Geospatial eXploitation Products™

SOCET GXP®

Integrated with the
GXP Xplorer® Platform

BAE SYSTEMS

Geospatial eXploitation Products™

SOCET GXP®

- Create geospatial products from imagery, terrain, LiDAR, video and more
- Utilize airborne or satellite imagery to create 3-D models and plan future construction
- Monitor infrastructure corridors and communication networks to detect potential issues
- Coordinate operational missions and designate troop maneuvers
- Rapidly produce intelligence reports in a variety of formats enabling critical decisions

SOCET GXP is an advanced geospatial intelligence software solution that utilizes imagery from satellite and aerial sources to identify, analyze, and extract ground features, allowing for rapid product creation. Image analysis, advanced photogrammetric techniques, remote sensing, and feature collection workflows are seamlessly combined into one comprehensive package.

Supporting multiple projects and missions, SOCET GXP workflows are designed to reduce production cycle times, eliminate the redundancy of multiple software packages, and maximize interoperability with other geospatial technologies including SketchUp, KML / KMZ, GeoPDF®, ArcGIS®, COLLADA™, and OpenFlight.

Seamlessly integrated with the GXP Xplorer Platform, SOCET GXP allows users to stream imagery in multiple formats directly into a Multiport for exploitation. Once analysis is completed, users can easily publish final products back to their GXP Xplorer® catalog, allowing for subsequent discovery by the entire federated user base.

The Workflow Improvement Module (WIM) integrates the GXP Xplorer catalog directly with the SOCET GXP Multiport for efficient geospatial queries enabling users to discover content while eliminating the need to switch between applications.

Reduce costly data search efforts

Statistics show that analysts spend up to 50 percent of their time locating imagery and data across disparate systems, networks, and geographic locations.

By combining SOCET GXP with GXP Xplorer and the WIM, your production time will decrease, your productivity will increase, and your organization will save both time and money.

Foundational capabilities

- Image analysis and intelligence production
- Precise mensuration
- Rigorous sensor models
- Remote sensing
- LiDAR visualization and exploitation
- Terrain extraction and editing
- Video exploitation
- Streaming enabled client
- Robust Application Programming Interface (API)
- Multi-sensor triangulation and Orthorectification

Streamlined interface

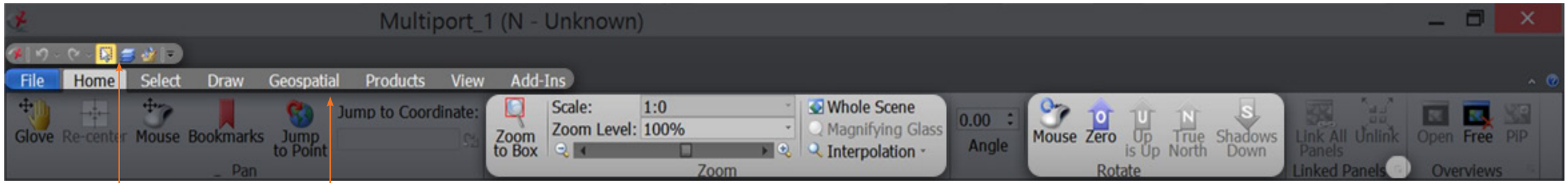
An intuitive design customized to your workflow

SOCET GXP offers an intuitive design that is consistent across multiple workflows, reducing the time needed for training on new software. A customizable Ribbon interface provides users with the ability to rapidly access commonly used functionality, while dockable windows and access to thousands of preferences give users the ability to customize their experience in a manner most efficient to their common workflows.

The addition of Cue Cards and Super Tooltips gives an on-screen indication to the functionality of various buttons so that users can quickly learn new SOCET GXP capabilities. Tools such as the Image List allow users to quickly display and organize hundreds of images allowing for immediate exploitation.

Scenarios

- Utilize the Image List to view hundreds of images of a site to generate a trend analysis product
- Organize your geospatial product workflow into a logical sequence using the Quick Access Toolbar
- Combine feature extraction tools to create custom tools increasing extraction efficiency
- Use SOCET GXP's Live Preview feature to view annotation changes before committing
- Set user preferences for a common, enterprise-wide look to improve efficiencies and training



Define your toolset
Add frequently used tasks to the Quick Access Toolbar.

Reduce screen clutter
Menus and tabs update dynamically. Tools not used for the current task are hidden.

Find tools easily
Related functionality and buttons are grouped together.

Access tools quickly
Buttons execute a task or begin a process.

Advanced functionality
Launch related windows with advanced functionality.

Map View in Workspace Manager shows geospatial footprints.

Key features

- Quick Access Toolbar
- Customized preferences
- Layer Manager
- ToolBox
- Cue Cards
- Super Tooltips
- Count graphics
- Preference searching
- Image List
- Job Queue

A broad range of capabilities

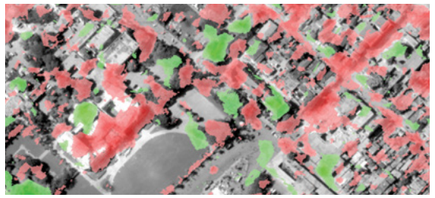
Bringing light to the complexities of your geospatial data, SOCET GXP enables users to examine every facet of an image with a wide selection of tools including anomaly detection, supervised classification algorithms, and powerful enhancement tools. Complex terrain and temporal analysis tools can be used to improve situational awareness.

Users can apply annotations, extract 3-D features, and add icons with the ToolBox functionality, enabling data exploitation, development of geospatial products and reports, and delivery of actionable intelligence to field personnel.

Terrain generation and analysis

Utilizing terrain enhances intelligence analysis by allowing analysts to create products such as Terrain Shaded Reliefs, Slope Maps, Aspect Maps, and HLZ candidate sites. Terrain files from different times can be compared using volumetric analysis to detect usage rates on piles of raw materials or to help determine excavation amounts from construction sites.

SOCET GXP also delivers world-class terrain generation algorithms which allow users to create and edit terrain models from aerial or satellite stereo imagery. The Automatic Spatial Modeler algorithm gives users a powerful tool for creating high resolution terrain files as well as point clouds from these stereo images. Users can combine imagery, terrain, and 2-D and 3-D features in the 3D Multiport to create truly immersive scenes.



DSMs from stereo satellite imagery before and after the 2010 Haiti earthquake. Red shows areas of negative elevation change indicating earthquake damage. Stereo imagery from the DSM generation courtesy of DigitalGlobe® and GeoEye.

Key capabilities

- Auto-DTED
- Terrain Shaded Relief
- Slope Map
- Aspect Map
- HLZ indication
- Volumetric analysis
- Automatic Terrain Generation (ATG) from stereo imagery
- Point cloud generation from stereo imagery
- 2D and 3D GeoPDF creation
- View and generate contour lines
- Grid and TIN editing tools

Scenarios

- Compare spoil pile changes over time to identify excavation amounts at a construction site
- Identify areas susceptible to flooding by identifying terrain levels below certain elevations
- Generate high resolution point clouds over areas where flying LiDAR is not feasible for cost or security reasons
- Edit terrain files to clean up artifacts and create a polished output Digital Elevation Model (DEM)

LiDAR analysis

SOCET GXP provides a robust capability for exploiting and viewing LiDAR data. Users can create and visualize bare-earth terrain files, surface models, and point clouds. The 3D Multiport gives analysts a comprehensive view of their data and allows for LiDAR data to be merged with imagery, other terrain models, and 3-D features. Users can quickly switch visualization methods for LiDAR point clouds including colorization by elevation, classification, return level, or imagery.

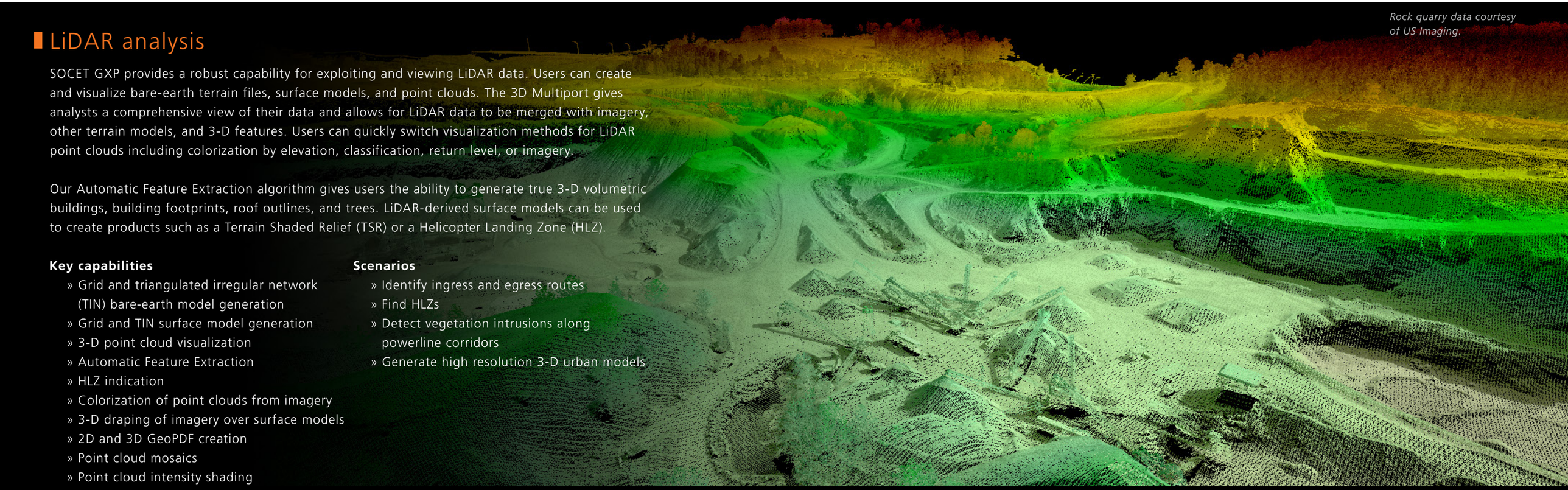
Our Automatic Feature Extraction algorithm gives users the ability to generate true 3-D volumetric buildings, building footprints, roof outlines, and trees. LiDAR-derived surface models can be used to create products such as a Terrain Shaded Relief (TSR) or a Helicopter Landing Zone (HLZ).

Key capabilities

- Grid and triangulated irregular network (TIN) bare-earth model generation
- Grid and TIN surface model generation
- 3-D point cloud visualization
- Automatic Feature Extraction
- HLZ indication
- Colorization of point clouds from imagery
- 3-D draping of imagery over surface models
- 2D and 3D GeoPDF creation
- Point cloud mosaics
- Point cloud intensity shading

Scenarios

- Identify ingress and egress routes
- Find HLZs
- Detect vegetation intrusions along powerline corridors
- Generate high resolution 3-D urban models



Rock quarry data courtesy of US Imaging.

In the field
Multispectral, 8-band, WorldView-2 images taken after the 2011 earthquake and tsunami in Japan are used to classify oil leaking into the ocean from a damaged refinery. The extent and location of oil and debris in the ocean is monitored over time to assist relief efforts, determine environmental impact, and expose potential navigational hazards.

SOCET GXP algorithms track the footprint of oil washed into the ocean. Anomaly detection and supervised classification algorithms quickly establish the size and location of debris when compared to its surroundings. Viewing and exploitation windows are linked when roaming to display the results of multiple algorithms simultaneously. The spectral signature of the supervised classification is saved in subsequent image collections for rapid classification.

Remote Sensing

Using more than just visible light, SOCET GXP enables analysis of complex hyperspectral imagery (HSI), multispectral imagery (MSI), synthetic aperture radar (SAR) data, and LiDAR. Sensing much more than the naked eye, users can detect a camouflaged vehicle immersed in a dense forest, identify oil spills, and determine the health of crops or vegetation through simple interfaces and real-time processing.

Key capabilities
- » Anomaly detection
- » Pan-sharpening
- » Reflectance calibration
- » Components analysis
- » Linear spectral unmixing
- » Spectral change detection
- » Unsupervised classification
- » Find-in-Scene (supervised classification)
- » Spectral libraries
- » Image colorization
- » MSI composites
- » Scatter plot
- » Histograms
- » Band math
- » Destriping
- » Spectral masks

Feature analysis

Users can identify adverse conditions such as rough terrain, dense vegetation, or collapsed bridges, while accurately pinpointing operational or evacuation routes. This reduces the dependency on external specialty packages to provide situational awareness, visualization, and data collection.

SOCET GXP Multiport synchronized with SOCET for ArcGIS window. Imagery courtesy of DigitalGlobe.

Key capabilities
- » Advanced drawing and feature collection capabilities include buffers, parallel lines, trim/extend, thin level of detail, square, curve, arc, static, freehand/stream digitize, monotonic, copy/rubber stamp, move, rotate, scale, 3-D extrude, and 3-D walls
- » 2-D and 3-D snapping for grid, lines, points/vertices, and planes, plus a custom snap cursor to improve collection efficiency by providing visual cues during extraction
- » Automatic attribution
- » Specification files
- » Style sheets
- » Feature query
- » SketchUp integration
- » Feature database
- » Stereo Model Manager
- » COLLADA and KMZ models
- » SOCET for ArcGIS
- » Spatially Enabled Exploitation (SEE)

Data triangulation

Interpreting data from an unprecedented variety of sensor models in their native format, SOCET GXP delivers advanced triangulation while significantly increasing the accuracy of geospatial exploitation.

SOCET GXP Multiport synchronized with SOCET for ArcGIS window. Imagery courtesy of DigitalGlobe.

In the field
The first step in creating accurate geospatial products is triangulation. On April 27, 2011, a massive tornado touched down in Tuscaloosa, AL, killing 50 people and causing damage to more than 5,000 homes.

Two days later, the National Oceanic and Atmospheric Administration's (NOAA) National Geodetic Survey (NGS) flew an aerial mission using their Trimble® Digital Sensor System (DSS™) to create a digital orthophoto mosaic of the area to assist relief efforts, and help assess the damage.

SOCET GXP uses imagery and metadata in its native format, eliminating the need to reformat data. Color TIFF imagery from the Trimble DSS is directly associated with the Trimble POSEO IMU/GPS data within the SOCET GXP Frame Import process. This process associates the exterior and interior camera orientation information from the metadata to the imagery allowing it to be tied to Earth — in this case, the latitude and longitude of Tuscaloosa.

Key capabilities
- » Automatic tie point matching
- » Graphic analysis
- » Control point editor
- » Interactive Point Measurement
- » Automatic Point Measurement
- » Triangulation block setup and management
- » SEE

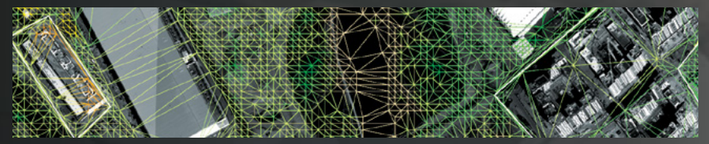
3-D modeling and visualization

Using SOCET GXP, analysts can extract 3-D features with intuitive tools, automation, and real-time texturing to bring data to life. Users can view entry points, measure the height of walls, and identify and prepare for obstacles, whether they're directly in the way or waiting around the corner. Visualize entire city blocks from every angle with real or simulated textures to support construction and planning, situational awareness, patterns of life, and navigation.

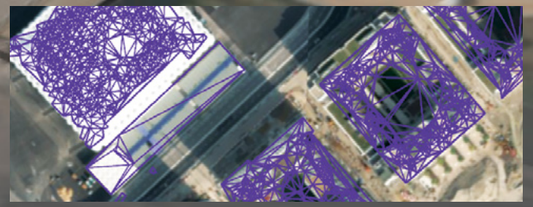
In the field

Ordnance Survey Great Britain (OSGB) captured an aerial view of the 2012 Summer Olympic park in London, England. SOCET GXP was used to extract 3-D features to show progress for buildings under construction. Full engineering models in COLLADA format were included to show a visual of current buildings with views of completed buildings. Projective sensor models for images from the aerial photography, taken by the OSGB, and satellite imagery, were loaded into a Stereo or a 2D Multiport for 3-D feature collection.

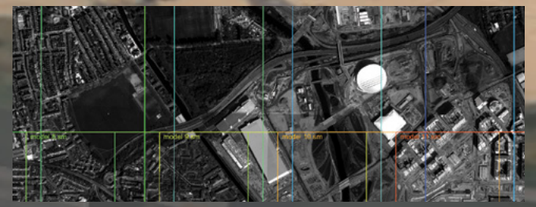
Underlying terrain was created automatically from stereo imagery using ATG functionality. The ATG process generated DSM and bare-earth terrain models. A half-meter TIN was extracted from the stereo images to accurately model the earth. The terrain model and 3-D features were textured with imagery automatically and viewed in the 3D Multiport for site progress assessment.



Interactive Terrain Edit showing polygon break lines added to a TIN that includes tools for thinning or deleting mass points. Imagery courtesy of Ordnance Survey Great Britain.



Automatic Feature Extraction (AFE) of buildings from a 0.5m, Next Generation Automatic Terrain Extraction (NGATE) DSM. Imagery courtesy of Ordnance Survey Great Britain.



Stereo Model Manager footprints shown on a Virtual Mosaic of the block of aerial images. Imagery courtesy of Ordnance Survey Great Britain.

Real-time image orthorectification

Using Ortho Manager, analysts can convert one or more images into an orthophoto or an orthophoto mosaic (with seam lines) by transforming the pixels to their proper position based on sensor model, terrain, and feature information.

With Ortho On-the-Fly™, the orthorectified process is completed in real time, providing instant visualization of imagery and data for analysis and exploitation.

In the field

The flight mission for the NOAA/NGS relief operation acquired imagery with 30 percent overlap with the intent to produce orthophotos and a high-resolution, large-area coverage orthophoto mosaic.

The entire block of imagery was loaded into a single SOCET GXP Multiport after triangulation, and the Ortho On-the-Fly functionality applied. Image pixels stretched and warped to display the image as if it were taken from nadir throughout the entire image, or a mosaic of many images.

Key capabilities

- » True orthophotos
- » Ortho sheets/tiles
- » Mosaic
- » Automatic seam line
- » Interactive seam line editing
- » Raster Product Format (RPF)

Seam lines for an image mosaic are generated automatically and displayed for editing with Ortho On-the-Fly processing applied resulting in edits that detail the actual product output. Imagery courtesy of NOAA/NGS.

Precision targeting

Fusing data, analytics, and operational strategies, SOCET GXP delivers fast and accurate targeting intelligence, minimizing manual measurement and allowing users to complete their missions with confidence. Combined with our Common Geopositioning Systems (CGS), SOCET GXP delivers the DoD standard for precision targeting, geopositioning, and photgrammetric applications.

CGS and SOCET GXP provide an all-source precision geolocation capability with reliable and accurate 3-D coordinates and statistically valid error estimates. CGS uses SOCET GXP as the integrated viewer to deploy as a standalone targeting workstation.

Key capabilities

» Automatic registration
» Source selection
» Configurable target icons for output products

Imagery courtesy of DigitalGlobe

Integration with enterprise systems

Integrating seamlessly with the GXP Xplorer Platform and your enterprise system architecture, SOCET GXP eliminates the time and expense associated with system integrators and the creation, maintenance, and support of stove-piped Electronic Light Table (ELT) solutions. This enables organizations to better focus effort and development dollars on mission requirements and solving the task at hand.

Key capabilities

» C++ API
» Comprehensive documentation
» Source code available for sample applications

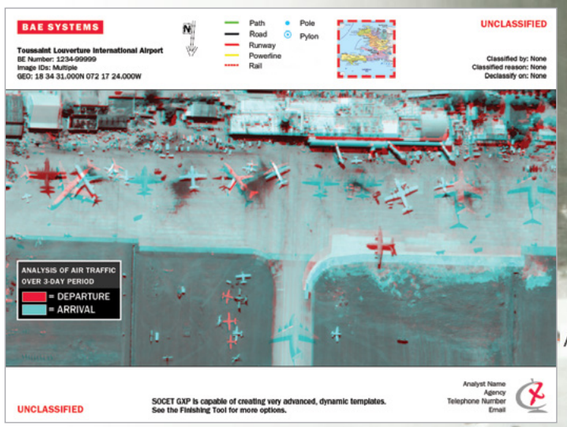
Customized reporting and product creation

SOCET GXP enables development of advanced, customized geospatial products and reports that support collaboration with colleagues and mission partners in the field. Both pre-defined and custom product templates can be created and saved for subsequent use in product generation.

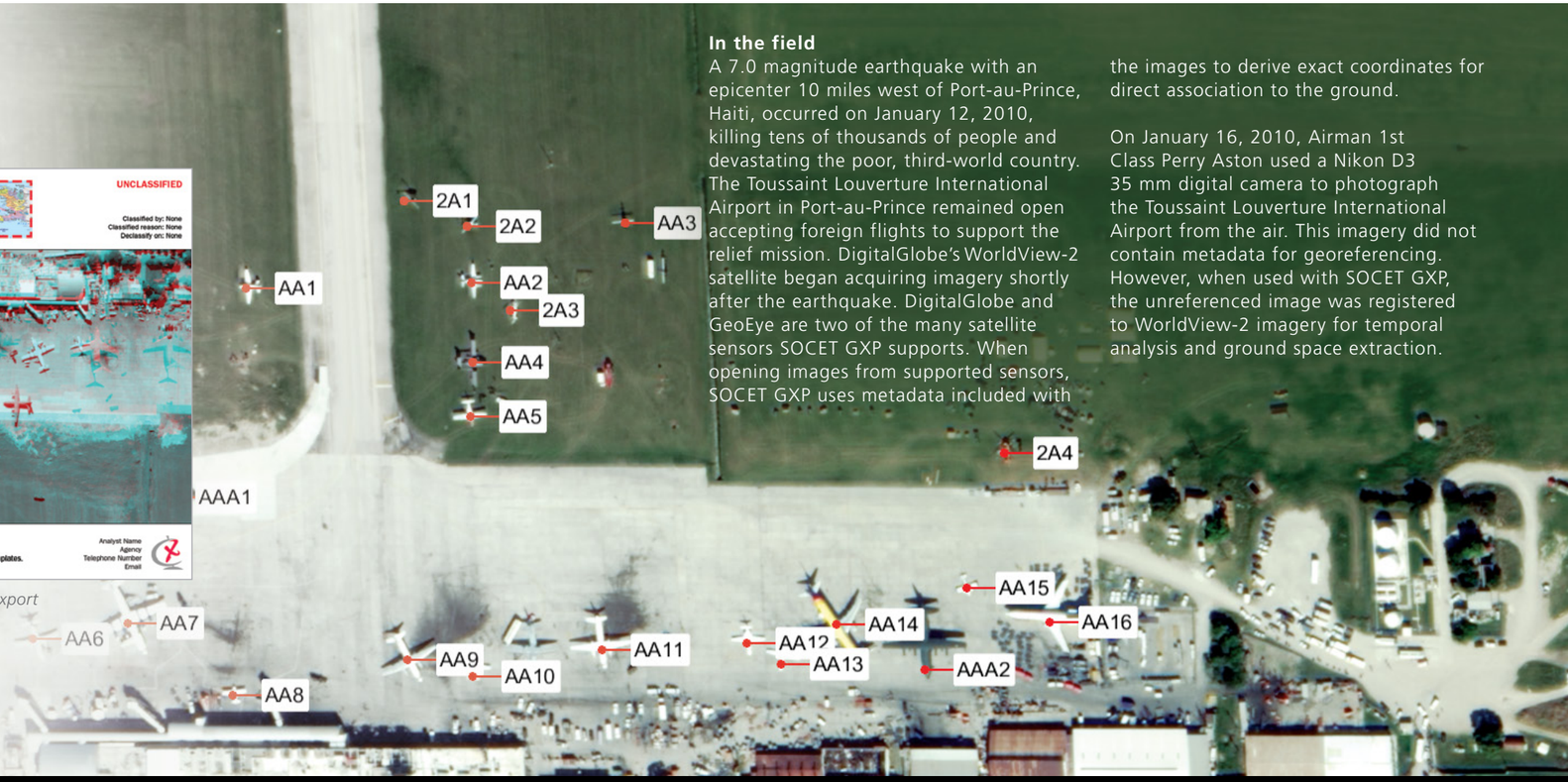
Key features

Product templates display with labels extracted from various sources that include imagery metadata, classification markings, system date/time, and user login name. Users can:

» Zoom-in on Area of Interest (AOI)
» Add graphics and annotations
» Snapshot to PowerPoint®
» Save as a National Imagery Transmission Format (NITF) product
» Output as a layered TerraGo® 2D GeoPDF or 3D GeoPDF



Snapshot of the workspace to PowerPoint, or export to GeoPDF. Imagery courtesy of DigitalGlobe.



In the field

A 7.0 magnitude earthquake with an epicenter 10 miles west of Port-au-Prince, Haiti, occurred on January 12, 2010, killing tens of thousands of people and devastating the poor, third-world country. The Toussaint Louverture International Airport in Port-au-Prince remained open accepting foreign flights to support the relief mission. DigitalGlobe's WorldView-2 satellite began acquiring imagery shortly after the earthquake. DigitalGlobe and GeoEye are two of the many satellite sensors SOCET GXP supports. When opening images from supported sensors, SOCET GXP uses metadata included with the images to derive exact coordinates for direct association to the ground.

On January 16, 2010, Airman 1st Class Perry Aston used a Nikon D3 35 mm digital camera to photograph the Toussaint Louverture International Airport from the air. This imagery did not contain metadata for georeferencing. However, when used with SOCET GXP, the unreferenced image was registered to WorldView-2 imagery for temporal analysis and ground space extraction.

GXP InMotion™

Video analysis

The GXP InMotion Desktop application integrates seamlessly with the GXP Xplorer Platform, leveraging the power of GXP Xplorer's search and discovery, and SOCET GXP's unparalleled accuracy, sensor modeling, and image exploitation capabilities.

Locate video assets across an enterprise, no matter where the data is stored or geographically located, with GXP Xplorer. Perform video analysis tasks with GXP InMotion and export the finished products to SOCET GXP for even more advanced analysis, annotation, product creation, and delivery.

Supported video and motion imagery formats:

- » H.264 (MPEG-2)
- » 104.5, 601.1 metadata
- » Apple® QuickTime®
- » Microsoft Windows® (.wmv, .asf)
- » User datagram protocol (UDP) streaming video via URL
- » Video from a video capture device (USB, PCI)
- » Standard still image formats with sequential timing

View details from the video track included in metadata, such as location, speed, and direction.

Worldwide support and training

GXP® offers flexible training modules and support options for your organization, whether you require training for an entire project team or simply need supplemental one-on-one instruction.

Our worldwide training centers deliver complimentary customer training with curriculum tailored specifically to your learning requirements. Onsite training, which is available at the time of initial software installation to introduce you to the functionality of SOCET GXP, can be supplemented at a later date with refresher courses or advanced workflows.

SOCET GXP in the field

SOCET GXP software is used on the frontlines for homeland defense and security, and by systems integrators working on National Geospatial-Intelligence Agency programs to produce GEOINT products.

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.

Customers include:

- Defense forces
- Intelligence agencies
- Homeland security
- Universities, colleges, research organizations
- Systems integrators
- State, local, and regional governments
- Private photogrammetry, mapping, surveying companies
- Transportation departments
- National and local mapping agencies
- Natural resources management consultants
- Image scientists

About BAE Systems

BAE Systems is a global defense, aerospace, and security company with more than 83,000 employees worldwide. The Company delivers a full range of products and services for air, land, and naval forces, as well as advanced electronics, security, information technology solutions, and support services.

BAE Systems is a global provider of software for image analysis, geospatial production, mapping, 3-D visualization, video analysis, and photogrammetry. For more than 40 years, BAE Systems been a trusted supplier of imagery, geospatial products, and services to the defense and intelligence communities, and commercial markets. BAE Systems has experience and depth in managing, implementing, and developing products with a wide variety of other industry-standard applications that support geospatial and related tradecrafts, and experience developing GIS tools. This experience requires knowledge of the scientific underpinning of the technologies, methods, and techniques in use to solve geospatial production challenges.

Geospatial eXploitation Products (GXP)

GXP develops powerful software tools used to deliver highly accurate geospatial and intelligence data. Based in San Diego, CA, GXP provides direct worldwide sales and support. In some areas, this is done in conjunction with a select team of distributors to facilitate greater coverage and to provide effective customer service. GXP offers its customers top-quality technical support and training to optimize their return on investment.

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