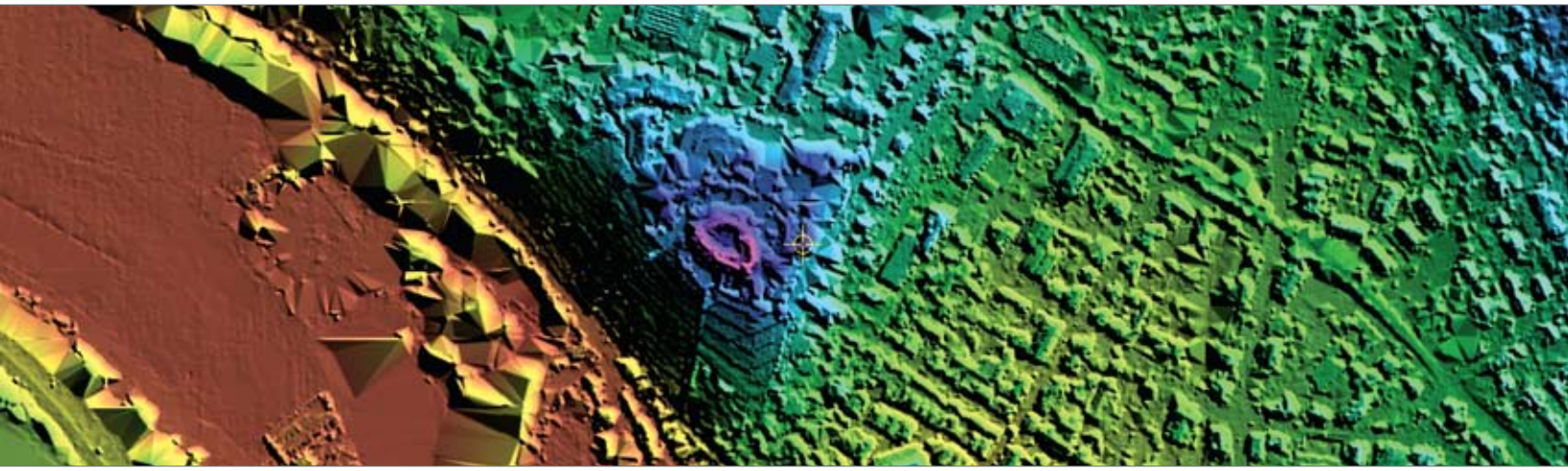
SOCET SET®



Overview

SOCET SET®, BAE Systems' digital mapping software application, is used for precision photogrammetry and geospatial analysis. The software is renowned for its unequaled depth, performance, and ability to ingest data from numerous government and commercial image sources. SOCET SET works with the latest airborne digital sensors and includes innovative point-matching algorithms for multi-sensor triangulation. It offers powerful functionality for triangulation, DEM extraction, orthorectification, mosaicking, and feature collection. Moreover, these capabilities reduce labor hours through optimized, end-to-end workflows, resulting in significant cost savings throughout the mapping process.

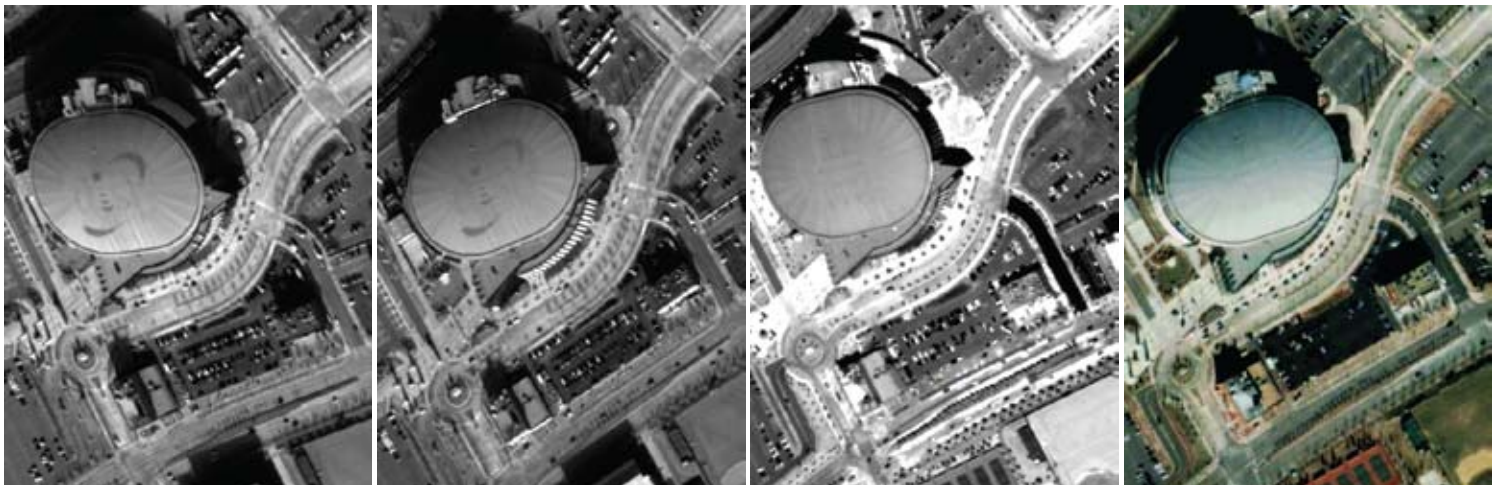
Customers worldwide use SOCET SET to create accurate, high-resolution digital terrain and surface models, image maps, 3D visualizations, GIS databases, and more. Its incomparable accuracy comes from the image sensor modeling process, which uses rigorous mathematical models to associate points on an image with their real-world locations.

SOCET SET also exploits film, digital airborne, satellite, and terrestrial imagery. The software can combine different sources within one project, giving the user maximum flexibility to meet mapping goals. In addition, users can batch-process operations to increase productivity, including distributed processing on networked computers using the Condor® application.

SOCET SET's solid architecture, numerous data formats and sensor models, unmatched algorithms, and rich feature set are the product of more than 25 years of development. This versatile photogrammetry tool tackles large projects with ease, allowing users to streamline tedious, routine digital mapping tasks and optimize their workflows. The data collected and produced by SOCET SET can be exported in various formats for end users, or for input to other applications. These raster and vector products, derived from many different image sources, are widely used throughout the mapping, GIS, remote sensing, visualization, and simulation communities.

Multiple sensors

– SOCET SET supports multiple image sources with an unrivaled range of data formats.
– Satellite image sources: WorldView-1, QuickBird, EROS B, FORMOSAT-2, IKONOS®, OrbView-3, SPOT, LANDSAT, Radarsat, NTM, ALOS PRISM, TerraSAR-X, COSMO-SkyMed, and others; new sensor models added with each release.
– Airborne image sources from scanned film and digital imagery: ADS40, DMC, DSS, UltraCam, and most other aerial frame and panoramic sensors.
– Native image formats: SOCET SET recognizes leading image formats such as: TIFF, NITF, JPEG 2000, JPEG, and GeoTIFF.
– Simultaneous use of multiple sensors, sensor models, and associated image formats for exploitation, triangulation, and product generation.



From left to right: WorldView-1 stereo pair in NCDRD format and QuickBird Basic Image, courtesy of DigitalGlobe™; IKONOS pan-sharpened RPC image, courtesy of GeoEye®.

Triangulation and point measurement

SOCET SET has a precise image control process that allows for incomparable accuracy

– Rigorous mathematical models are used to associate points on an image with their real-world locations.
– The Automatic Point Measurement (APM) module allows for tie points to be generated and measured with unmatched speed and accuracy, even in conditions where multi-sensor or multi-temporal imagery is used.
– The Interactive Point Measurement module allows manual and semi-automatic measurement of tie, control, and check points with multiple viewports, including stereo.
– The Multi-Sensor Triangulation module enables simultaneous image registration by adjusting image metadata from multiple sources for exceptional speed and accuracy.
– Satellite ephemeris metadata and airborne GPS/IMU data aid the image control process.

Multiple image display for manual and semi-automatic point measurement and review, including graphics for diagnosis of the overall triangution solution.

Terrain and surface modeling

Create digital terrain models (DTM) and digital surface models (DSM) automatically with numerous tools for editing and quality assurance

Input and output terrain sources
– SOCET SET can import DTED®, ASCII, ArcGrid®, GeoTIFF, NITF, LAS LIDAR, GSI, Intermap BIL, USGS DEM, NED, and SDTS formats.
– Terrain database accommodates billions of points; suited to LIDAR data or photogrammetrically derived terrain models.
– Generates LIDAR intensity images during import.

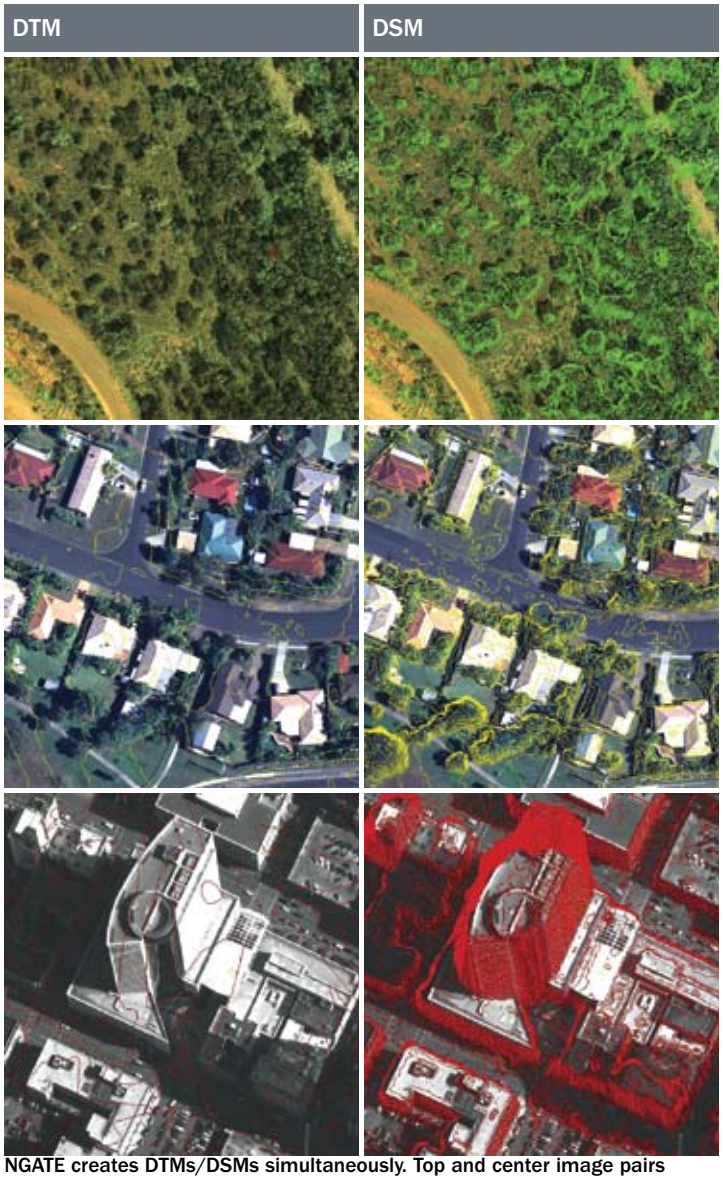
Automatic Terrain Extraction (ATE) module
Provides a fully automated capability to extract elevation data from stereo imagery.

Next-Generation Automatic Terrain Extraction (NGATE) module
Technically advanced module for automatic DTM/DSM generation featuring radical new algorithms based on a combination of area and edge matching; allows for terrain and surface modeling down to the image pixel level.
– Each pixel is matched many times, resulting in a dense and accurate point cloud which resembles LIDAR data.
– Simultaneous creation of DTMs/DSMs.
– Uses breaklines and mass points in a triangulated irregular network (TIN) data storage format.

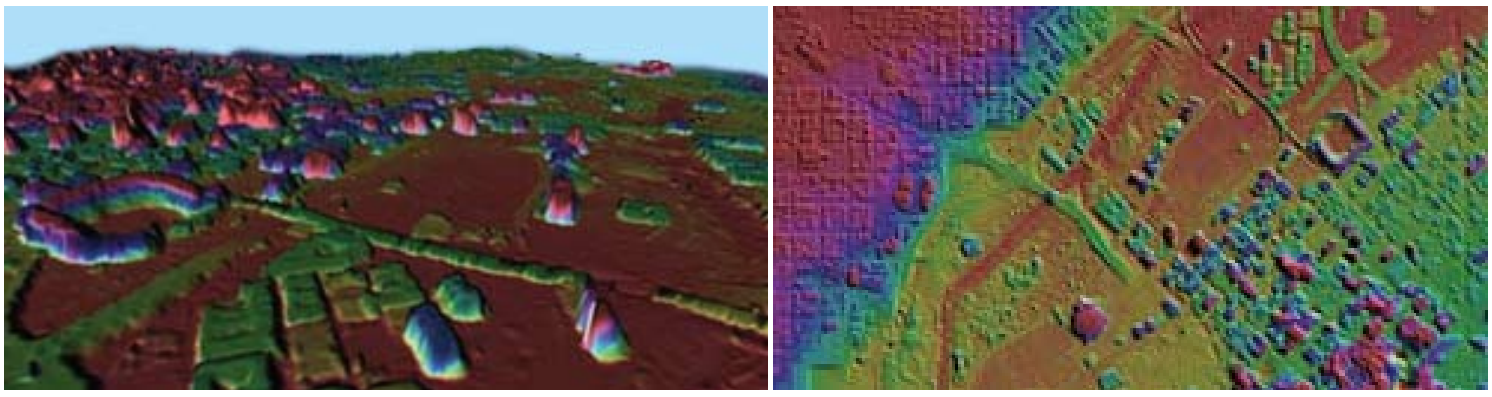
Interactive Terrain Editor (ITE) module
Enables users to visualize and correct elevation models with an unsurpassed set of tools and graphical display of choices using stereo imagery.
– Adaptive tools for TIN and grid data storage formats.
– Point, geomorphic line, and area tools.
– Huge range of bare-earth tools for removal of trees and buildings for productive generation of DTMs from DSMs.
– All tools applicable to LIDAR point clouds or photogrammetrically derived DSMs.

Terrain/Feature Merge module
Combines multiple elevation data sets and optional vector data into a single output file in either TIN or grid data storage format.

Quality assurance
Statistical comparison of DTMs and DSMs with control source points or other DTMs/DSMs.



NGATE creates DTMs/DSMs simultaneously. Top and center image pairs courtesy of AAMHatch. Bottom image pair courtesy of HJW GeoSpatial.


One-meter DSMs created using NGATE from 0.5 m GSD WorldView-1 stereo imagery. Both models are of the same area; image on left is a perspective view of part of the terrain shaded relief image on the right.

Feature collection and update

Interactive vector extraction for ESRI® ArcGIS® or stand-alone environments with tools for enhanced productivity

SOCET for ArcGIS (SFA)® module: SOCET SET photogrammetric accuracy and stereoscopic viewing combined with data extraction within the ArcGIS environment

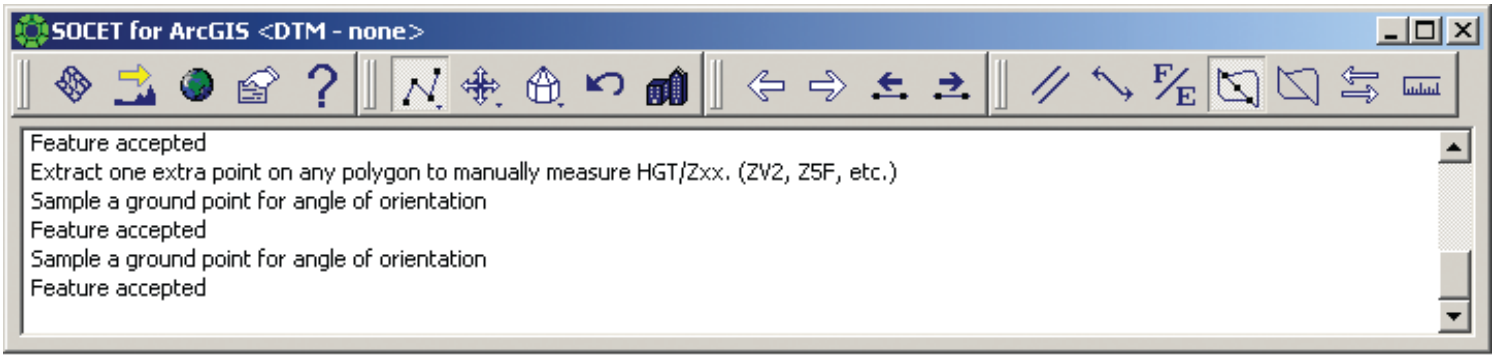
– 3D information is captured directly in the ESRI® environment with the SOCET SET connection to ArcMap®.
– Choice of using ArcMap or SOCET SET Sketch tools for 3D feature collection.
– Manual and automatic attribution.
– SFA/ArcMap interface allows connection with the geodatabase, whether personal or multi-user, and allows for versioning.
– Products produced for general public use: planimetric data, utilities infrastructure and inventory, resource management geodatabases, land management geodatabases, emergency planning geodatabases.
– Products produced for defense customers: NGA products such as urban feature data, topographic line maps, lines of communication, digital, aeronautical, and flip charts.

Feature Extraction module: vector capture and attribution

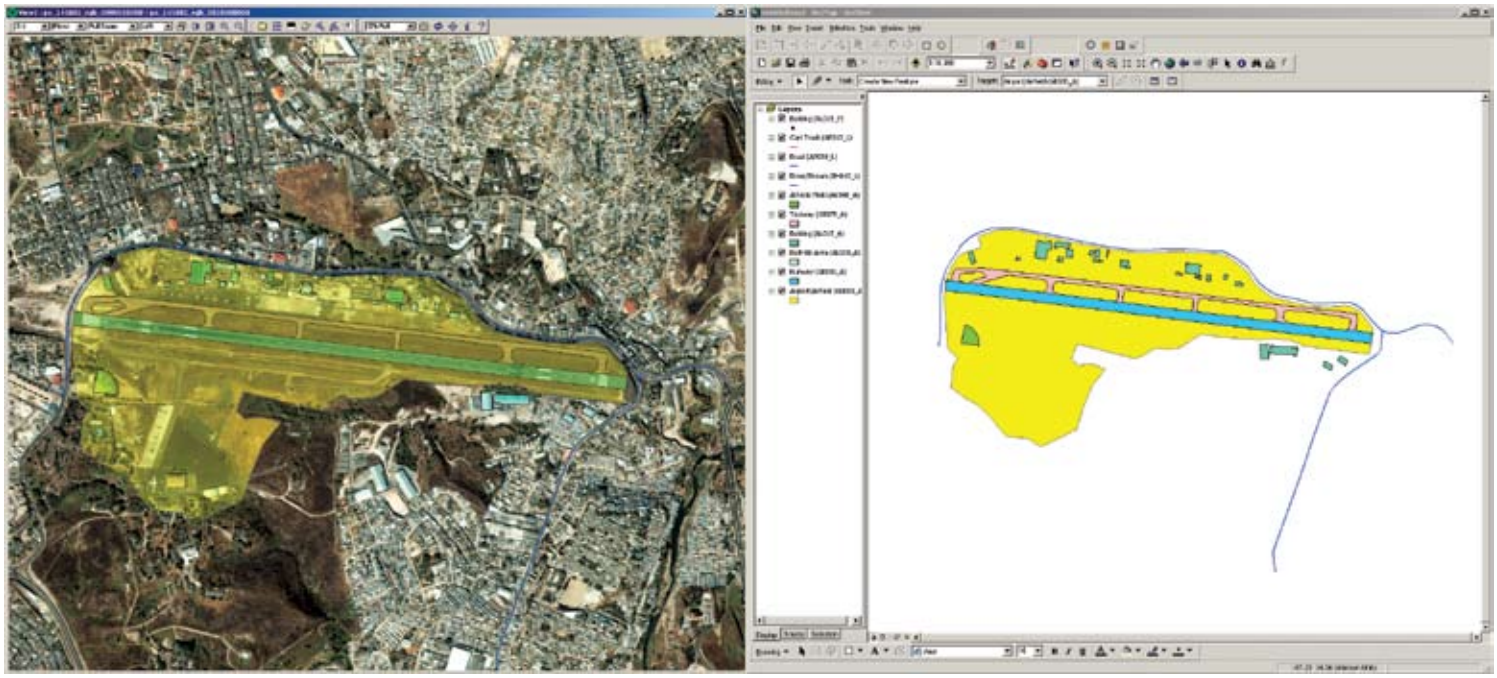
– 3D information is captured into a SOCET SET feature database using SOCET SET Sketch tools.
– Manual and automatic attribution.
– Import/export: shapefiles, DXF or ASCII.
– Volumetric feature extraction: Easy-to-use tools for creating common building roof types and for loading terrain — buildings can be rendered into visualization/simulation packages with texturing applied during SOCET SET OpenFlight™ export.

UrbanModeler™ module: designed specifically for creating volumetric 3D urban models

– Templates and cue cards streamline 3D collection.
– Special volumetric topology tools: snap to roof, grouping, snap to face, and vertex sharing.
– 3D viewer dynamically updates with edits.
– Visual attribution.
– Export to OpenFlight, SOCET SET feature database, and shapefiles.



SOCET SET Sketch tools are used internally for SOCET SET Feature Extraction, Seamline Editing, and Interactive Terrain Extraction, as well as externally in SFA allowing expanded capability for ArcMap by providing enhanced 3D extraction and editing capabilities.



SOCET for ArcGIS. IKONOS image courtesy of GeoEye®.

Ortho and image products

The Ortho module offers flexible, efficient functionality for producing color-balanced orthophotos and broad area mosaics

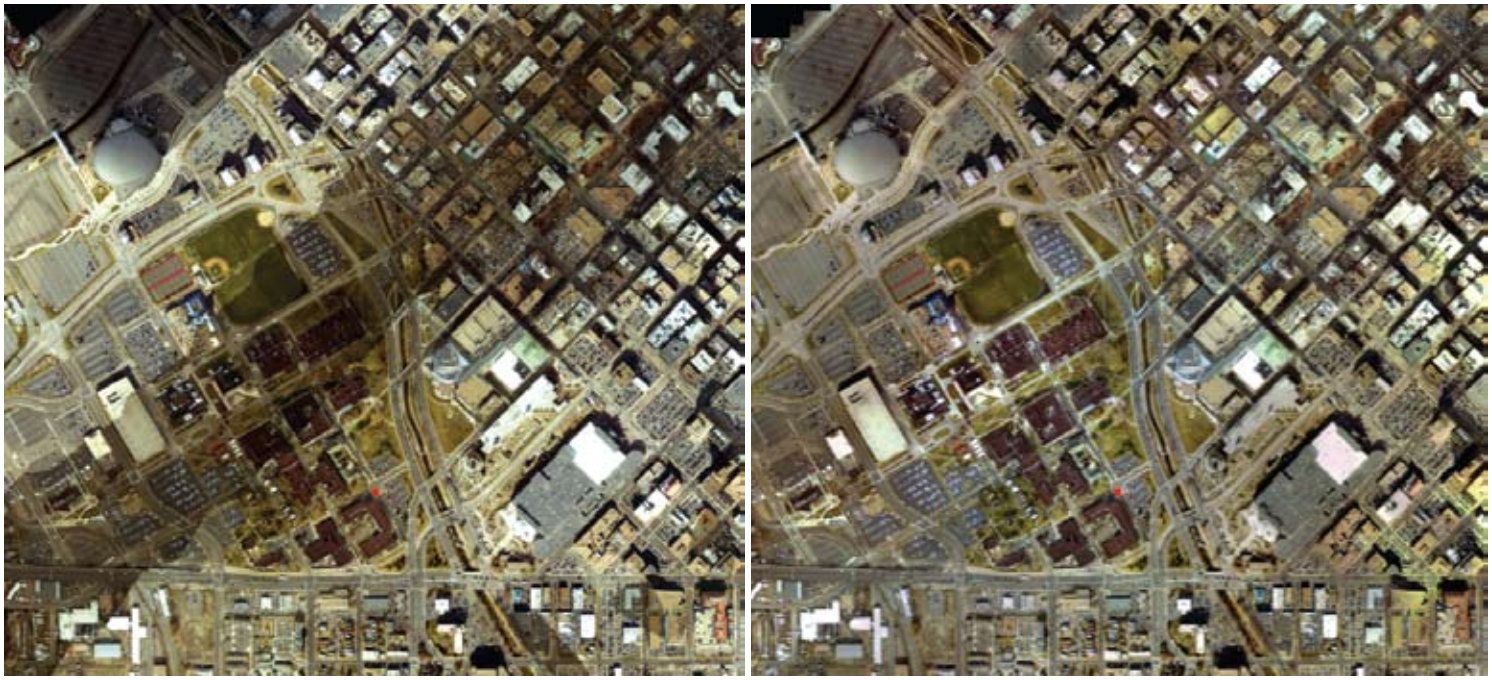
Orthomosaic
Create sheets or large area coverage orthomosaic products.
– Automatic seamline options.
– Image balance correction for brightness and contrast variations due to hot spots, vignetting, differences in scanner quality or settings, different film types, and images acquired at different times of the day or year.
– Color matching using band ratios, localized corrections and global balancing.
– Pixel void fill.
– Feathering and smoothing operations applied along seamlines.
– Seamline editing.

True orthophoto
Corrects for displacements of buildings, bridges, or other surfaces caused by features not lying on the terrain surface.

Ortho-stereomate
Creates a stereomate for an orthophoto with options for creating left or right stereomate and the amount of vertical exaggeration, thus allowing stereo visualization of an orthophoto.

Orthophoto pansharpening
Allows low-resolution color images to be merged with high-resolution panchromatic images, resulting in a colorized, high-resolution orthophoto.

Change detection
Two raw images can be compared with input terrain for proper pixel registration, resulting in a finished, orthorectified image with changes highlighted.



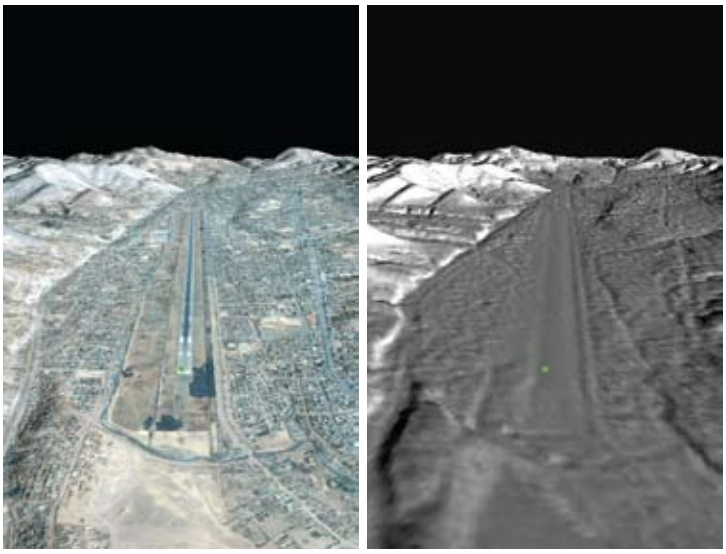
From left, raw and color-balanced orthomosaics of approximately 300 digital frame images.

Scene visualization

SOCET SET terrain and feature datasets can be exported for use in many commercial, real-time visual simulation applications by using the OpenFlight output capability

– OpenFlight output exports SOCET SET database files in the MultiGen OpenFlight format.
  • Supports multiple levels of detail, degrees of freedom, and sound — both within a file and to external files — replication, animation sequences, bounding volumes for real-time culling, scene lighting features, light points and light point strings, transparency, texture mapping, material properties, and other features.
– SOCET SET database files can consist of any combination of feature data, terrain data, or image data.
– Features and terrain are automatically textured with imagery using ray-tracing techniques for determining the “best” image for texturing.
  • True orthos are best used for texturing terrain.
  • Off-nadir imagery is best used for texturing buildings.
– Option for exporting shapefiles with associated project file (*.prj), which contains datum and coordinate system information.

Stereo IKONOS image pair with superimposed graphics identifying areas of interest for interactive extraction and attribution of vertical obstructions. IKONOS images courtesy of GeoEye.



Two perspective runway views showing the NGATE-derived surface model draped over the IKONOS image (left) and as a grayscale shaded relief image. IKONOS images courtesy of GeoEye.

ClearFlite® module

Vertical obstruction identification for airfields

- Documents features and vertical obstructions that could cause safety problems for aircraft.
- Enables viewing of zones and obstruction surfaces to identify objects penetrating above the stereoscopic imagery.
- Identifies zones and obstruction surfaces for different governing agencies such as the FAA, NGA, and ICAO.
- Automatically creates surfaces and performs obstacle analysis for:
  - FAA TERPS Part 77.
  - FAA, ANA.
  - ICAO PANS-OPS.
  - Specialized surfaces for government and military customers.
- Automatically identifies obstructions that penetrate the various obstruction surfaces using DSM from sources such as NGATE and LIDAR.
- Manual collection and editing of 3D volumetric features, points, lines, and polygons using visual cues from stereo and cursor color for data above or below the Obstruction Identification Surface.

Additional products

- DataThruWay® (DTW): import and sensor modeling for government image sources.
- DPPDB Format Production Module*: generate DPPDB-like products from NTM or commercial sources.
- CIB Format Production Module*: generate CIB-like products from NTM or commercial sources.
- Mapping, charting, and geodetic feature specifications for extraction and attribution of features consistent with the Feature Attribute Coding Catalog to support mapping products such as Topographic Line Maps and City Graphic.

Additional highlights

- Condor distributed processing for reduced-resolution data-set generation, ATE, NGATE, and Mosaic, as well as specific functions for DPPDB-like and CIB-like generation.
- Developer's Toolkit (DevKit) lets users write custom scripts; plug-in sensor models allow third-party developers to integrate multiple custom sensor models with SOCET SET.
- Integrated with VrOne® from Cardinal Systems, LLC for vector collection, editing, batch processing, and translation to popular vector formats such as DGN and DXF.
- Integrated with BINGO for frame imagery triangulation; extremely efficient with very large projects — capable of processing blocks of more than 20,000 photos; supports GPS/IMU self-calibration; extensive tools for graphical analysis and blunder elimination.
- Batch-processing capabilities for many modules such as APM, ATE, NGATE, Ortho, and Dodger.
- Rectifies on the fly.
- Supports PC (Microsoft® Windows® XP, Vista® **) and UNIX® (Sun Microsystems® Solaris™ 10).
- Multiple license servers can be defined for query by SOCET SET applications.
- Documentation: user's manual, sysadmin manual, online help system, Web discussion forums.
- First-class support engineers, available via e-mail, telephone, or fax; online access to all patches and product information; training classes at our facilities or yours.

* SOCET SET Digital Point Positioning Data Base (DPPDB) format production module [which uses MIL-PRF-89034, March 1999 format specifi cations] and SOCET SET Controlled Image Base® (CIB) format production module [which uses MIL-PRF-89041, 15 May 1999 format specifications]

** Effective May 2008, Microsoft Vista does not support quad-buffered stereo, which is used by SOCET SET for stereo viewing

SOCET GXP®

The union of image analysis, geospatial analysis, photogrammetry, and mapping within a single product

In keeping with BAE Systems' vision that analysis and mapping tasks are merging into a single market, SOCET SET's photogrammetric strength is being integrated into one end-to-end software package. SOCET GXP® combines image analysis and geospatial production (photogrammetry) tools into one flexible, user-friendly software package.

Today, image analysts need the capability to extract accurate geospatial information, while geospatial analysts and mapping professionals require increased ease of use and additional analysis tools. BAE Systems has listened to existing and prospective users who must learn and operate as many as six different software products — and organizations and commands are looking for time and cost savings across the board. This new product architecture, the foundation for the comprehensive SOCET GXP application, addresses these issues.

SOCET GXP captures the geospatial production strengths of SOCET SET, which reflects more than more than 1,000 labor years of development. The SOCET GXP architecture is scalable and highly configurable so that customers can buy specific functionality for their requirements. Like SOCET SET, SOCET GXP offers the same appearance, performance, user experience, and software baseline for UNIX and Windows, ensuring ease of use among multiple workstations.

Transitioning from SOCET SET to SOCET GXP

Current SOCET SET customers already benefit from an integrated suite of tools to manage their geospatial information infrastructure. SOCET GXP is the next-generation software suite that incorporates the latest technology, user feedback, and top-notch support to get customers up and running quickly.

Users who have not yet transitioned to SOCET GXP can run both systems until it is convenient to migrate to the new product. SOCET SET customers with current Upgrade Entitlement automatically receive a copy of SOCET GXP.

Implementing a new system involves a significant investment in time and resources. BAE Systems will provide patches and technical support for SOCET SET during the transition period. Using intuitive tools and shortcuts for most tasks, customers realize the benefits immediately. New users have expressed overwhelming satisfaction with SOCET GXP's intuitive interface and automated, pushbutton functionality for complex processing steps, all of which contribute to efficient workflows and significant time savings.

Foundation for the future

SOCET GXP offers a solid foundation users can build on well into the future as requirements change and organizations evolve. By implementing an advanced technology infrastructure, BAE Systems is empowering organizations to embrace a long-term solution that consolidates resources, reduces operating and maintenance costs, and increases productivity.

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