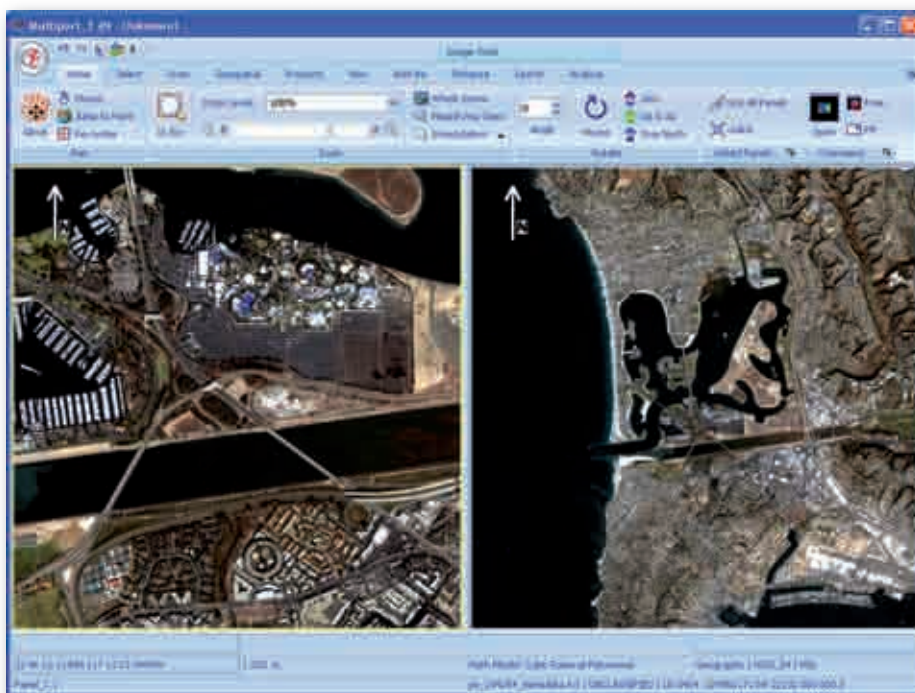


# SOCET GXP v3.0

## Geospatial-intelligence Software

*In the past few decades, the GIS industry has feasted on a proliferation of specialty software packages designed to accomplish every task imaginable to increase productivity. Technology has taken the tradecraft from tenured professionals, leaving them little choice but to become proficient with a myriad of computer-based tools and devices to stay competitive. With so many options, new paradigms to digest, and long hours logged to learn new products, it was only a matter of time until a next-generation software package would make its debut, eclipsing those that came before it to introduce a new way of working with geospatial data: SOCET GXP v3.0.*

By Carolyn Gordon



*The Ribbon user interface provides access to additional options related to the functional group on which it is located, with advanced functionality related to that group.*

### eXtreme Analysis with SOCET GXP v3.0

BAE Systems' SOCET GXP v3.0 software represents the convergence of image analysis and geospatial analysis in one software package for diverse uses — from finding beach landing sites for combat troops to helping land the Mars Rover. It moves away from a task-based model that requires individual specialty products to a comprehensive solution that facilitates the completion of end-to-end workflows. The company calls this fusion of functionality eXtreme Analysis, or XA.

XA empowers individuals to satisfy multiple analysis and mapping tasks quickly and efficiently, reducing the dependency on multiple tools. SOCET GXP makes it possible for a broad

range of personnel, trained and untrained, military and civilian, to use the same product to build, view, and analyze geospatial-intelligence information. It consolidates image exploitation, geospatial production, and mapping tasks, and establishes the basis for future feature extraction and analysis.

A customizable interface and extensive network of user-defined preferences allow individuals and system administrators to organize the desktop environment according to specific workflows. Users can connect to Google Earth and the ESRI geodatabase to create, store, and share geographic information, and to export geographically-rich image data and finished map products such as PowerPoint slides and GeoPDF files directly from the SOCET GXP

workspace. The GeoPDF format, gaining popularity in the GIS and geospatial-intelligence communities, is an invaluable resource. Anyone with access to the Adobe Reader can view, mark up, or configure geographic attributes contained in an image or map generated with SOCET GXP from a desktop computer. The PDF document maintains predominant features and coordinates, yet compresses the file to a size suitable for transmission via email, portable drive or shared network. With this technology, customers can share geospatial assets with users in the field, regardless of their physical location and technology, facilitating interoperability and collaboration.

SOCET GXP is designed to simplify workflows and make the software easy to use for new and veteran users. Tools for image analysis, 3D simulation, and targeting are particularly helpful for homeland defense or military intelligence missions, while pushbutton functionality for orthorectification, triangulation, mosaicking, and digital terrain model generation benefits geospatial analysts and photogrammetrists.

The software processes data from a variety of image sources and creates products that can be compressed and saved in multiple formats. Data and reports can be e-mailed and accessed from mobile laptop computers, relay stations, and ground control centers. Products generated from SOCET GXP include topographic image maps, 3D models with realistic geographic context, and target charts.

Another advantage of SOCET GXP that is critical to many customers is that it offers the same appearance, performance, user experience, and software baseline for both UNIX and Windows, for ease of use among multiple workstations. By providing all of the required functionality in one product with a single user interface, BAE Systems empowers organizations to consolidate resources and increase productivity. The SOCET GXP architecture is scalable and highly

configurable so that customers can buy specific functionality to meet their requirements. While a particular organization may have several configurations or software bundles in place, all of the software functions with the same underlying architecture and user interface. The single user interface eliminates the problem encountered by customers today, who have to use several different software packages to accomplish their tasks. Some of them use as many as six packages, often unrelated or loosely integrated, and cannot possibly be trained well enough on each one to take full advantage of its capabilities. By minimizing the number of software packages required, SOCET GXP users can streamline training, reduce integration and O&M costs, simplify licensing and customer support, and increase productivity.

### The Transformation of an Industry

Several years ago, BAE Systems observed a transformation in the geospatial-intelligence and GIS disciplines. Image analysts who traditionally used electronic light tables for analyzing satellite and aerial images needed a user-friendly software application for extracting accurate geospatial information, while photogrammetrists, cartographers, and geospatial production teams were looking for an image-analysis tool to simplify rigorous processing tasks, and improve productivity. With successful software products in both markets, the company forged ahead to develop a comprehensive, scalable application to satisfy image analysis and geospatial production requirements.

At that time, BAE Systems offered two distinct software products — the VITec electronic light table (VITec ELT), a UNIX-based system for image viewing, analysis, and exploitation, and SOCET SET, a versatile photogrammetry suite for precision 3D mapping, feature collection, and digital terrain generation. The close association BAE Systems had with VITec ELT and SOCET SET users was instrumental in understanding the needs of each audience. In 2004 the vision became a reality with the release of SOCET GXP, a next-generation image analysis

*By minimizing the number of software packages required, SOCET GXP users can streamline training, reduce integration and O&M costs, simplify licensing and customer support, and increase productivity.*

and geospatial production application. SOCET SET's photogrammetric strengths are being transferred to SOCET GXP and enhanced by SOCET GXP's fresh architecture and productive user interface. The combined strengths of VITec ELT and SOCET SET are the basis for eXtreme Analysis. Rigorous sensor modeling, a hallmark of the SOCET SET application, is available in SOCET GXP, which makes it possible for users to combine imagery from several sensors — commercial, defense, airborne, and customer-defined plug-in sensor models — in one project for comprehensive analysis. With the implementation of a new graphical user interface, most tasks are initiated with a few mouse-clicks, and the workspace can be organized according to individual or organizational preferences for maximum ease of use.

### SOCET GXP — a Closer Look

SOCET GXP uses imagery from numerous image sources to identify and analyze ground features. Analysts can automatically measure, annotate, store, and retrieve the features in a series of images to expedite geospatial production, image analysis, and map creation. The information is used to monitor changes over time, aid in disaster relief and recovery, develop transportation, utilities and communications networks, coordinate surveillance missions, and designate troop maneuvers. In field or crisis situations, first responders and deployed forces depend on up-to-the-

minute information to make critical decisions. Real-time image analysis, automated geospatial production, mapping, and 3D visualization can be accomplished using SOCET GXP's pushbutton functionality. Sophisticated new algorithms, developed by BAE Systems' research and development teams, automate complex tasks. Typically, these end-to-end workflows require several specialty packages and a series of manual operations. However, SOCET GXP manages tedious image processing steps automatically. The rigorous mathematical calculations are executed behind the scenes, freeing users to focus on other tasks.

### User Interface

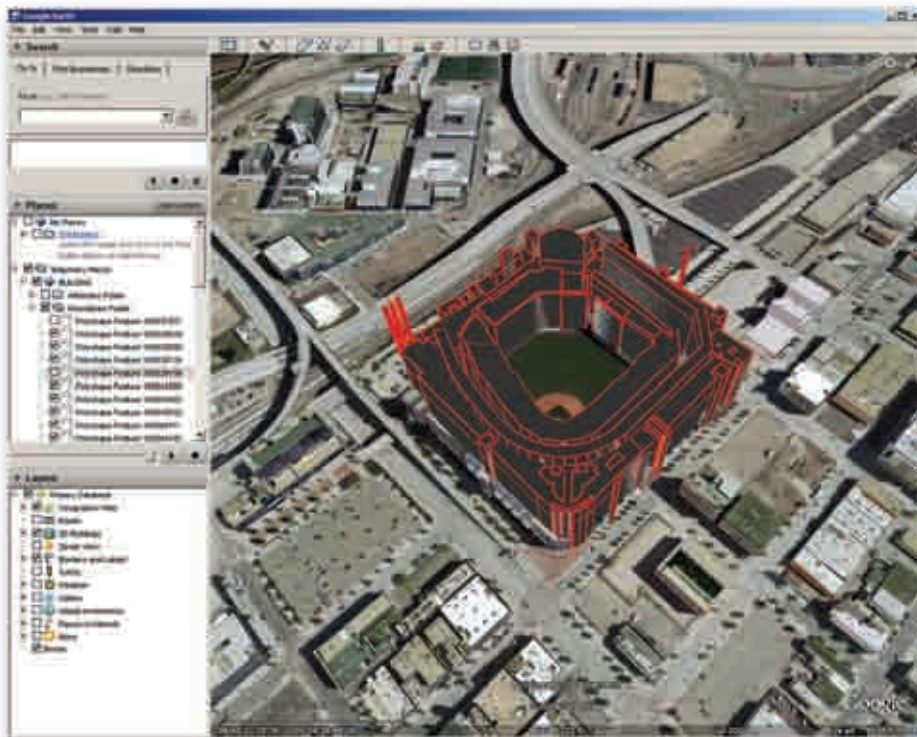
SOCET GXP v3.0 replaces a traditional menu and toolbar system with The Ribbon, the main component of a new user interface that organizes tools by tabs that correspond to each task. The Ribbon displays tools when needed, and hides them when not in use to avoid cluttering the desktop environment. It uses contextualization to simplify the number of choices available at any given time. The implementation of this flexible interface is based on the Microsoft Office Fluent user interface, designed to save time, help individuals access all functionality available in an application, and provide a scalable platform to build on for the future.

SOCET GXP v3.0 is the first commercial, end-to-end geospatial information management application to implement the Microsoft Office Fluent user interface. Users who have tested the software like the increased flexibility, workspace customization, and accessibility to SOCET GXP's versatile toolset.

Microsoft invested more than three years of research and development and millions of dollars in the new user interface design. They analyzed over 3 billion data sessions collected from Microsoft Office software users; conducted surveys and usability studies; built hundreds of conceptual prototypes; and experimented with new designs through customer site deployments and beta programs. Today, most of the software Microsoft devel-



SOCET GXP v3.0 features an updated interface designed to simplify workflows and make the software easy to use for every kind of task. Some tabs are contextual and appear only when relevant to the current task.



Users can connect to Google Earth in real time to locate and preview images geospatially. Feature layers can be toggled on and off as needed.

ops includes the new user interface, and a number of other companies have adopted it for their applications. Thus, the Microsoft Office Fluent user interface is well on its way to becoming the standard user interface for large-scale applications.

#### **XA and Change Detection**

With eXtreme Analysis tools for detecting changes from one day to the next, analysts can anticipate conditions such as rough terrain or collapsed bridges and pinpoint operational routes more accurately. The application produces image graphics — such as roads, buildings, and targets — using a ground coordinate system that records latitude, longitude, and elevation data, eliminating the need for manual registration.

#### **ESRI Database Connectivity**

SOCET GXP provides a direct connection to the ESRI geodatabase, the Environmental Systems Research Institute's common data storage and management framework. The Spatially Enabled Exploitation add-on module uses familiar tools and universal file formats to edit, store, and retrieve information, avoiding time-consuming searches for hard-copy reports. Analysts use this module to identify an object, define, annotate, and classify that object, and then store a record of its pixel composition directly in an ESRI geodatabase. These smart vectors can then be queried in a variety of ways. Ordinarily, vector data is collected when text-

based reports are created, but not saved in a format that facilitates quick retrieval based on temporal and geographic attributes. To ensure accurate image alignment over time, it is critical to store data using ground coordinates, resulting in ground space graphics — using precise image coordinates and sensor models to reference graphics to their corresponding geographic locations. Therefore, graphics are always aligned properly on sequential images captured over time. As new imagery arrives, it can be registered in the same coordinate system as previous images, so fresh information can be exploited in time series analyses with earlier collections. This functionality makes SOCET GXP unique in the marketplace.

Other advantages of direct SOCET GXP and ESRI geodatabase connectivity include remote access by multiple users, versioning, and security. The availability of this online connection to a geospatial database within a software environment provides analysts with a wide range of powerful tools including coordinate systems and sensor models, image import, and photogrammetric functionality such as triangulation, elevation extraction, orthorectification, and visualization. Connection with the database allows users to work with data over secure networks for accurate, timely analysis.

#### **Google Earth**

Google Earth is a popular 3D color visualization and discovery tool used in tandem with

SOCET GXP to aid change detection and situational awareness. Google Earth synchronizes with the location of an image open in the SOCET GXP application to provide geospatial context. Alternating between the applications, views update dynamically. Large geographic regions are scanned for an area of interest or specific location. Next, annotations, features, and graphics are added to form the basis of an intelligence report. The information can be exported as an image footprint for Google Earth, a PowerPoint slide, or a GeoPDF file.

#### **Automated Photogrammetry**

A digital terrain model (DTM) is one of the most important 3D geospatial data types. One of the key automation technologies in soft-copy photogrammetry is to generate a DTM automatically. The most reliable and widely used algorithm for DTM generation is normalized image correlation. However, this algorithm has limitations when dealing with elevation discontinuities such as building edges, because it is based on the assumption that elevation within a window rarely changes.

SOCET GXP includes Next-Generation Automatic Terrain Extraction (NGATE) functionality, an image processing innovation developed by BAE Systems that can decrease manual editing time significantly. NGATE uses a hybrid matching process to create precise elevation data for 3D terrain and surface models. Its unique combination of image matching techniques offer clear improvements over earlier digital photogrammetric mapping procedures for generating elevation data from imagery.

NGATE is particularly useful for mapping urban areas, large geographic landscapes, mountainous or rough terrain, and areas with little contrast, such as road surfaces on large scale imagery and vast deserts.

In addition to tools for terrain model generation, pushbutton triangulation, and mosaicking, SOCET GXP has an automated process for orthorectification. The Ortho On-the-Fly tool orthorectifies and mosaics raw images in real time to produce continuous, accurate imagery of an expansive area. The results can be used for immediate product generation or future analyses. Orthorectification removes geometric errors or displacements in an image caused by the orientation of the sensor or variations in the terrain elevation. The result has a consistent scale, allowing accurate measurements of position, distance and direction. Ortho On-the-Fly enables first responders and analysts in the field to view and analyze orthorectified imagery without delay, or revert to the raw data. Raw images are available for extended processing such as automatic terrain genera-

tion, 3D feature extraction and mensuration, and stereo visualization. This innovative development is an important component of geospatial production workflows. It offers image analysts, geospatial analysts and mapping professionals an easy-to-use application, as well as a visual conduit into advanced capabilities within the software. Real-time processing allows for the creation of a variety of products that were once created in advanced or extended processes. SOCET GXP v3.0 provides tools for “do-it-yourself” users, from data analysis to product generation. A do-it-yourself user can improve the accuracy of an Ortho On-the-Fly solution when the georeferencing information of the input imagery and the underlying terrain model is inaccurate. Access to tools such as triangulation, and terrain generation and editing allow higher levels of accuracy when the input data needs improvement. These processes are still part of advanced or extended batch solutions, but they are easily accessible from SOCET GXP.

### System Architecture and Building Applications

The SOCET GXP architecture is based on more than 20 years of research and development. The system architecture is built to provide high-performance image processing from commercial hardware. It has a common software baseline, look, and feel for both UNIX and Windows operating systems. A robust API eases integration of the application into larger system architectures and provides a solid prototyping tool and third-party development platform. This gives customers and systems integrators the capability to create complex commercial and government off-the-shelf solutions for specific programs and missions.



*The automated triangulation process adjusts satellite or airborne sensor models to improve the accuracy for coordinates and measurements derived from imagery. It simplifies the triangulation process so that users who are not familiar with photogrammetry can be assured that all objects in an image, such as buildings, bridges, roads and other features, are represented accurately.*

*For individuals with little or no photogrammetry or image analysis experience, SOCET GXP offers a wide range of analysis and production capabilities wrapped in a flexible user interface that provides visual cues for quick ramp up.*

### Conclusion

BAE Systems owes much of its success to its customers. Year-after-year, feedback is gathered, evaluated, and implemented in software updates. Annual user conferences and beta testing programs provide a collaborative forum for engineers and product development teams to meet with users to gain a realistic understanding of workflows and to test usability. It is equally important to document feedback from troops on the front lines. Deployed forces using SOCET GXP in the operational environment often rotate in and out frequently and different people are doing the work from one week to the next. This is also true of large organizations that employ shift workers. Being aware of these conditions is helpful in BAE Systems' efforts in developing a product that is relevant and useful to a diverse user community.

For individuals with little or no photogrammetry or image analysis experience, SOCET GXP offers a wide range of analysis and production capabilities wrapped in a flexible user interface that provides visual cues for quick ramp up. Novice users can learn the basics, and continually build on prior knowledge as time permits. On the other hand, skilled professionals are pleased with the depth of functionality and user preferences that can be tailored to specific workflows. Add-on modules are available for specialized functionality.

As an early adopter of the Microsoft Office Fluent user interface technology in its SOCET GXP software applica-

tion, BAE Systems is among the first to include this advanced technology in a commercial product — a notable accomplishment that is likely to transform the GIS and geospatial-intelligence communities. As a result, SOCET GXP is becoming the tool of choice among mapping professionals, image analysts, geospatial analysts, and photogrammetrists.

SOCET GXP's technically advanced functionality serves government and civil customers' needs for photogrammetry, rapid mapping, visualization, image exploitation and analysis, precision targeting, intelligence, simulation, and mission planning.

The software currently is used on the front-lines in Iraq and Afghanistan, and systems integrators working on intelligence programs are using it to produce GEOINT products. In addition, the U.S. Army has procured SOCET GXP for Army-wide implementation into its Imagery Workstation baseline for operational units, establishing the software as its primary GEOINT exploitation tool.

SOCET GXP v3.0 is available for PC (Microsoft Windows XP, Vista) and UNIX (Sun Microsystems Solaris 10) operating systems.

*Carolyn Gordon, marketing and communications, BAE Systems. For more information, have a look at [www.baesystems.com/gxp](http://www.baesystems.com/gxp).*