Aviation safety and efficiency

CASE STUDY

Remote sensing satellite operator assists national agency to provide safer, fuel-efficient arrival and departure procedures for Latin American airfields

Customer: GeoEye™/U.S. Trade and Development Agency (US-TDA) on behalf of Latin American Civil Aviation Commission (LACAC)

Industry: Commercial Air Transportation

The challenge
As cities develop rapidly around large airfields, new man-made obstacles become increasingly hazardous to aircraft. Rising fuel costs have pushed commercial airlines to search for more fuel-efficient routes in and out of airfields. Consequently, accurate data and maps must be created to document current terrain, obstacles, and up-to-date airfield features resulting from new construction. Air traffic controllers use the information to help pilots exercise safe approaches and take-offs.

In the role of primary contractor, GeoEye, the largest operator of commercial earth imaging satellites in the world, based in Dulles, Virginia, was contracted by the US-TDA on behalf of LACAC to collect and document terrain, obstacles and features for some of the most hazardous airfields in Latin America. The goal was to aid in the development of safer and more fuel-efficient airfield arrival and departure procedures for the region.

The opportunity
Due to the high cost of road and railway construction and maintenance, as well as significant distances between major population centers, commercial air travel is a mainstay of Latin America. The US-TDA funds projects around the world to improve transportation infrastructure and other lines of communication in the developing world. Each national Civil Aviation Commission (CAC) in South America is also a member of LACAC, which works with organizations such as US-TDA to achieve improvements in Latin America.

The evaluation
In the past, traditional ground survey methods used to document terrain, obstacles and features were both slow and costly, while survey equipment was difficult to transport. Results were inconsistent due to extreme differences in survey expertise, methodologies, equipment, and, in some countries, security threats from activist groups. This is complicated by significant natural obstacles such as mountains, lakes, rivers, forests and adverse climatic conditions.

GeoEye provides imagery and innovative geospatial image processing services to customers worldwide. Its vast digital archive includes a wealth of satellite and aerial imagery. Using SOCET SET®, the industry-leading photogrammetry and geospatial analysis software package from BAE Systems, GeoEye operators extracted all of the relevant airfield features: runways, taxiways, ramps and aprons, parking positions, and significant airfield buildings. Source data was provided by single-orbit, in-track stereo image pairs, collected by GeoEye's IKONOS® satellite.

Airfields identified for GeoEye evaluation

"We have used ClearFlite® for many years in all of our DoD and commercial airport mapping programs. For a single solution that supports mapping of terrain, obstacles, and airport features, nothing beats ClearFlite."

Dejan Damjanovic
Program Manager, GeoEye

The solution
Once the entire set of airfield features had been collected into ESRI® shapefiles for each airfield, SOCET SET was used to create digital elevation models. The final step took advantage of SOCET SET's ClearFlite module to collect terrain, obstacles, and features that penetrated the Obstruction Identification Surface (OIS), which is designed to ensure safe maneuvering around airfields.

ClearFlite is an airfield obstruction identification tool that computes the data and generates an OIS model, saving time and allowing analysts to operate in real-time stereo mode to identify obstructions. ClearFlite creates the 3D OIS automatically from the digitized runway endpoints, or from known coordinates, and superimposes the surface on to the georeferenced stereo imagery. The 3D OIS defines the obstruction area, and, based on runway length, includes the following surfaces: approach, primary, inner and outer horizontal, conical and transition. Objects that penetrate the OIS are vertical obstructions. Different zones and surfaces are defined for NGA, the FAA and ICAO. This information can also be collected in the form of ESRI shapefile, MicroStation® or AutoCAD formats.

After GeoEye operators had collected airfield terrain, obstacles and features, the GPS/GNSS Procedures were constructed, which make use of the GPS, GLONASS or GALILEO constellations of geo-positioning satellites. GPS/GNSS Procedures provide a framework for safe, fuel-efficient routes for approaches and take-offs. For this project, Innovative Solutions International (ISI) provided the GPS/GNSS Procedures. ISI's expertise is providing all phases of communication, navigation, and surveillance/air traffic management, from planning to implementation.

Finally, each completed procedure was flight-tested on a revenue-free flight by a major U.S. airline to ensure that aircraft could operate with adequate safety margins while using more direct routes to save time and fuel, and increase the number of flights per hour.

Conclusion
Collectively, SOCET SET and ClearFlite software, along with IKONOS stereo image pairs, offer an accurate and efficient means of collecting data and identifying airfield obstructions using photogrammetry rather than traditional airfield survey methods. Air operators worldwide benefit from increased safety procedures, thanks to the updated surveys. In addition, new, enhanced GPS/GNSS Procedures contribute to more efficient flight patterns, and, ultimately, reduced fuel costs.

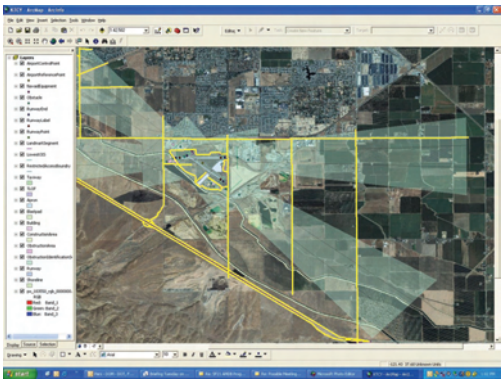
Furthermore, ClearFlite is flexible enough to perform obstacle analysis for:
– FAA TERPS Part 77 obstacles
– FAA, ANA obstacles
– ICAO PANS-OPS obstacles
– Specialized surfaces for government and military customers

Airfield planimetric features – runways, taxiways, aprons, parking positions, ramps, buildings, perimeters, and painted features such as centerlines and runway markings.

Terrain – the surface of the ground in the vicinity of the airfield, which is used as part of the obstacle survey to ensure that it does not penetrate the OIS, as in the example below.

Vertical obstacles – point, line or polygon features in the vicinity of the airfield; these are used as part of the survey, to ensure that obstacles do not penetrate the OIS as in the example below.

Viru Viru International Airfield, Santa Cruz, Bolivia – ICAO Code SLVR


Example of a GPS/GNSS Obstacle survey for a U.S. airfield