address the need for field-expedient change detection capabilities to improve the speed of command, the TEC team developed BuckEye, an airborne digital imaging system that captures imagery and generates high-resolution geospatial data for use during tactical missions. The system includes a digital color camera and a LIDAR sensor to collect elevation data. A laptop computer controls the sensor and monitors data acquisition while in flight. It operates at a range of altitudes, depending on the required image resolution, swath width, and LIDAR point density — a variety of configurations can meet each tactical requirement — and is capable of acquiring more than 100 square kilometers of data per day. The combination of imagery and LIDAR makes it easier to produce precise, high-resolution digital elevation models of urban areas for strategic operations.



BuckEye LIDAR elevation model

The BuckEye Imagery/LIDAR system in Iraq is centrally controlled to support the entire theater. It has collected more than 12,000 square kilometers of data, primarily over urban areas, but also along main supply routes. This revolutionary data set includes over 400 tiles of LIDAR elevation data at 10 meter resolution that now covers most Iraqi cities.

BuckEye evolved quickly from the initial prototype, based on electro-optical (EO) sensing, to a system using both high-resolution EO imagery and LIDAR point clouds to produce precise elevation data for optimal terrain visualization. The 22-megapixel digital camera, scientifically calibrated so that radial and decentering distortion can be compensated during data processing, has 9 µm pixels and produces color imagery with 16 bits per band. Color images are downloaded, decompressed, georeferenced, triangulated, orthorectified, and mosaicked.

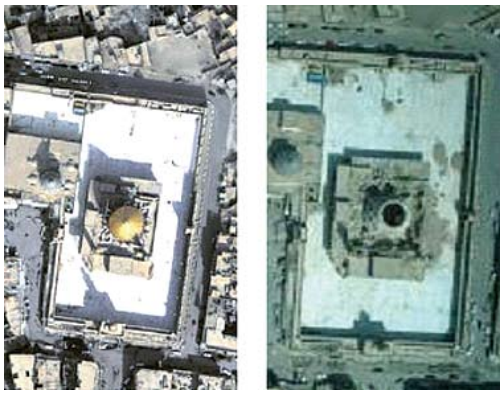
Under contract with TEC, BAE Systems is leading a team of analysts who use SOCET SET®, the premier photogrammetry software application, to accomplish complex image processing steps, and to produce large scale maps and terrain elevation models. Recognized for its powerful functionality, SOCET SET performs softcopy aerotriangulation, elevation data processing, image dodging and balancing, orthorectification, and mosaicking. Its batch import functionality can process more than 500,000 images, while other automated features, such as automatic tie point measurement, supplemental control point measurement from LIDAR intensity images, bundle block adjustment, blunder detection, orthomosaic generation, and seamline generation and feathering, are all instrumental in expediting production. In addition, BAE Systems provides support services such as project planning, execution, and quality control.

After the data is processed and verified for quality, it is indexed and posted to secure networks or delivered on DVD. Other products available for download from these secure networks are GeoPDF files, 3D flythroughs, and high-resolution Urban Tactical Planner. All BuckEye products are unclassified, and the data is available to troops in the field as well as all Department of Defense networks.

BuckEye is especially well suited for unmanned aircraft. Ongoing developments will add a thermal infrared (IR) sensor and the resultant EO/LIDAR/IR integrated system will be capable of operating on a variety of manned and unmanned platforms.

Conclusion

TEC continues work on the BuckEye system, with new applications in development to deliver more advanced 3D mapping products. Much of this work is possible because of advances in the GIS industry, such as cost-effective, high-volume orthophoto production, and other new mapping features offered by SOCET SET software, which streamline image processing steps. Moreover, in recent years, TEC has been able to move from research and development to prototyping, testing, and rapid implementation, due to improved software and automated processes. To verify feasibility, developments are tested in the field and deployed on active missions, including Operation Iraqi Freedom and Operation Enduring Freedom, enabling the U.S. armed forces to share highly accurate geospatial intelligence faster among a larger group of people than ever before.



BuckEye change detection

BuckEye systems were first deployed in support of Operation Iraqi Freedom in late 2004, operated by TEC personnel. The helicopter-mounted camera systems are embedded at the brigade level, giving the ground commander the ability to employ the system to best support tactical operations. During the Iraqi elections, BuckEye was used to help increase security by capturing imagery over a defined geographic area.