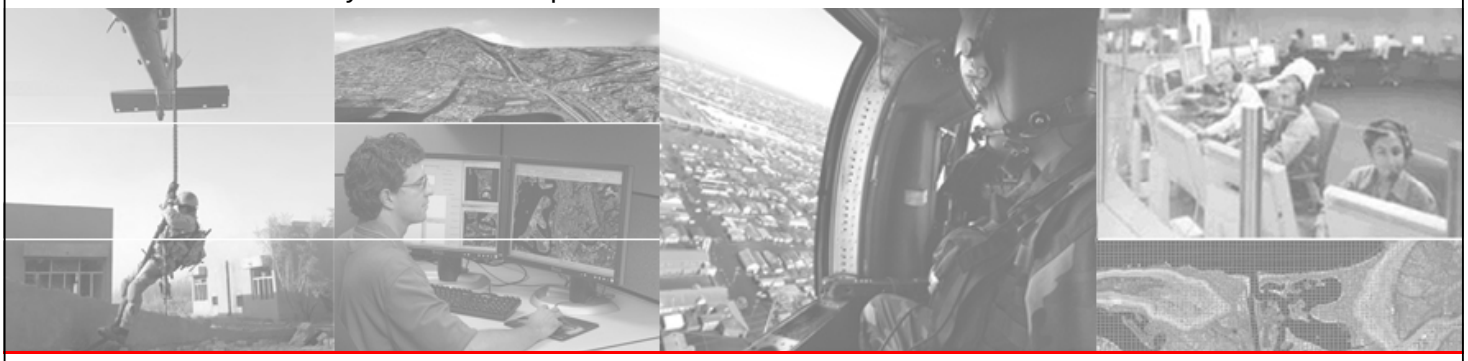
New Features in SOCET SET®

Stewart Walker, San Diego, USA



Geospatial eXploitation Products™ (GXP)

- Line of business in BAE Systems North American operation
- 100+ employees
- Planned annual revenue $30 m
- Headquartered in San Diego, California, USA
- Other offices
  - US (6)
  - Cambridge, UK
  - Canberra, Australia

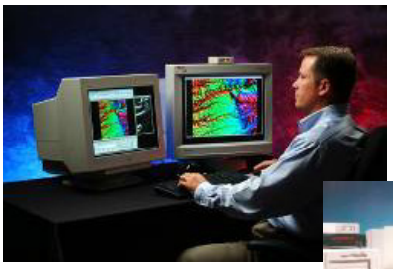
GXP products

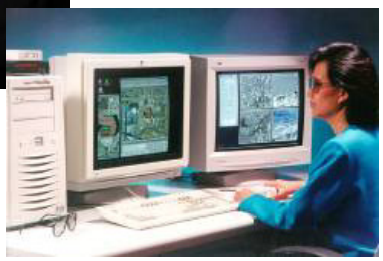
- Commercial software for photogrammetry, mapping and GIS, image analysis, geospatial analysis, C4ISR, targeting, HSI/MSI, visualization and simulation, natural resource management, and detection of airport obstructions
- Applying image processing technologies to commercial mapping and image exploitation for 25 years
  - History can be traced back to work by Helava Associates on contracts for the Defense Mapping Agency in the 1980s, on which General Dynamics was the prime contractor
  - Decision to go commercial taken in 1990

GXP products … 2

- SOCET SET (1990) – premier software package for digital photogrammetry
  - Installations in >70 countries
- VITec® (1991) – image analysis product for defense; discontinued except for ongoing government contracts
- SOCET GXP® (2005) – recently introduced product with a new user interface and architecture
  - Currently focused on image analysis for defense
  - Will incorporate the functionality of SOCET SET in 2008-09
  - All applications in a single product, with a single user interface
- Microsoft® Windows® or Sun Microsystems® Solaris™
- For internal and external systems integrators as well as end users

Introduction to SOCET SET





Characteristics of SOCET SET

- Remarkable range
- Full photogrammetric flowline
  - Project management, image import, viewing, etc.
  - Coordinate systems and map projections
  - Triangulation
  - Extraction and editing of digital terrain models (DTMs)
  - Orthorectification, mosaicking, dodging and balancing, true orthos
  - Feature extraction and ArcGIS® interface
  - Perspective scenes and fly-throughs
  - Identification and mapping of airfield obstructions
  - Map finishing
- Productive
- Software development kit: fully documented SDK

Triangulation (if metadata not good enough)

- Interactive Point Measurement (IPM)
  - Manual measurement and editing of control points and tie points
- Automatic Point Measurement (APM)
  - Automatic generation of tie points by image matching
  - Combination of of area- and feature-based matching
  - Accommodates large scale differences
- Multi-Sensor Triangulation
  - Bundle adjustment with self-calibration
  - Rigorous mathematical solution, full error reporting, covariances, statistical summaries
  - Capable of combining different image sources in the same triangulation

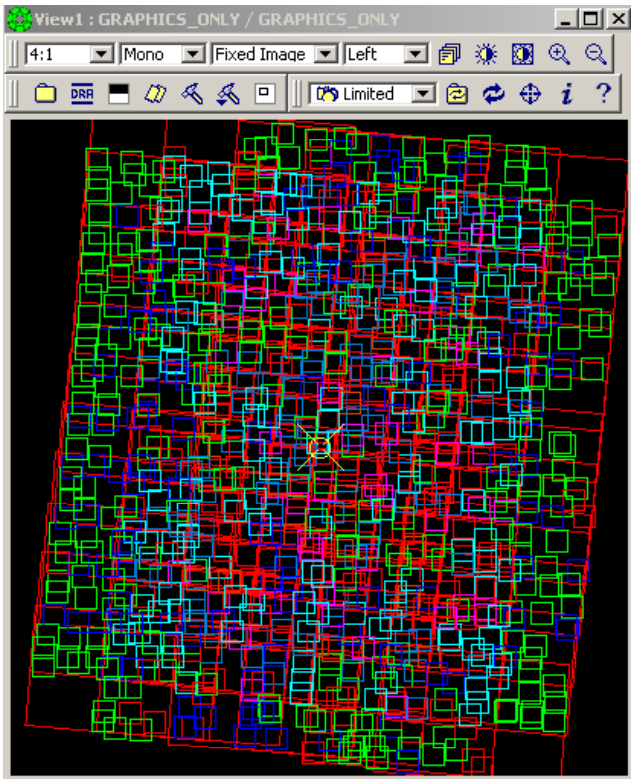
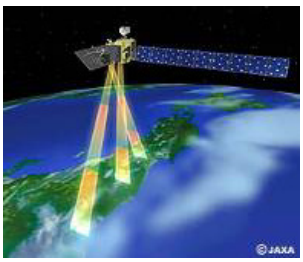


Image sources (import and sensor modeling)

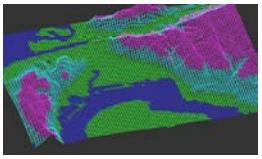
- Frame (film and digital)
  - Aerial film cameras
  - DMC, UltraCam, DSS, Buckeye, etc.
  - Close range imagery
  - GPS/IMU or triangulation metadata
- Landsat
- SPOT
- ERS
- IRS
- JERS
- Orthophotos
  - DOQ, ArcWorld, GeoTIFF
- EROS B
- IKONOS®
- QuickBird
- RADARSAT
- RSS 9K
- Panoramic

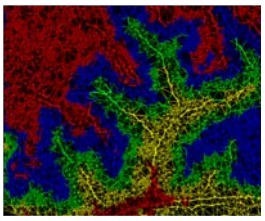
- Various US DoD
- NITF
- Leica ADS40
- OrbView-3
- GeoEye™-1
- WorldView-1
- ALOS
- ASTER
- FORMOSAT-2
- TerraSAR-X
- SAR Lupe
- Polynomials
  - Quadratic rational, DLT, cubic etc.
- RSM
- IfSAR
- LIDAR
- Digitized maps in various projections
- Customized, e.g. JAS 150, HiRISE

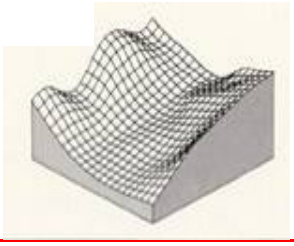


Digital terrain models (DTMs)

- Generation of digital surface model (DSM) by image matching
- Derivation of digital elevation model (DEM) by bare-earth filtering
- Both TINs and grids
- Automatic Terrain Extraction (ATE)
  - Developed over 20 years
  - Default and user-defined strategies
  - High performance, especially for sparser DTMs
- Next-Generation Automatic Terrain Extraction (NGATE)
  - Combination of area- and edge-matching
  - Matching on every pixel for greater accuracy
  - More robust than other software, especially in urban areas
  - ***30% reduction in editing time***
- Interactive Terrain Editing (ITE)
  - Powerful tool set for editing automatically generated DTMs
  - Manual measurement of DTMs
  - Merging of DTMs with other DTMs or with feature data sets

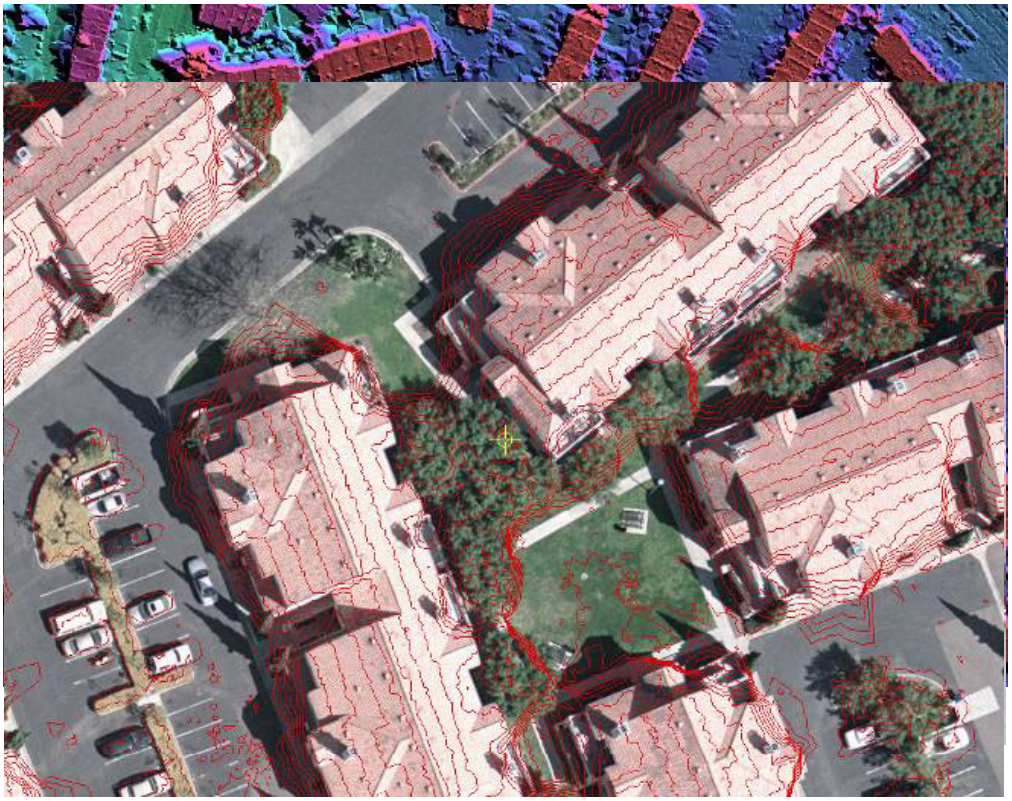






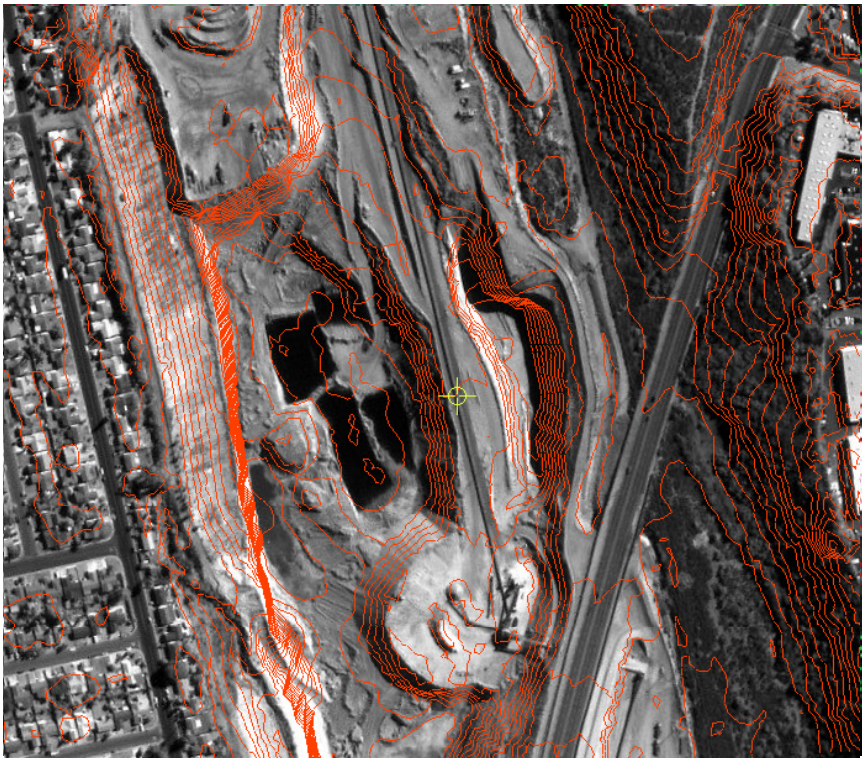
NGATE in urban areas

- Dense DTM represents urban features better
- Authentic modeling of building edges
- Robust performance – fewer blunders



NGATE with IKONOS one-meter imagery

- More detail
- Models small features more closely
- Handles steep slopes and discontinuities well

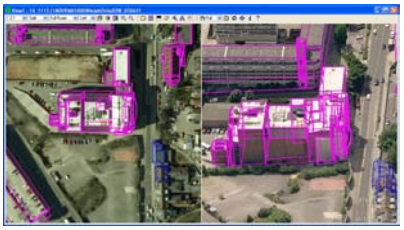


Bare-earth algorithm

- Removes trees and buildings according to user specifications
- Goes from DSM to DEM
- Works with photogrammetric or LIDAR data
- New tools being added continuously

SOCET SET v5.4: 3D city modeling

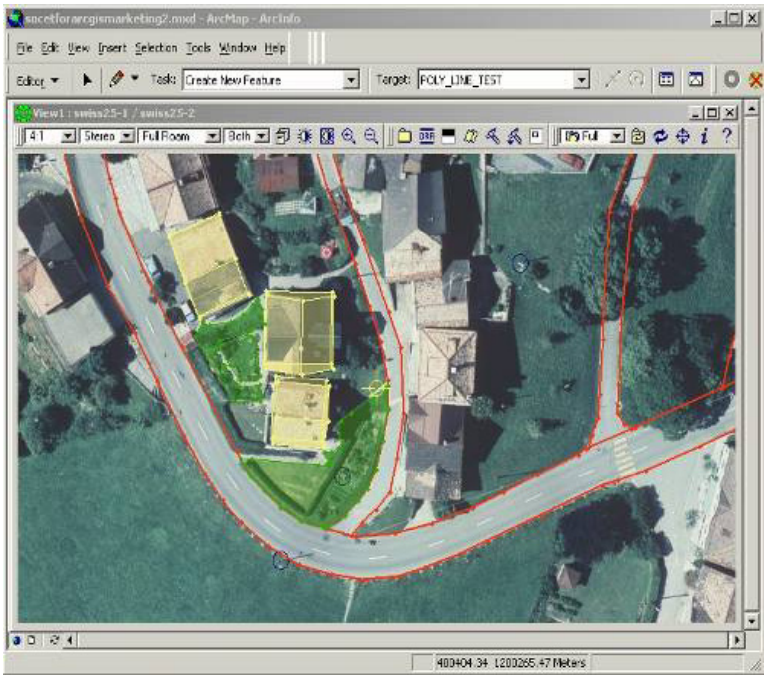
- Increasing demands for urban modeling for planning, emergency response, transportation, disaster relief, environmental impact
- Increasing availability of off-the-shelf oblique imagery from several vendors with aircraft and specialized camera configurations
- SOCET SET's strengths facilitate data acquisition for 3D city modeling
  - Import of wide range of imagery and metadata
    - Satellite
    - Vertical and oblique airborne
    - Terrestrial
  - Multi-sensor triangulation for accurate data fusion
  - Volumetric (3D) feature extraction
  - Automatic texturing
  - Export to OpenFlight format



Imagery courtesy of Blom Aerofilms

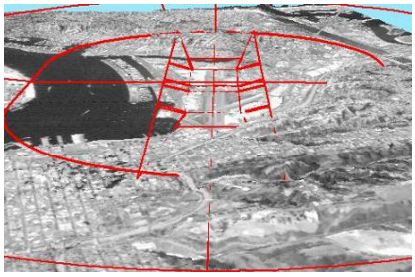
SOCET for ArcGIS: the idea

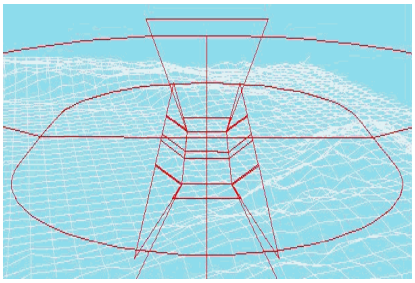
- Embedding photogrammetry into ArcGIS
  - One system: ArcMap® controls everything
  - One viewport: SOCET Stereo Viewport replaces ArcMap Canvas
  - One cursor
- Optionally, ArcGIS users see almost no photogrammetry or SOCET SET functions once the system has been set up
  - Use ArcMap Editor tools or SOCET SET tools

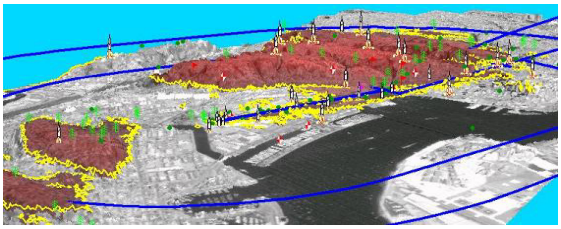


ClearFlite: obstructions around airfields

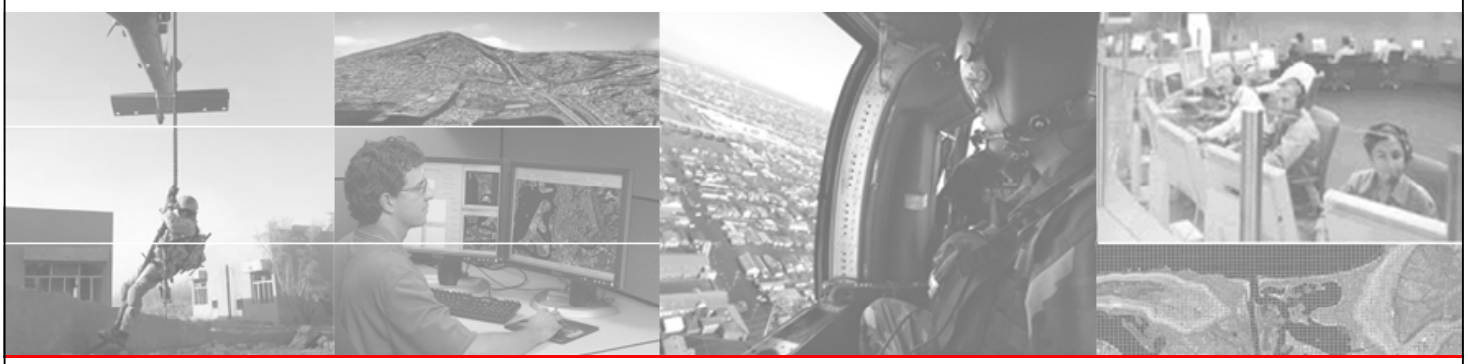
- Safety of air traffic requires obstruction-free, well defined routes for take-off and landing
- Objects penetrating above Obstruction Identification Surface (OIS) must be identified, measured and recorded
  - Defined by standards bodies – FAA, ICAO, NGA
- ClearFlite enables OIS to be viewed against the stereomodel
  - Easy to identify objects penetrating above it
  - Objects are measured, just like normal feature collection, and recorded
  - Resulting data is exported in appropriate formats such, as AIXM



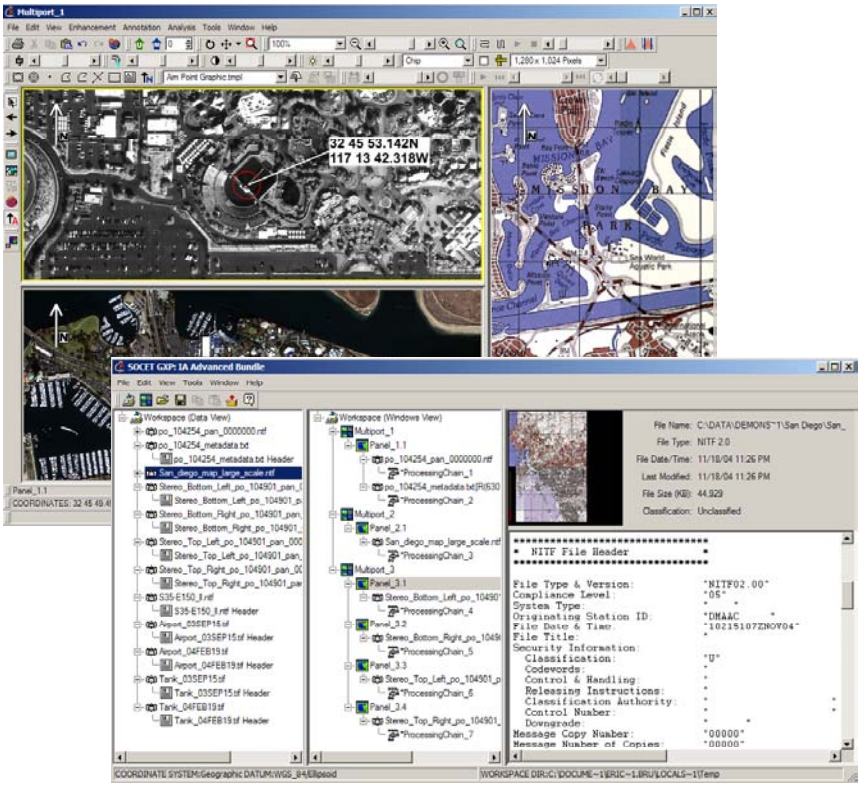




Introduction to SOCET GXP for SOCET SET users



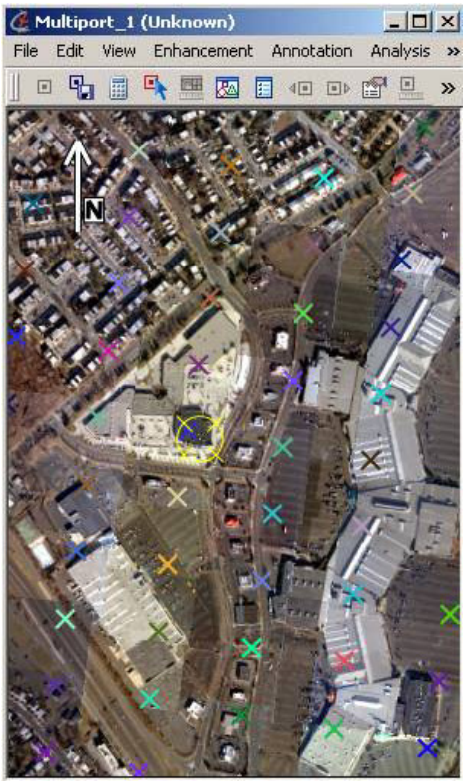
Flexibility and ease of use



- SOCET GXP offers flexibility in look and feel
- Work with multiple datasets from different kinds of sources to enhance analysis capabilities
- Work with data in separate Multiports, panels, or merge different types of data into one window for automatic mosaicing and comparison analysis
- All data is organized within the Workspace Manager making data organization easy to use and extremely accessible

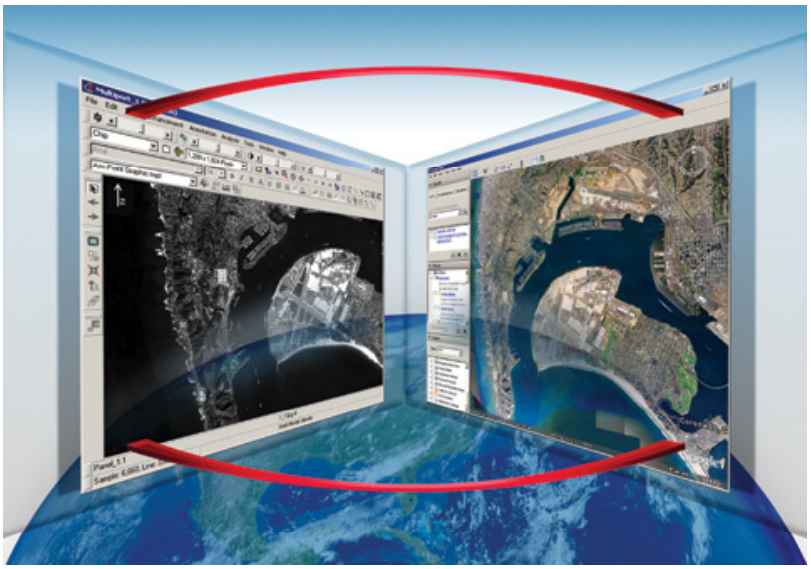
Multiple datasets per panel (virtual mosaic)

- A virtual mosaic is created whenever multiple images are loaded into a single non-stereo panel of a Multiport
  - Images are mosaicked based on the 4-corners compensated for terrain
  - SOCET GXP does not limit the number of data files (images, terrain, annotations, etc...) that can be combined in one exploitation panel
- The example shown on the right contains 66 (11,500x7,500 pixels) color images loaded in the same panel and automatically stacked/mosaicked according to the geographic locations of the data
  - Because they overlap, the scene becomes a “virtual mosaic”
  - Each image can be individually enhanced to balance the overall scene

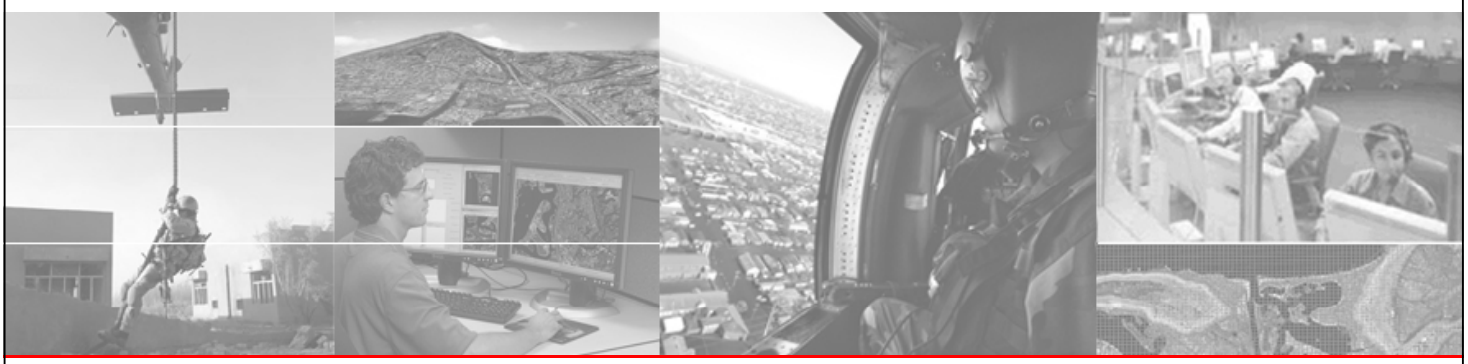


Google Earth™ integration

- Manual and automatic synchronization between SOCET GXP Multiport and Google Earth
- SOCET GXP Google Earth capabilities
  - Synchronized Views
  - Move To Location
  - Overlay Image
  - Export Graphics(s)
  - Export Image Footprint(s)

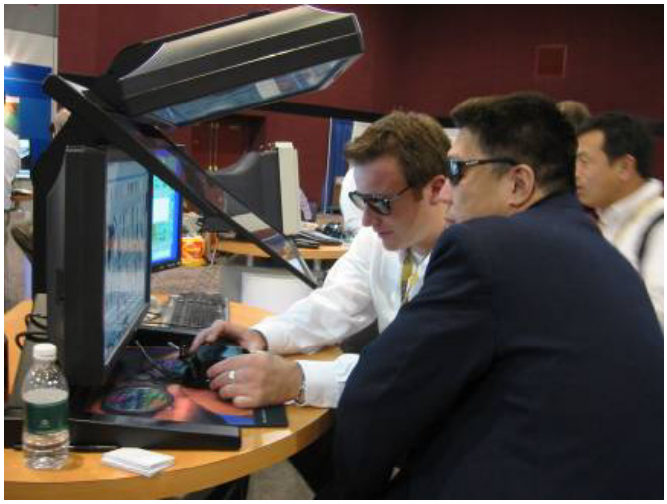


The future



Directions for the future

- SOCET SET
  - Incremental developments
  - Additional sensor models
- SOCET GXP
  - Microsoft Ribbon user interface
  - Extensive photogrammetric functionality
  - More image processing and terrain analysis functions
- Convergence towards a single product for all customers



SOCET GXP v3.0 enhancements (2008)

- Substantial photogrammetric functionality
  - Imagery and sensors
  - Triangulation
  - Terrain Extraction
  - Orthorectification and mosaicking
  - On-the-fly orthomosaic for all supported sensor models
  - Feature Extraction and SOCET for ArcGIS
- Some functionality for the “middle market”
  - MSI/HSI and radar tools
  - More extensive terrain analysis
- Photogrammetric functionality completed in v3.1 (2009)