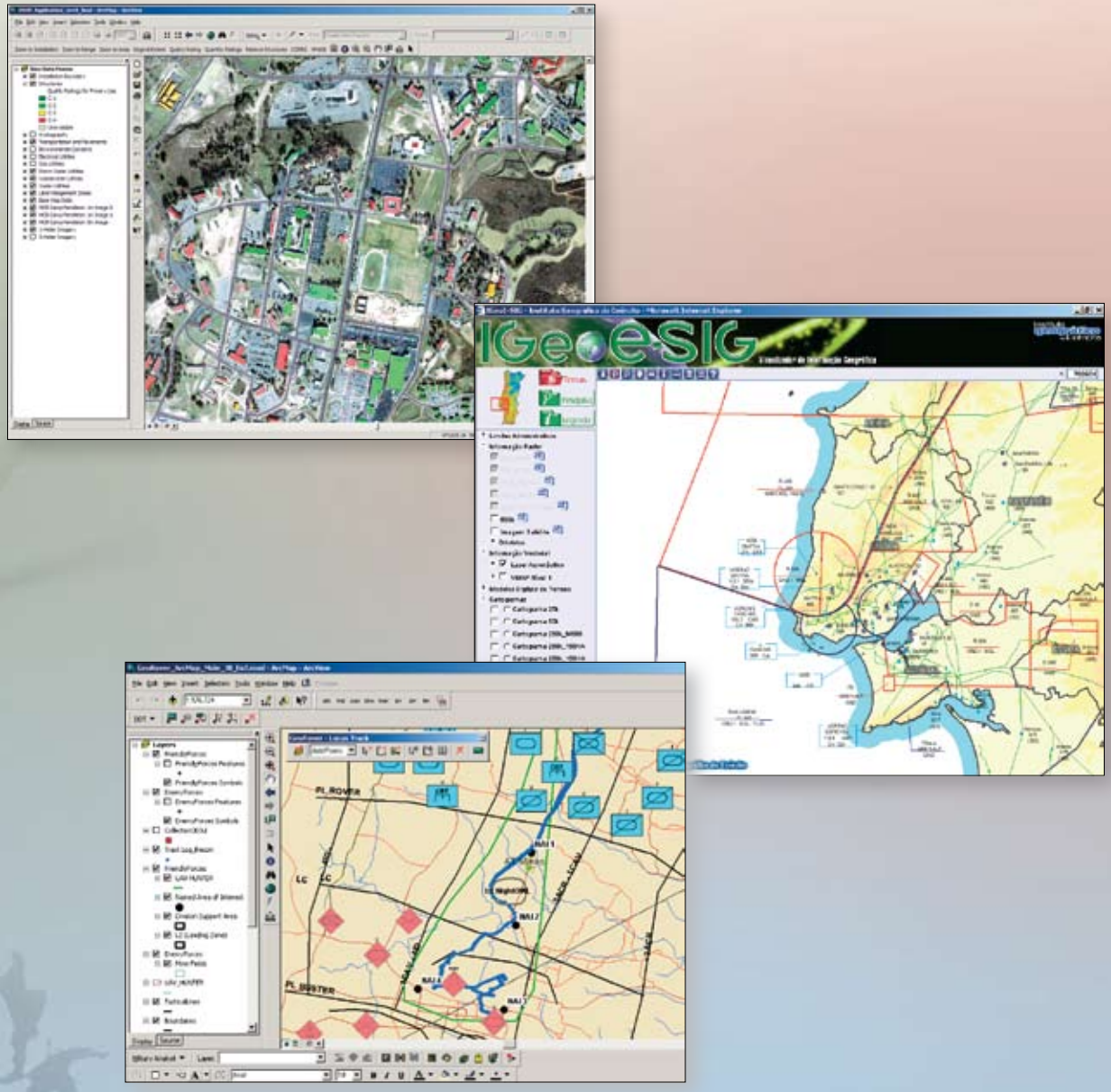
Volume 2

GIS in the Defense and Intelligence Communities



ESRI

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Dear Colleagues:

You have been busy! Less than one year ago, I wrote an introduction to the first volume of *GIS in the Defense and Intelligence Communities*. Interest in this publication has been considerable, both in terms of readership and desire to contribute stories. That interest is reflected in the publication of volume two.

Volume one announced the widespread use of GIS technology in the defense and intelligence communities. This second volume discusses aspects of GIS that I find most intriguing. It is a testament to your creativity in finding new applications for GIS technology as demonstrated in the following examples:

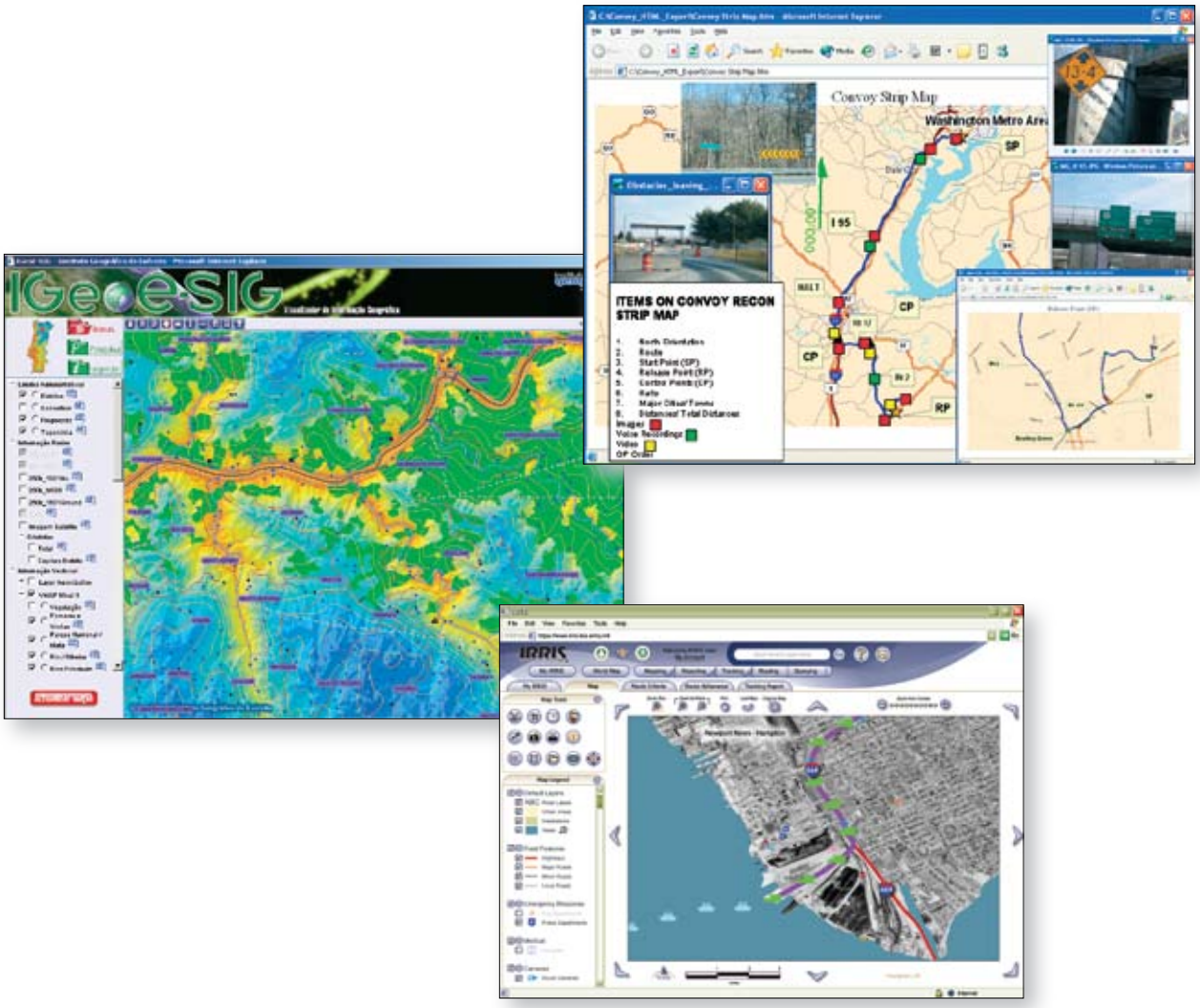
- Dyess Air Force Base, Texas, uses GIS to track dumpsters on base, not the most obvious use of GIS but one that helps manage spending. Once that spatial information infrastructure is in place, the possibilities seem endless.
- The Battlespace Terrain Reasoning and Awareness (BTRA) developers are using GIS to advance the science of terrain analysis. This is a continuation of 10 years of effort at the Topographic Engineering Center at Fort Belvoir, Virginia, and is the latest in a series of innovative solutions from this world-leading organization.
- The Gripen JAS-39 aircraft uses GIS to prepare datasets for loading into its avionics systems. It is exciting to see beautiful cartography on the cockpit displays of these fourth-generation fighters.
- The Instituto Geográfico do Exército (The Geographic Institute of the Army) in Lisbon, Portugal, has provided an informative story about its work publishing maps and charts over the network. Again, it is important to note that cartographic quality does not have to be sacrificed to disseminate spatial information over the Web.

It is often said that to challenge a Marine is to invite excellence. The headquarters of the Marine Corps promised to deliver stories for this volume of the book. They certainly delivered!

It has been a pleasure to review your important work that is shared in this volume.

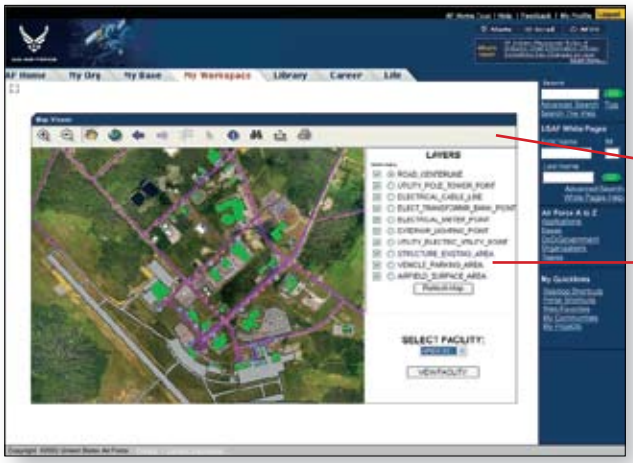
Warm regards,

Jack Dangermond



AIR FORCE

Operationalizing GeoBase through GCSS-AF



The Full Page View will provide users with additional features such as zoom, pan, and data layering options.

Toolbar provides features such as zoom, pan, and print.

Users can select which layers of data to display on the map.

In 2001, the United States Air Force (USAF) stood up the Headquarters Air Force GeoIntegration Office (HAF GIO) to bring geospatial capabilities to the Air Force enterprise in an efficient and effective manner. Under Colonel Brian Cullis, the GeoBase program quickly took root through its Garrison, Expeditionary/GeoReach, and Strategic implementations. By 2004, there were GeoIntegration Offices (GIOs) at all 12 major commands as well as seven field-operating agencies and direct-reporting units. That year, Col. Cullis moved to the Office of the Secretary of Defense to implement the Defense Installation Spatial Data Infrastructure (DISDI), leaving behind a vision of "one installation–one map" that has become ingrained in the GeoBase culture.

Colonel Hal Tinsley now pilots the HAF GIO, and his focus is to operationalize GeoBase—to put the capability (for unclassified resources) into the hands of all USAF personnel, from airmen to general officers to all civilian, military, and contractor support personnel in between. The vehicle for bringing GeoBase resources to the USAF enterprise is the Air Force Portal, the doorway into the Global Combat Support System–Air Force (GCSS-AF) that will ultimately support the Global Information Grid (GIG).

The first step, achieved in April 2005, was to simply load imagery and base boundary files for viewing and download through the AF Portal.

Next on the AF Portal horizon is the ability to access Air Force Common Installation Pictures (CIPs) through Web Map/Web Feature Services as presented conceptually to the left.

Geospatial data access will be controlled through roles assigned and enforced through PKI measures inherent in the AF Portal security protocols. Once CIPs are online, the next step will be to grant controlled access to Mission Data Sets (MDSs) within the Air Force domain. From there, the goal is to provide appropriate access to all levels of GeoBase installation mapping and visualization data to all personnel, forward and rear, USAF or DoD, whenever and wherever they need it on the Global Information Grid.

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Gripen Aircraft Digital Map Generating System

Gripen cockpit with electronic moving map on center display

The Digital Map Generating System (DMGS) provides the Gripen aircraft system with geographic data. Several subsystems and support systems in the aircraft system use geographic databases. The mission for DMGS is to generate correlated sets of databases and manage the geographic data used to generate the databases.

Gripen Aircraft System and Geographic Data

Gripen is the first fourth-generation multirole aircraft in operational service. The integrated avionics in the aircraft enable functions to combine sensor information with geographic data to create situation awareness. This implies higher requirements on geographic data than in previous generations of aircraft. The aircraft uses geographic data for the moving map presentation and navigation system functionality.

To perform an airborne mission, the aircraft is used together with its support systems. Mission planning and evaluation systems, as well as flight trainers and rehearsal systems, are all users of geographic data. For mission success, it is crucial to have reliable and correlated geographic data produced for all these systems as quickly as possible. DMGS is built with these operational requirements.

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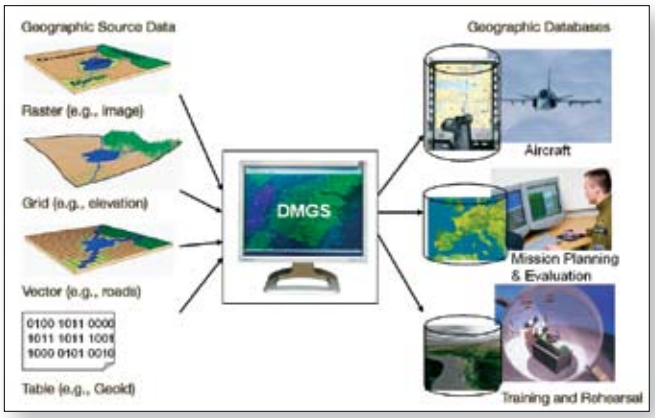
Geographic Database Generation

One database, one system, and one process for generating data to the whole aircraft system—that is the overall idea of DMGS. Data is extracted, processed, and exported from the common database to the database format required by the target system.

When DMGS is used, data of various formats is imported into a common database repository. In this step, data can be verified and processed (i.e., to make it seamless). Then selected data is extracted to be processed in the export modules.



DMGS generates geodatabases to multiple target systems from source data in one common database.

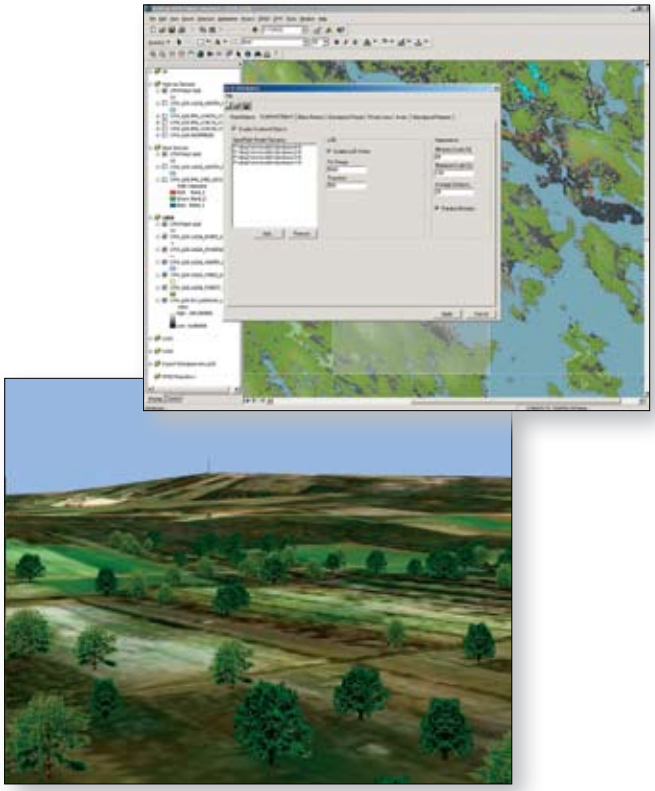
Correlated Geographic Databases and Data Management

The main benefits of DMGS are the correlation of output databases and data management in the common database. By using one common database and one generating system for all geographic databases in the aircraft system, the result is a cost-efficient, coherent, and reliable process producing correlated databases.

Another important benefit gained by using a powerful geographic database is the data management functions that can be supported. Some examples are traceability from exported data to imported source data, partial update of databases, configuration control of data, verification before use and release of data, and concurrent processing.

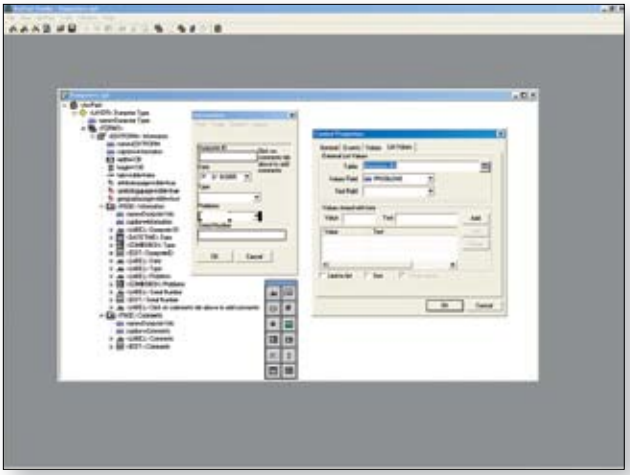
Summary

DMGS is built as an application in ArcGIS® Desktop using ArcObjects™ to develop system-specific tools and ArcSDE® with an Oracle® DBMS for geodatabase management. By using ESRI® GIS tools, the system helps bridge the gap between organizations producing source data and the systems using the geographic data. This is an expansion of the traditional usage of ESRI tools. Also, using one system to generate geographic data for several target systems bridges the gap between the target system user communities.

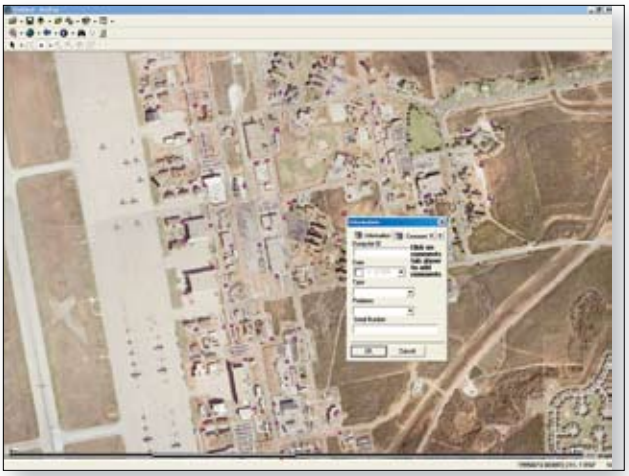


DMGS screen shot when processing data to visualize database and view results

Reduction in Manpower Required for Annual Survey at Dyess AFB



The setup window for the custom menu options for data collection



Upon creating a point, the data entry window pops up to provide a user-friendly environment for inputting the attributes.

Mission

Air Force Civil Engineering requires that waste and recycle dumpsters be tracked and logged for contract maintenance purposes. Originally, dumpster tracking involved marking the status of the dumpster on a notepad. There are several inherent issues when an inventory is performed with a notepad rather than a digital method. These issues include interpreting the handwriting on the notepad, inventory repetition, writing correct information, annotating comments, tracking the status of the dumpsters, the inability to truly document how many dumpsters are on location, and the length of time such an inventory would take. A better method was needed to track and inventory the dumpsters.

Capabilities

To provide a useful solution, a list of capabilities needed to be created. These capabilities included

- Quick-and-easy data collection
- Customizable data collection attributes
- Attribute choices rather than typing in information
- Additions or subtractions of data and attributes
- Trend and problem area analysis
- Directly compatible (import/export) with GIS
- Physical condition tracking
- Features easy to relocate with GPS
- Ease of integration of new data into existing dataset
- Light (portable/easy to carry)
- Short learning curve to basic use

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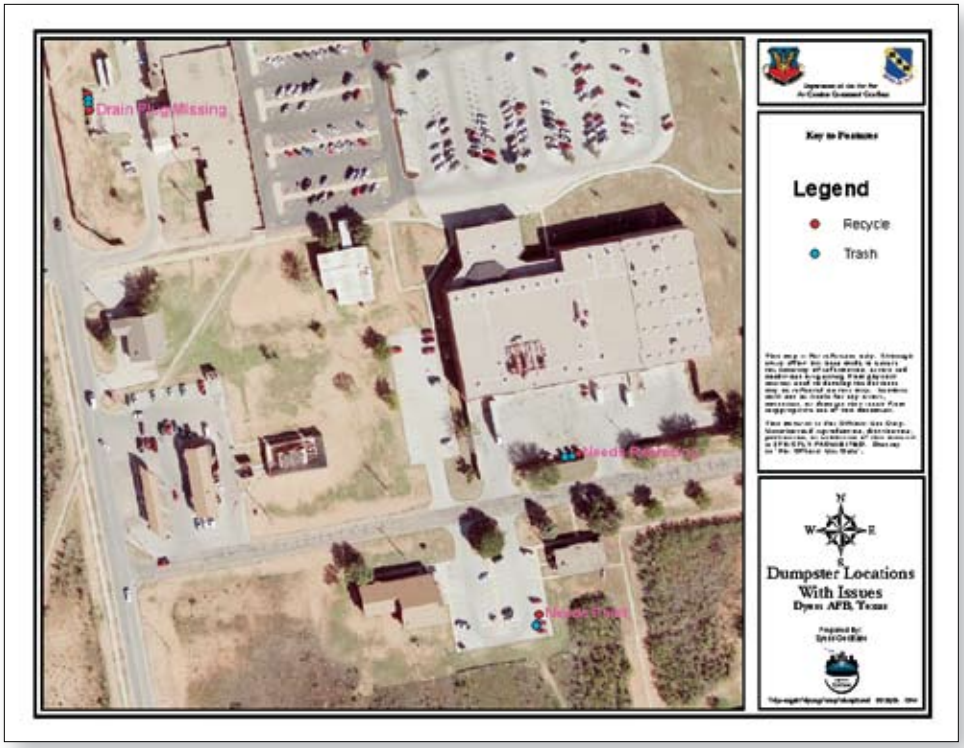


Color-coded dumpster map with labels on dumpsters stating problem to be resolved

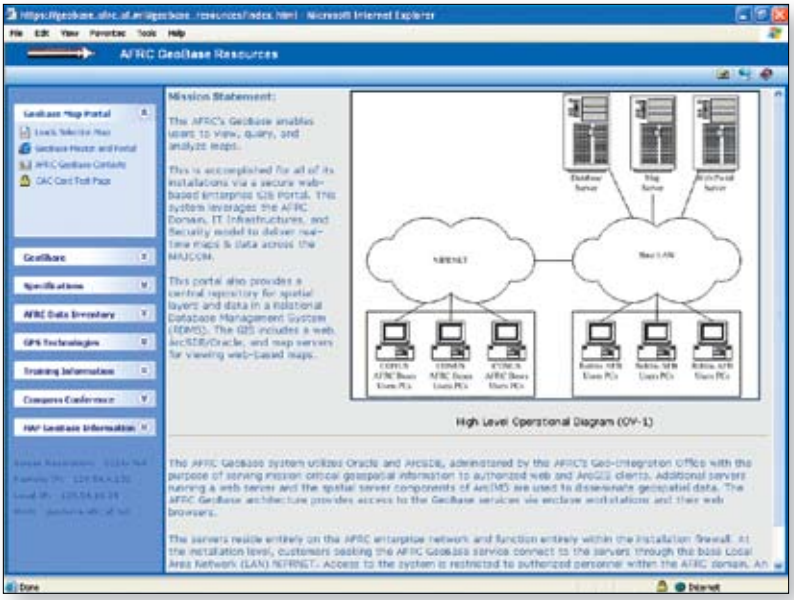
Through fieldwork and meetings, a workflow process was established to utilize ArcMap and ArcPad® to collect and organize data on dumpster locations. The data for both waste and recycle dumpsters was used to add or move the dumpsters to locations that would better serve the customer. The physical condition of each dumpster is entered into the database so damage and usage can be monitored. Areas with higher damage rates or units that fill up faster can be highlighted to point out areas that need improvement.

Result

The inventory can be performed efficiently and effectively. The total inventory time changed from as many as 20 days to only two days because the maintenance history is collected and saved for future reference. The inventory has the ability to document the total number of dumpsters at the base. This information proved Dyess AFB was short 20 percent of the number of dumpsters required by contract. The base could increase the number of dumpsters by 20 percent at no additional cost and provide better service to its customers.

M.Sgt. Pope updating the attributes of a previously logged dumpster

Enterprise-Level Web-Based GIS for Multiple Bases and Map Services



AFRC's GeoBase puts the MAJCOM's geospatial information at its users' fingertips.

Mission

The Air Force Reserve Command (AFRC) is one of the major commands in the Department of the Air Force. The AFRC Major Commands (MAJCOMs) maintain a GIO and GeoBase system to serve the GIS and geospatial needs of their directorates.

Background

AFRC's GIO utilizes a Web-enabled GeoBase system to support the GIS needs for 14 USAF installations. AFRC's system includes more than 60 map services and more than 130 GIS layers. This system supports a diverse set of functional communities and end users. Users are either data consumers (typical users), data providers (GIS and CAD analysts), or data administrators.

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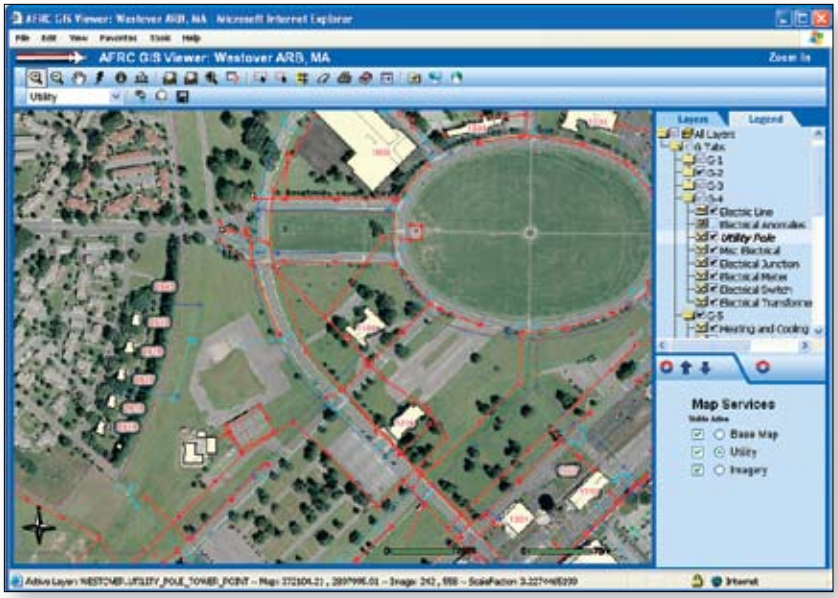
Web-Based Enterprise GIS Using ESRI's ArcIMS System

Capabilities: The GeoBase system is located on central network servers in AFRC's SC Networking Center located at its HQ. The system includes more than 60 ArcIMS® services and more than 130 GIS layers. The central system has an Oracle back end database, ArcIMS map servers, and front-end Web servers.

The entire MAJCOM GeoBase system is database driven, and its users' rights and resources are managed through secure and reusable Web interfaces. These systems allow users to navigate to base and application-specific functions and data (e.g., facility, planning, utility, basemap, environmental).

AFRC's GeoBase systems follow AFRC's Network and Domain Security Policies per USAF and DoD policies. The system uses network domain accounts integrated with DoD's CAC-Card. There are more than 280 end users who use CAC-Cards to get user-specific resources to add, edit, and browse data. Numerous additional users use network accounts for browse-only access to resources.

DoD's System Security Authorization Agreement (SSAA) and its Certification and Accreditation (C&A) procedures were completed for this AFRC enterprise system.



AFRC's custom map viewer allows multiple services to be displayed. Its map interfaces enhance GIS Web services and are reused across all its bases. Its database-driven design supports the open standards and specifications needed to sustain an enterprise system.

Benefits: The benefits associated with utilizing a network-based, Web-enabled enterprise ArcIMS system are numerous including the following:

- Resources can be managed and shared across MAJCOM's LAN/WAN systems.
- GIS layer names and data management practices are standardized for MAJCOM's bases.
- Map legends are database driven and generated on the fly from multiple map services.
- Base end users work with familiar and reusable Web interfaces for multiple GIS functions.
- AFRC obtained a DoD Certificate to Operate (CTO) and registration in its master Systems Compliance Database (SCD) for its GeoBase and related systems.
- The system follows AFRC's and DoD's security and information management requirements. This positions AFRC's MAJCOM map services to be securely shared with HAF, other MAJCOMs, or other DoD systems as needs dictate.

All these capabilities and benefits associated with an enterprise approach result in a lower Total Cost of Ownership (TCO) for providing and managing MAJCOM-wide GIS resources. The enterprise approach will allow AFRC map services to be shared with the GCSS portal via MAJCOM's established firewall and security procedures.

Summary and Future Plans: AFRC's GeoBase has been continuously updated to meet MAJCOM's dynamic requirements. Upgrades have been implemented using design standards and specifications shared with all parties and commercial off-the-shelf (COTS) systems. Therefore, AFRC has a number of forward-pointing enterprise initiatives. Some notable new implementations include emplacing the dedicated aerial imagery ArcIMS server, implementing an ArcGIS Server, and configuring a new Oracle Management Server. The Web interface is also being updated as functional communities request new data uses and applications. GIS, GPS, and related training initiatives are concurrently being brought online for end users as well.

U.S. AIR FORCE

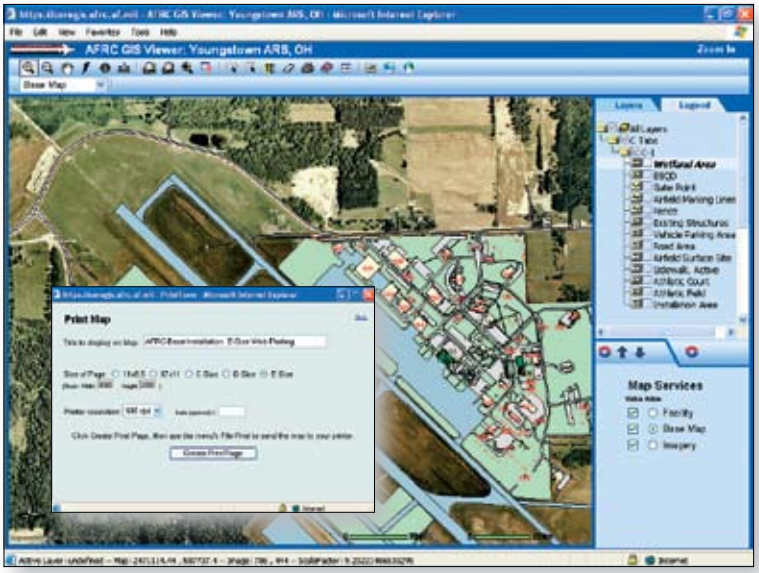
AIR FORCE RESERVE COMMAND

Dynamic Web-Based GIS Browsing and Plotting for Multiple Bases and Map Services

Facilities map service

Basemap service

Imagery map service



AFRC's GeoBase makes multiple ArcIMS services available for browsing and large format, Web-based color printing and plotting via its central GIS system.

Mission/Overview: AFRC is one of the major commands in the Department of the Air Force. AFRC MAJCOM maintains a GIO and GeoBase system to serve the GIS and geospatial needs of its directorates.

Background/Introduction: AFRC's GIO utilizes a Web-enabled GeoBase system to support the GIS needs of 14 USAF installations. The Web-based GIS allows plotting from multiple map services using dynamic overlays to merge and create A to E size plotting.

Dynamic Web-Based Plotting from Multiple ArcIMS Services

Capabilities: The GeoBase system is located on central network servers in AFRC's SC Networking Center located at its HQ. The system includes more than 60 map services and more than 130 GIS layers.

The system has been designed in a manner to enable an entire MAJCOM to use its interfaces for browsing and querying data via a custom multiservice map viewer. The system is data-base driven and allows users to navigate to a base and select application-specific functions, data, and maps (e.g., facility, planning, utility, basemap, environmental).

The interface has been customized to work with multiple map

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services to automatically layer and prioritize maps to match end user needs as they browse GIS resources. The interface is reusable across multiple bases and allows on-the-fly, Web-based plotting from A to E size maps. This is enabled through the database-driven nature of the interface and its ability to stack multiple maps from a given base facility. When an end user selects the Print icon from the Web interface, the following steps occur:

1. The extents of all the map services and the order in which they are stacked on-screen are recorded.
2. A menu is presented that allows the user to select the final map size, resolution, and title.
3. A transparent image of each map service is created and given a unique ID.
4. Each transparent image is then overlaid based on the order on the map.
5. One composite image is created from the transparent overlays and sent to an output Web page.
6. The legend for the active service is displayed on the output Web page.
7. When the user is ready to print, a final reminder is sent to set the page to landscape if needed.

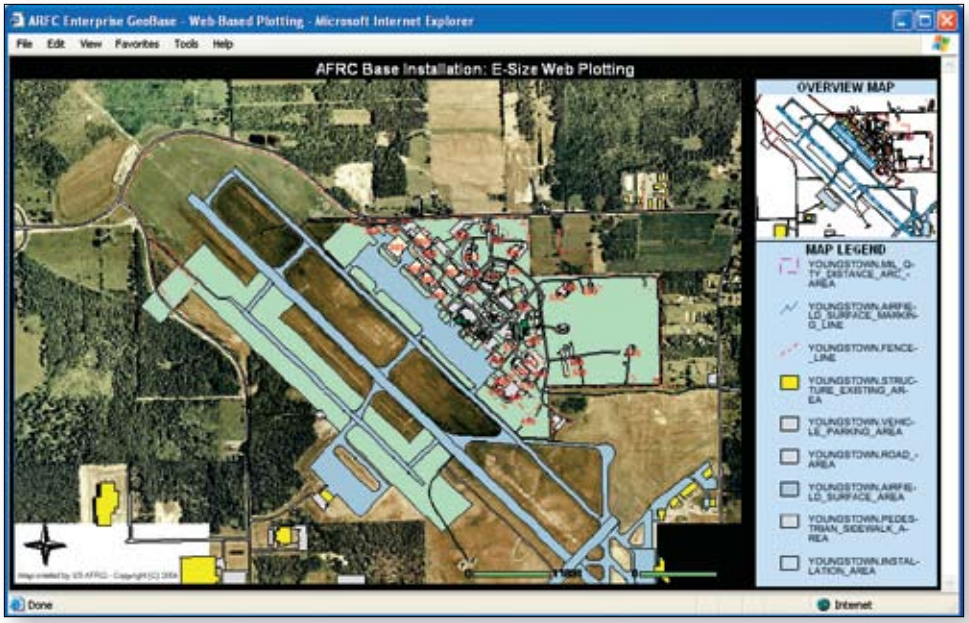
When printing large-format plots from the Web, it is important to increase the memory size that ArcIMS allocates to its map services. This is important when dynamically sized large prints are generated.

Benefits: The benefits associated with utilizing Web-based browsing and plotting menus are numerous including the following:

- The browsing and dynamic plotting of the MAJCOM's GIS resources have been automated.
- GIS map resources can be securely shared with many functional communities.
- Users can plot GIS data on demand without custom software or desktop configurations.
- The benefits of using a GIS are within the practical reach of many more end users.
- Base-level end users work with familiar and reusable Web interfaces for multiple GIS functions.

All the capabilities and benefits associated with dynamic Web-based mapping, browsing, and plotting result in a lower TCO for MAJCOM-wide GIS resources.

Summary and Future Plans: AFRC's GeoBase mapping and plotting interfaces have been designed to meet MAJCOM's dynamic requirements. This includes on-the-fly, Web-based plotting A to E size maps from ArcIMS. Some new system features are likely to include expanding the browsing and querying tools, adding more ArcIMS mapping services to serve functional communities, and allowing end users to interact more with GIS data to manipulate and save custom map settings.



Final plotter output from AFRC's multiservice Web interface

U.S. AIR FORCE

AIR FORCE RESERVE COMMAND

The United States Air Force Academy: Building Our Air Force's Strong GeoBase Foundation

Overview

The mission of the United States Air Force Academy (USAFA) is to "inspire and develop outstanding young men and women to become Air Force officers with knowledge, character, and discipline, motivated to lead the world's greatest aerospace force in service to the nation." One of the exciting ways the academy is improving its execution of that mission is through the constant improvement of its GeoBase initiatives at the base level and in its cadet classrooms.

Capabilities

USAFA Base Level: Mr. Tim Beerman, CH2M HILL
USAFA's initial capabilities include direct access to more than 120 feature classes and to general and mission-specific maps, historical documents, and other spatial data; USAFA weather stations; and an automated dig permit system through its Web-based GeoConsole. Several desktop applications are used to automate the general plan, base comprehensive plan, and airfield waiver management.

DFEG: Mr. Danny Portillo, HQ USAFA/DFEG
GIS software is used to support core courses that all cadets must take during their tenure at the academy. Beginning with the class of 2009, all cadet-issued laptops will contain the basic ESRI ArcGIS software toolsets to support a variety of core courses. Using GIS at USAFA will eventually become as common as using Microsoft® Office products.

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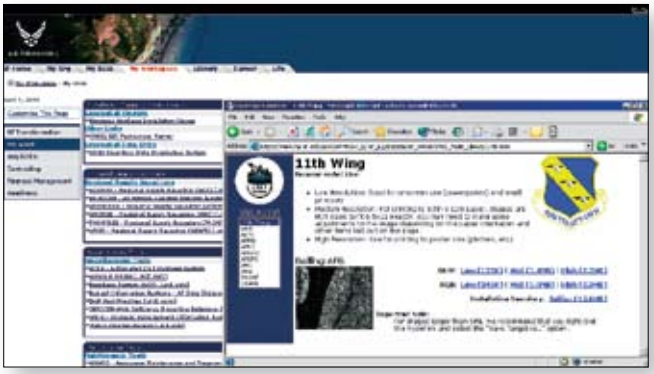
In the fall of 2004, the Department of Civil and Environmental Engineering (DFCE) undertook the largest classroom implementation of GIS in academia. Specifically, Civ Engr 210 implemented two new applications that mirror how GeoBase is implemented in the operational Air Force: Build-a-Base and the Contingency Support Exercise (CSE).

Build-a-Base: Build-a-Base serves as the culminating project testing cadets' mastery of base comprehensive planning, functional land-use analysis, and the Air Installation Compatibility Use Zone (AICUZ) concept.

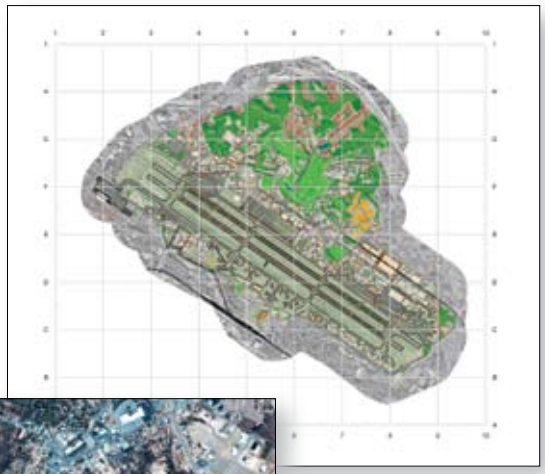
Contingency Support Exercise: The purpose of CSE is to educate and train cadets on the skills required of a support officer during contingency operations.



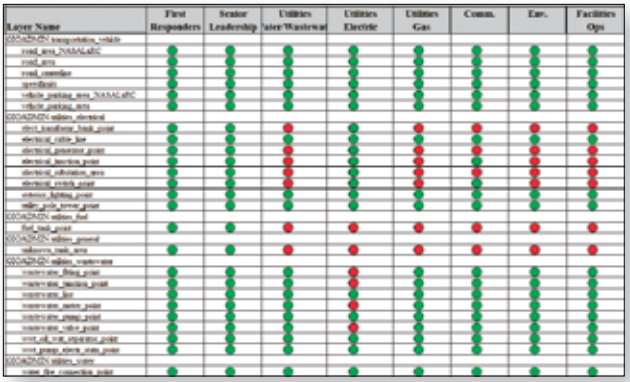
New cadet interface during the Contingency Support Exercise at K-93 Air Base

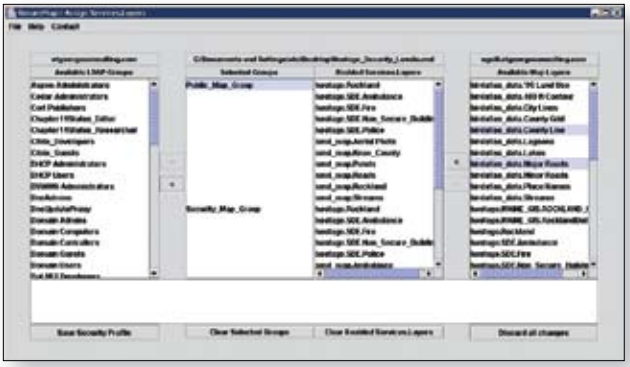
Conclusion

With the advent of the DF GeoBase Working Group, the faculty at the academy hopes to increase the synergy of sharing resources and manpower across the functional areas of academic and operational expertise. In addition, the faculty seeks to increase and organize cadet exposure to GIS across the curriculum under a unified plan of attack.



Layer-Level Security for Langley AFB SDI

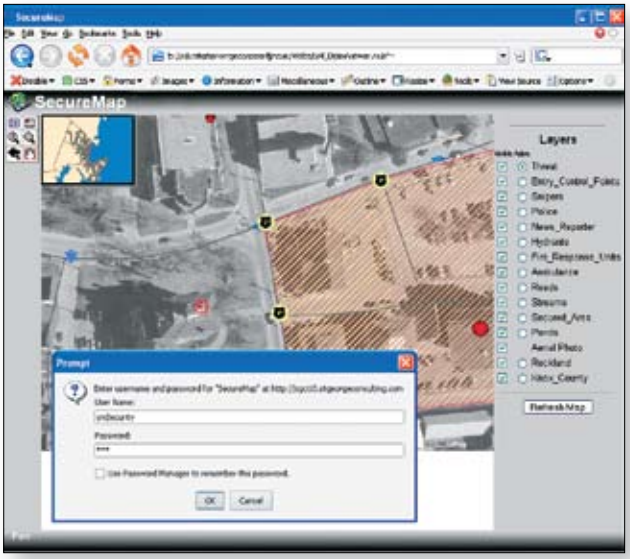




The Geo-Integration Office at Langley Air Force Base manages a mix of environmental, engineering, mission, and operational layers within its GeoBase GIS. Many of these layers are highly sensitive and require multitiered security and authentication.

Patricia McSherry, chief of the Langley GIO, created a sensitivity matrix for all layers in her GIS that categorizes layer access into functional groupings. From this analysis, she created a stoplight chart showing which layers should be visible to which functional groups.

Successful implementation of the security matrix demanded a map services infrastructure that was highly secure and also provided maximum flexibility and low maintenance overhead for GIO staff members. To accomplish this, McSherry contracted Penobscot Bay Media to deploy SecureMap for ArcIMS. This extension works with Langley's Active Directory authentication platform to provide flexible, dynamic, layer-level security controls across the Langley Air Force Base GIS.



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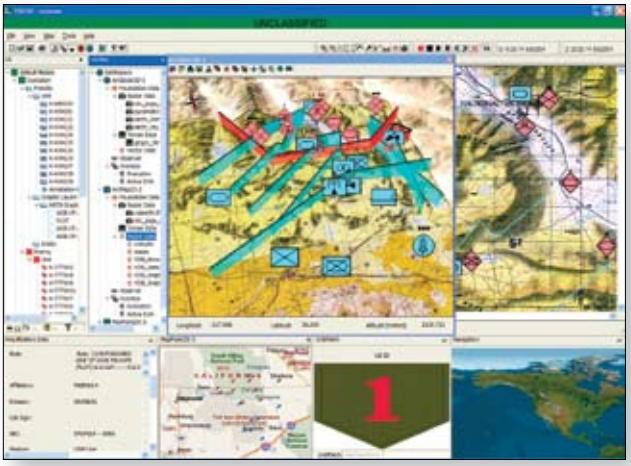
Penobscot Bay MEDIA

ARMY

Tactical Operations Center 3-D



The TOC 3-D application can display both 2-D and 3-D views of the battlespace.

Introduction

The Tactical Operations Center 3-D (TOC 3-D) application is being developed by Concurrent Technologies Corporation (CTC) under the Next Generation Command and Control System (NGCCS) TOC 3-D program. The TOC 3-D application provides multiple, highly interactive 2-D and 3-D views of the battlespace. It interfaces with Army Battle Command System (ABCS) systems, provides an integrated Common Tactical Picture (CTP)/Common Operational Picture (COP), and increases the situational awareness of combatant commanders.

Capabilities and Benefits

The TOC 3-D application integrates advanced GIS technologies, 3-D visualization, information management solutions, and evolving communications architectures to meet the U.S. Army's requirements to display battlespace-relevant data on a single display. This data includes maps, intelligence information, assets, and near-real-time and real-time data in a manner that incorporates position, orientation, and time. This provides the capability to overlay data from multiple Battlefield Functional Assets (BFAs). The TOC 3-D application interprets the data received and displays the following information:

- GIS data
- Georeferenced MIL-STD-2525B symbology
- Topographic analysis data
- Integrated CTP/COP
- Situational awareness

Integrating and validating the visualization capabilities of the Commercial Joint Mapping Toolkit (C/JMTK) are major objectives of the TOC 3-D application. Using C/JMTK, TOC 3-D has successfully prototyped the capability for the U.S. Army to add full-dimensional viewing of the battlefield. This full-dimensional viewing capability includes 2-D views, 3-D perspective views, and 2-D and 3-D views with a temporal component.

In summary, the TOC 3-D application combines all relevant data into one application that can be used by combatant commanders to make better-informed decisions.

More Information

Further information regarding the TOC 3-D program and application can be found at **www.toc3d.com**.

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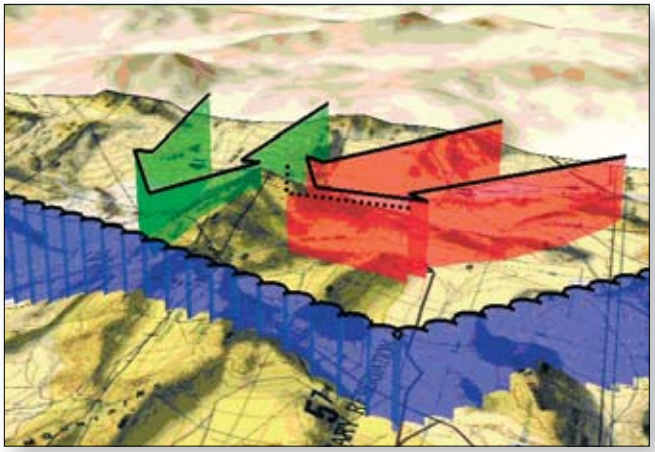
Billboarded symbols being displayed in the ArcGlobe™ control within the TOC 3-D application

Mission with more than 1,700 units being visualized in the ArcGlobe control within the TOC 3-D application



View of extruded tactical graphics within the TOC 3-D application

CTC Concurrent Technologies Corporation

TOC 3-D is an initiative by the U.S. Army Project Manager, Ground Combat Command and Control (PM GCC2) under the auspices of the Program Executive Office, Command, Control, and Communications Tactical (PEO C3T).

All Source Analysis System-Light: Rendering the Enemy Situation

Full MIL-STD-2525B, including MOOTW and custom symbology, and conventional and nontraditional warfare

ASAS-L supports OIF before, during, and after the fight

Today, ASAS-Light (ASAS-L) is the premier Army intelligence workstation supporting Operation Iraqi Freedom (OIF). A major reason for this is its success as a planning, visualization, and analysis tool before, during, and after the war in Iraq. ASAS-L is produced by Austin Info Systems, Inc. (AIS).

Using C/JMTK, ASAS-L provides a command-level view of the conventional battlefield augmented with multi-intelligence support and icons for military operations other than war (MOOTW) and custom theater-specific symbology. ASAS-L was one of two early Army adopters of C/JMTK with fielding now underway for deploying Army and Marine units.

Jim Wade, president of AIS, summarized the significance of the product by saying, "The current version of ASAS-L being fielded to deploying units provides the first multi-intelligence capable system that delivers both conventional and nonconventional asymmetric analysis capabilities."

Overview

AIS developed ASAS-L, providing intelligence analysis to worldwide operations, including Kosovo, Iraq, and Afghanistan, with more than 2,000 installations. An authorized ESRI business partner, AIS incorporates ArcGIS, ArcSDE, ArcIMS, MapObjects®, and C/JMTK in a variety of map-based workstations and Web-based geotactical displays. ASAS-L has now evolved to the next step, becoming the Joint Intelligence Toolkit (JIT). Beginning in July 2005, JIT will provide an extensible software product line-based feature set installable on new intelligence workstations.

JIT provides the war fighter with a multi-intelligence database, visualization, mapping, and messaging with plug-ins supporting collateral COMINT and ELINT. JIT also adds plug-ins supporting HUMINT, IMINT, and data fusion. Future plug-ins will be accredited for SCI operations supporting MASINT and COMINT. Based on standard ESRI GIS products, JIT readily integrates national-level intelligence products through standard ESRI file formats.

Capabilities and Accomplishments

AIS has worked with ESRI for five years as part of replacing the existing Joint Mapping Toolkit (JMTK) in ASAS-L. AIS pioneered its own MIL-STD-2525B rendering system for increased performance and complete coverage of war-fighting icons, tactical graphics, and MOOTW symbols. By providing AIS with direct and intuitive control of map-based rendering, C/JMTK has proven invaluable in ABCS integration efforts. The AIS JIT rendering software also supports Web-based map displays through ArcIMS. JIT also easily and seamlessly interfaces with ESRI's MapObjects for map-focused applications not requiring other GIS capabilities.

Contact Information

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JIT includes Emitter Mapper, a C/JMTK-based, high-volume line of bearing (LOB) extension that analyzes and displays geolocations for stationary emitters as well as geolocations and predicted tracks for nonstationary emitters. A unique feature is the display of contours derived from the density of LOB intersections in a rich emitter environment. The Emitter Mapper software supports fast rendering of LOB data (peak refresh rates exceeding one million LOBs per second), extension toolbars, and dockable windows for analysis interfaces. As with all JIT products, import/export capabilities promote data sharing in a net-centric, war-fighting environment.

"ASAS-L is an outstanding addition to the intel community," says Major William I. Brown, deputy G2 for the 101st Airborne. "It is a significant improvement over what we have been using. This product would have made all the difference for us if it could have been used in other areas of Iraq." The new MIP 6325 multi-intelligence software capabilities in ASAS-L are an upgrade to the software used during the first deployment in the war in Iraq.

Maj. Brown noted key functionality of ASAS-L for accessing and modifying multi-int data. ASAS-L user-friendly functions include

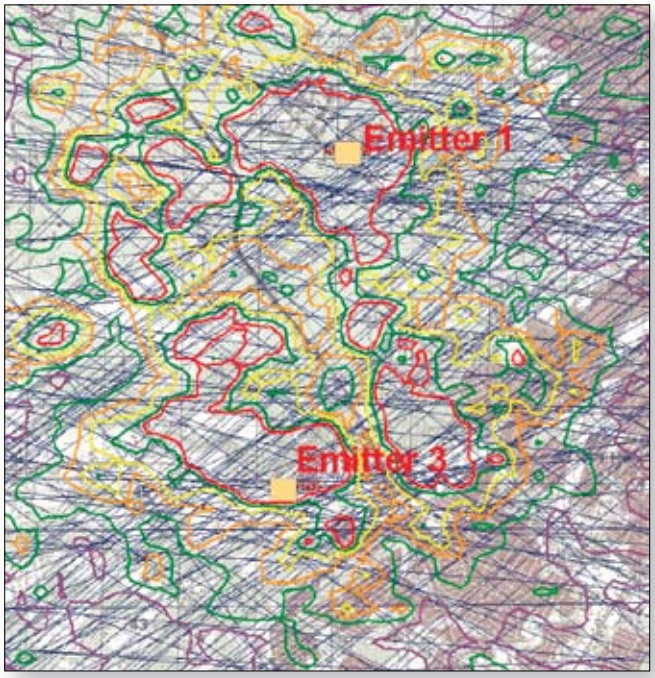
- A one-stop shop for information from all intelligence sources
- Concurrent display of all items
- Easy-to-sort linked charts
- Customizable charts

In an after-action report from Pfc. Jessica Lynch rescued by the 75th Ranger Regiment deployment, Maj. David Morrison stated the significance and usefulness of ASAS-L this way: "The ASAS-L provided me the 'just-in-time' data to help me formulate my IPB (Intelligence Preparations of the Battlefield) during our compressed/hasty MDMP (Military Decision-Making Process) to execute the mission. The ASAS-Light was the only system that I could use in the very short period of time to gain SA (situational awareness) on the area. We executed very quickly based on the amount of notice we were given prior to the mission execution."

Summary

AIS products work exceptionally well in conjunction with ESRI products to support the war fighter through

- Improved mapping capabilities
- Usability enhancements for analysis and visualization
- Better capability for collecting, analyzing, and displaying nontraditional COMINT collections
- Integration of national intelligence products
- Web-based map display and tools for data viewing
- Comprehensive, data-driven visualization tools, making it easier to query, display, plot, and edit related information
- Expanded features for resolving individually reported lines of bearing into composite locations
- Simultaneous correlation of records into a single data record or new network



Locate terrorist activity through line of bearing visualization.

Austin Info. Systems, Inc.

Battlespace Terrain Reasoning and Awareness

Course of action assessment and named areas of interest. The Digital MCOO and Maneuver Projection are used to assess three threat COAs. Based on the analysis of possible COAs/routes for the enemies' advance, BTRA calculates the time the force must enter and/or leave an NAI to affect the Blue Commander's mission. These times can be used to manage ISR or other force assets to monitor the NAI and refine threat assessment.

Introduction

BTRA's primary objective is to empower commanders, soldiers, and systems with actionable information that allows them to understand and incorporate the effects and impacts of terrain and weather on their functional responsibilities and processes (e.g., IPB, C2 planning, red and blue COA analysis). These effects can both enhance or constrain force tactics and behaviors, platform performance (ground and air), system performance (e.g., sensors), and the soldier. BTRA's focus is (1) to develop software analytics designed to create actionable information and knowledge products that capture integrated terrain and weather effects and (2) to develop interactive, predictive decision tools that can be embedded within other C4ISR systems.

Military transformation is highly dependent on a common, shared understanding predicated upon both existing, shared battlefield information and predictive estimates to achieve C4ISR agility. Extension of this doctrinal tenet to geospatial information argues that terrain and weather information should be founded in common analytics and employ common representation and predictive tools. For these reasons, BTRA technology has sought the widest possible transition base to C4ISR systems through NGA's Commercial Joint Mapping Toolkit (C/JMTK).

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Mission/Overview

BTRA's developmental approach is a response to the objective of "tearing down stovepipes" within C4ISR. Extensive requirements analysis of the Army's Future Combat System (FCS) and Distributed Common Ground/Surface Systems—Army (DCGS-A) has resulted in the identification and derivation of more than 200 C2 and nearly 175 intelligence-based requirements having significant geospatial relevance. Further analysis found additional requirements in the USMC Topographic Production Capability (TPC) and within time-critical targeting elements of the USAF Theater Battle Management Core Systems (TBMCS). All these programs of record are approved to use capabilities from C/JMTK.

Capabilities

BTRA capabilities represent the best attempt to address the broadest set of requirements. BTRA's focus is on the development of six information generation components and four decision tools addressing terrain and weather effects. Each of these components utilizes terrain feature data; digital elevation models; current and forecasted weather; and information regarding tactics, techniques, and system performance. BTRA analytic components generate information products addressing

- A suite of line-of-sight capabilities that incorporates weather attenuation
- Cover, concealment, and obstacles
- Advanced mobility analysis
- Spatial operational compartment and positions of advantage (key terrain) for specific force types/tasks
- High-fidelity weather/terrain effects of mobility and signature physics
- Digital ground and air Modified Combined Obstacle Overlays (MCOOs) supporting interactive route analysis

BTRA decision tools operate on BTRA information products, not the original data. These tools support

- Predictive multicriteria, multiobjective maneuver, and logistical route analysis for ground forces
- Physics-based predictive sensor performance for IR, seismic, and acoustic sensors
- Situation assessment
- Predictive threat assessment

Benefits

BTRA modular and automated capabilities provide the ability to incorporate predictive and interactive effects of the terrain and weather into C4ISR processes and systems to support real-time analysis and decision making. BTRA tools will greatly improve IPB and C2 processes, accelerating COA analysis and enabling interactive predictive analysis. These capabilities, along with BTRA sensor performance tools, have the potential to improve ISR asset management, threat detection, and identification. BTRA situation and threat analysis tools provide a geospatial capability supporting improved levels 2 and 3 fusion. By design, BTRA capabilities increase situational awareness and battle management effectiveness.

Summary

BTRA's decision to build upon ESRI and C/JMTK tools has allowed for rapid capability development, maturation, and transition. The Engineer Research and Development Center and BTRA's partnership with NGA and C/JMTK offer the potential for common capability and tools across the force and take the community one step closer to the elimination of information stovepipes and achieving true interoperability.

Multiple maneuver route analysis capable of supporting course of action. BTRA analysis employs digital MCOO to assess the movement and routes of two forces converging on a single objective. Colors depict the location of each force in mission-based time intervals.

The Intelligent Road/Rail Information Server

Convoy tracking and status

Introduction

The Intelligent Road/Rail Information Server (IRRIS®) technology is a first-of-its-kind Web-based GIS that has revolutionized the way the U.S. military views, analyzes, and tracks infrastructure data and mobile assets worldwide. IRRIS technology is so unique that it has been granted a U.S. patent.

GeoDecisions partnered with the Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) to develop an application that would assist the military in its efforts to streamline logistics and improve the global deployability of U.S. armed forces. IRRIS technology was created to provide an effective way for SDDCTEA to manage, document, and synchronize the movement of cargoes transported over land and sea on a global basis.

Mission/Overview

IRRIS uses advanced information technology, GIS, and location-based services to enable military users to be more proactive in coordinating and managing assets through an interactive mapping interface.

IRRIS technology was developed using ArcIMS, ArcSDE, and Oracle®. The geographic (locational) nature of the logistics information facilitates the use of GIS mapping to visualize assets and perform analysis (e.g., plume, buffer, route adherence, geofencing, automated alerts, and notifications) and spatial queries.

Altogether, the application integrates transportation logistics, real-time tracking, and infrastructure data into a single, secure application that is accessible through the Internet. With real-time and relevant information about road conditions, construction, incidents, and weather from more than 150 worldwide datasets, IRRIS technology can enhance decision making, facilitate the rapid deployment of military assets and personnel, and track military convoys and freight globally.

The critical functions of IRRIS are to

- Provide a common interface into a system that offers a one-stop shop to information.
- Provide real-time information.
- Integrate all information into one common operating picture.
- Maintain flexibility to handle the latest technological advancements.
- Be scalable to manage small local issues as well as significant regional and national events.

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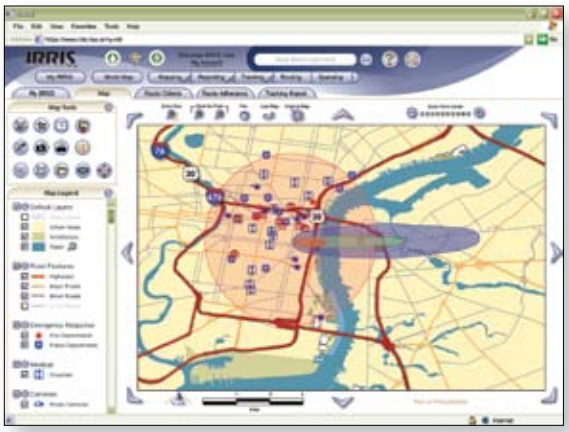
As IRRIS technology continues to improve and demonstrate its wide range of use, adaptability, and ease of integration with new sources of static and real-time data, its demand by other branches and military agencies has increased.

In addition to SDDCTEA and its parent command SDDC, the application has been used by the Naval Operational Logistics Support Center (NOLSC) Ammunition, Defense Transportation Tracking System (DTTS), Defense Threat Reduction Agency (DTRA), Army National Guard, Federal Highway Administration (FHWA), U.S. Transportation Command (USTRANSCOM), U.S. Northern Command (USNORTHCOM), and U.S. Department of Transportation (US DOT).

Capabilities

- Tracking of intermodal shipments via road, rail, and water (in-transit visibility/total asset visibility)
- Real-time intelligent weather and notification
- Live traffic and incident data including up-to-the-minute route cameras
- Accurate, dynamic routing; driving directions; and route adherence
- Detailed infrastructure information and mapping
- Wireless and personal digital assistant (PDA) access
- Connection to data on critical facilities such as nuclear power plants, dams, and hospitals
- Display and analysis (e.g., proximity, buffer) of information over GIS-based mapping for enhanced decision making
- Plume modeling
- Automated alerts and notification
- Georeferencing



Display and analysis of information over geographic information system-based mapping for enhanced decision making

Routing of vehicles, containers, and ocean cargo; live traffic and incident data

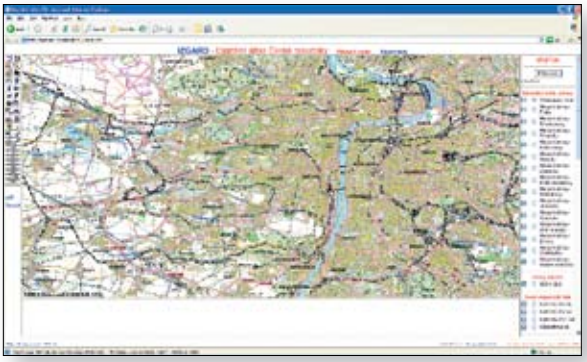
Benefits: IRRIS technology has allowed SDDCTEA to streamline military logistics, reducing the time and costs for military training and operations. The application has also provided the military, as well as DoD, with greatly improved situational awareness worldwide. This leading-edge technology is providing a dynamic, integrated tool for real-time tracking of DoD assets, especially effective for monitoring sensitive shipments.

In addition to its functional benefits, IRRIS technology saved U.S. taxpayers approximately $35 million and enabled SDDCTEA to track 750,000 shipments worldwide in 2004.

Summary: IRRIS technology is a very effective logistics and decision support tool for the military. Foremost, it provides an easy-to-use, Web-based interface for access to static and real-time information. Also, the application's open system technology leverages best practices in information technology and easily integrates with existing systems. This flexibility allows the system to accommodate the varying needs of military and government agencies.

IRRIS technology continues to improve as new data becomes available and logistics and emergency management functionality is requested. Its ability to integrate existing live data feeds and static GIS data from various government and commercial sources makes it a powerful tool for logistics, transportation, homeland security, and other civilian applications.

IZGARD



Czech Army Data Network

The Czech Army is using new information technologies and its military data network for simple data interchange, electronic mailing among military users, military Web pages, and its staff information system application. In May 2002, the Czech Military Geographic Service started a geographic information server called IZGARD, offering basic GIS functionality to all users of the military network. IZGARD is the Czech acronym for Internet Display of Military Geographic Data. The IZGARD service is currently available both on the Czech military intranet and, with limited data content, on the public Internet.

IZGARD History

The IZGARD project was part of the information support to the military data network. During initial testing against competing Internet mapping software, ESRI's ArcIMS was evaluated. Because of the competitor's difficulties with the Czech alphabet display and ESRI's close support of all data formats used by the Military Geographic Service, ArcIMS was chosen for further development. The development started with ArcIMS 3.1 and continued with versions 4.0 and 9.0.

IZGARD Functions and Usage

- Introduce GIS beginners to the Military Geographic Information System content.
- Offer geographic data from the national level up to the 1:25,000 scale.
- Offer global geographic data at 1:1 million and 1:250,000 scales.
- Create a tool for aerial imagery archive search and ordering.
- Develop an application for environmental disaster evaluation.
- Create a tool for searching Czech administrative units.

Technical Environment

Since May 2002, the project has been running on the VTOPÚ data server in Dobruška, Czech Republic, that is connected to the Military Data Network. In October 2002, the civilian version of the IMS site was started on a server at ARCDATA PRAHA, s.r.o., ESRI's Czech distributor. Later, the civilian version was installed on a server of the Czech Ministry of the Environment. Source datasets are stored partially in shapefiles and partially in an Oracle SDE geodatabase.

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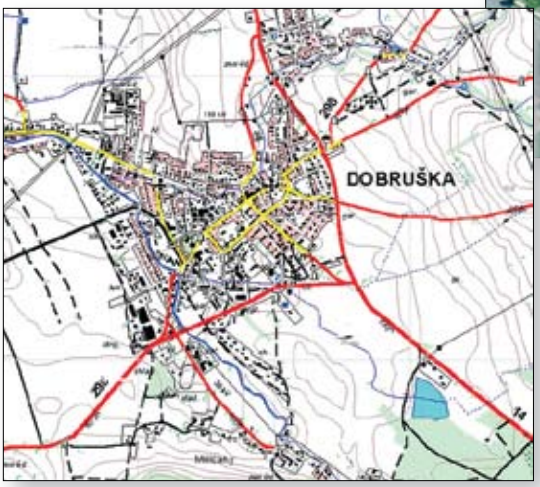
Software tools used for Internet publishing are ESRI's ArcIMS 9 and Web presentation support tools Apache 1.3 and Jakarta 3.2.1 (Apache Software Foundation, Inc.). ArcIMS offers tools for data display compatible with the Czech and NATO standard portrayal of geographic features. There is an effort to continually improve the quality of feature symbolization to be clearly readable and to distinguish necessary information applied to individual features.

IZGARD Success

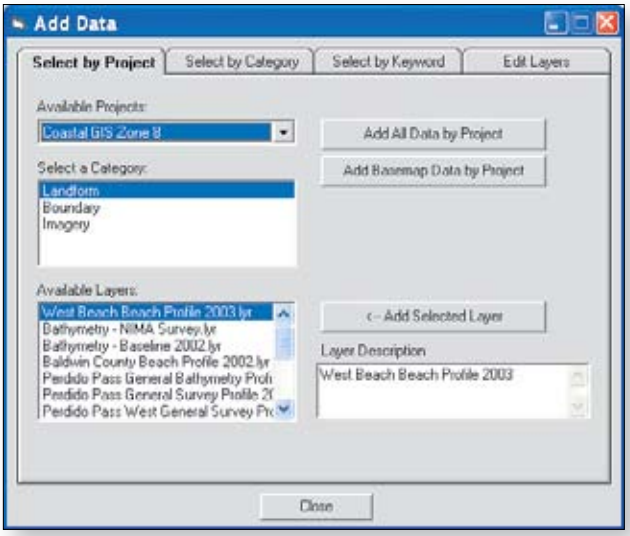
At the ESRI/Leica Czech User Conference in 2003, the poster Data Integration in the IZGARD Environment was awarded third prize by an expert jury and first by a vote of the conference audience. In 2004, another poster, 10 Steps to Imagery with the IZGARD Tool, was named first by the expert jury and received second place in conference audience voting.

IZGARD Web Site

Public Internet URL (with limited data content): http://xeon.env.cz/Website/dmu/index/index.html



U.S. Army Corps of Engineers Approach to Regional Coastal Mapping



The retrieval tools in the eCoastal Toolbox (eGIS: Data Viewer Tools) allow a user to retrieve information from a variety of sources by launching a comprehensive interface. Using Data Picker, the user will be able to limit and control the data retrieval process. Users can search the geodatabase by project name, category, or keyword.

The U.S. Army Corps of Engineers (USACE) recently modernized its approach to managing and operating federally authorized navigation projects using the concept of regional management. Individual projects are combined and managed in the context of regional processes that drive sediment transport called regional sediment management. Its objective is to retain sand in the littoral system to foster more balanced, natural system processes and reduce project costs. Regional measuring and monitoring are key elements of this new approach and management practice.

The Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) is in the process of producing map products that include a seamless digital survey of the coastline of the United States with bathymetric lidar-derived elevations spaced at five meters horizontally and topographic lidar-derived elevations spaced at one meter. These surveys covered an area from the waterline landward 500 meters and, where water clarity permitted, seaward 1,000 meters. In addition, digital imagery was collected coincident with the lidar surveys.

These coastal resources are being integrated into a GIS to assist in the organization and distribution of spatial information. The Mobile District's Spatial Data Branch has designed a Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE)-compliant geodatabase template and a series of comprehensive ArcGIS applications, named eCoastal, to assist the coastal engineer in effective planning and prediction of regional and local coastal processes. The specialized applications were developed to provide baseline information for regions including hydrographic and topographic data; shoreline position; aerial and oblique photography; hyperspectal imagery; dredging records; nautical charts; and other data regarding regional utilities, infrastructure, and land use. Customized GIS applications were also designed to retrieve pertinent hydrologic information, extract dredging information from district databases via reporting tools, and create bathymetric profiles and volume changes.

Contact Information

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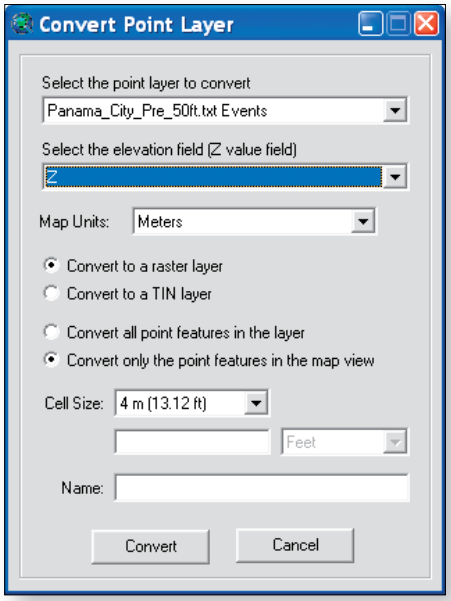
Through the work of JALBTCX and the Spatial Data Branch, data is being collected and distributed in an effort to provide the information needed for regional decision support. eCoastal provides engineers and scientists with tools to both visualize spatial data and perform engineering analyses. Employing data standards, integrating high-quality datasets, and distributing applications allows users to easily understand and analyze more data in less time and provides a mechanism to convert the data into useful information in a cost-effective and timely manner. This technology enables stakeholders in management decisions to explore the broad spatial and temporal impacts of potential management actions.

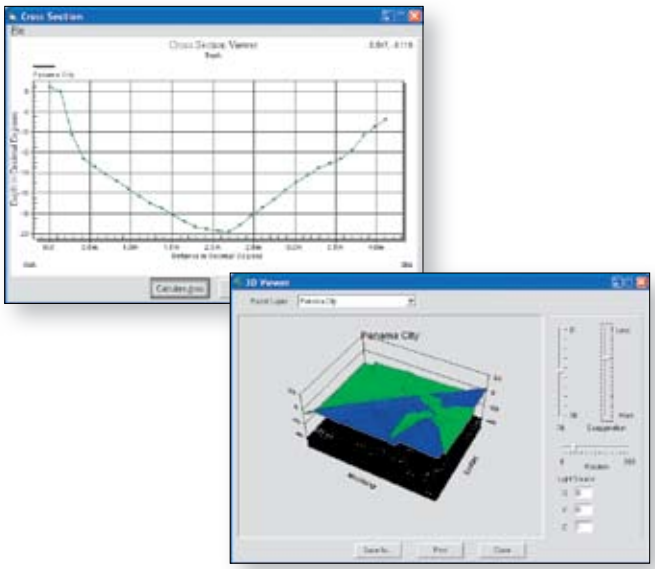
For more information regarding JALBTCX, contact W. Jeff Lillycrop, director, Joint Airborne Lidar Bathymetry Technical Center of Expertise, 7225 Stennis Airport Drive, Suite 100, Kiln, Mississippi 39556; by phone at 228-252-1101; or via e-mail at jeff.lillycrop@sam.usace.army.mil.

Support Information

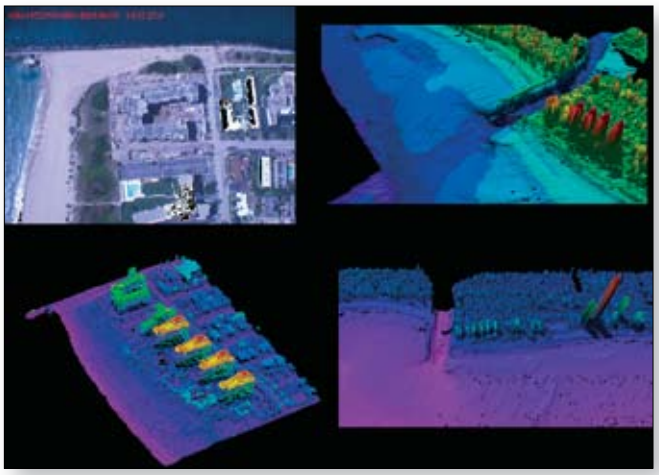
The eCoastal applications, SDSFIE geodatabase formats, and architecture can be downloaded from the Spatial Data Branch, Mobile District at http://gis.sam.usace.army.mil. Technical support for setting up the hardware, software, and applications developed by the Mobile District can be obtained by contacting Rose Dopsovic, Spatial Data Branch, Mobile District, via e-mail at rose.dopsovic@usace.army.mil; by phone at 251-690-3107; or via mail at 109 St. Joseph Street, Mobile, Alabama 36602.



Graphical user interfaces have been created to assist the engineer in generating surfaces.



The 3D and Profile tool allows the user to view raster layers in a cross section or 3D environment. Using this tool, the user can gain a different perspective on the survey data. Users have the option to view a subset or the entire surface and change the viewing conditions.



Sample of JALBTCX's data collection from the NCMP. It shows a seamless digital survey of coastline with bathymetric lidar-derived elevations spaced at five meters horizontally and topographic lidar-derived elevations spaced at one meter. These surveys covered an area from the waterline landward 500 meters and, where water clarity permitted, seaward 1,000 meters. In addition, digital imagery was collected coincident with the lidar surveys.

SFOR Geographic Support

General view of production area

Reference map—background map for all thematic geo products

Stabilization Forces in Bosnia and Herzegovina (SFOR in BiH) finished their mission at the end of 2004. SFOR's geographic mission was "to conduct geographic support within the SFOR Area of Operation (AO) to ensure the availability and interoperability of required geographic products; coordinate the supply of maps, charts, and digital geographic information to participating forces; and provide special geographic products, information, and services as required."

During the Balkans mission, geographers from Canada, France, Germany, Great Britain, the Netherlands, Poland, and the United States were able to perform many interesting geotasks such as

- Terrain analysis and visualization
- Map production and reproduction
- Map supply and distribution
- Data management through a geoserver
- Provision of geoadvice and liaison

They were equipped with appropriate hardware to fulfill these tasks, but even excellent hardware means nothing without software—specifically GIS software. During the SFOR mission, the following GIS software was used:

- ArcView® 3.2
- ArcView Spatial Analyst
- ArcView 3D Analyst™
- ArcPress™
- ERDAS® IMAGINE® 8.4

The geosection was responsible for collecting geographic information, both in analog and digital forms. Data providers were located not only within the headquarters (such as CJ2, CJ3, CJ4, Joint Operational Centre [JOC], and NC3A) but also in governmental and nongovernmental organizations as well.

During this process, the following information was gathered:

- Topographic line maps of various scales
- Air navigation charts
- Town plans of various scales
- Raster data
- Matrix data
- Vector data
- Imagery

Contact Information

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HQ SFOR CGO (September 2003–2004)
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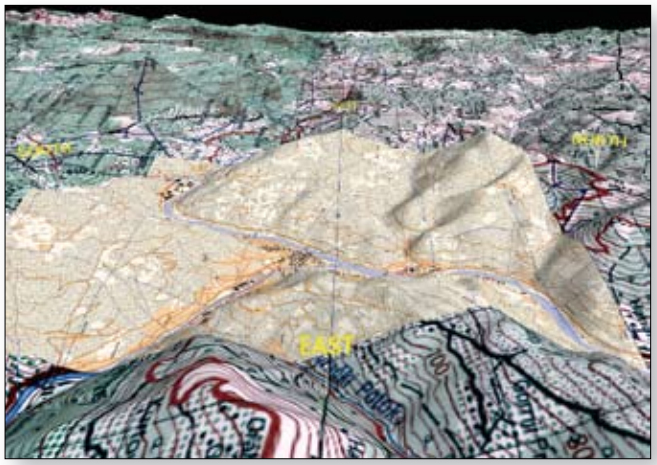
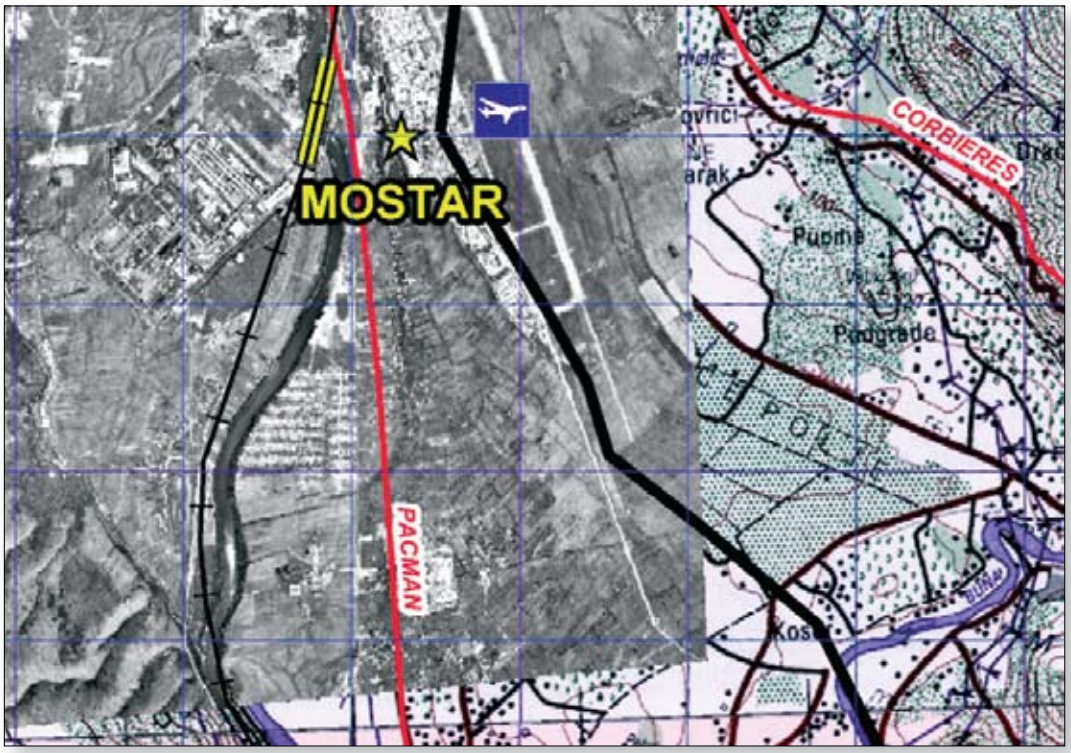
To answer questions of SFOR headquarters, hundreds of geographic products were developed. Among the products are

- SFOR Unit Disposition Map
- SFOR Route Map
- SFOR Helicopter Landing Sites Map
- SFOR Medical Facilities Map
- Smuggling Roads
- Industrial Hazard Sites
- Election Results
- SNIC Roads (Snow and Ice Coverage Map)
- Border Crossing Points
- Weapon Storage Sites
- Canton and Opstinas (Administrative Division Map)
- Ethnic Distribution
- Depleted Uranium Map



Terrain visualization (3D)—Focal area. 2D dataset draped over the digital terrain elevation model.



Example of SFOR MISC product

Geospatial Information Science at the United States Military Academy

Overview

The United States Military Academy's Geospatial Information Science Program prepares America's future Army leaders to effectively apply geospatial technology and achieve information superiority on tomorrow's battlefields. As a member of West Point's Geography and Environmental Engineering Department, the program supports the academy's mission of preparing cadets to be officers in the Army by offering them a wide range of education and research opportunities. At the same time, the program leverages its faculty expertise and resources to provide education and research support to numerous Department of Defense organizations.

Cadet Education

The program offers a full spectrum of geospatial courses to meet the education requirements of cadets majoring in geospatial information science or as electives for various other majors. Cadets majoring in the program study cartography, basic and advanced GIS, and basic and advanced remote sensing and complete their education with surveying and/or photogrammetry.

Cadet Research

Cadets often complete an individual advanced research project, which focuses on solving real-world geospatial problems. Example cadet projects include (1) creation of an Urban Tactical Planner (UTP) for West Point; (2) modeling multidwelling structures in a military housing SDSFIE geodatabase; (3) creation of an elevation data library from diverse sources and resolutions; (4) comparing land-use and land-cover assessments derived from Landsat, IKONOS, and Hyperion imagery; (5) integration study of new technology (GPS and spectral radiometry) into surveying and remote-sensing education; (6) watershed storm flow modeling with a GIS; (7) 3D visualization and analysis of the Gettysburg battlefield; (8) animated temporal map of change at West Point; and (9) Yuma Proving Ground desert classification with elevation data.

Cadet Summer Intern Program

To gain experience with real-world problems and apply their classroom knowledge, cadets participate in summer internships at various DoD agencies and commercial firms. Participating organizations include Topographic Engineering Center (TEC), Defense Geospatial Intelligence School (DGIS), U.S. Army Strategic Command (ARSTRAT), EarthData, and others. New locations can be offered in the future; interested organizations should contact the faculty.

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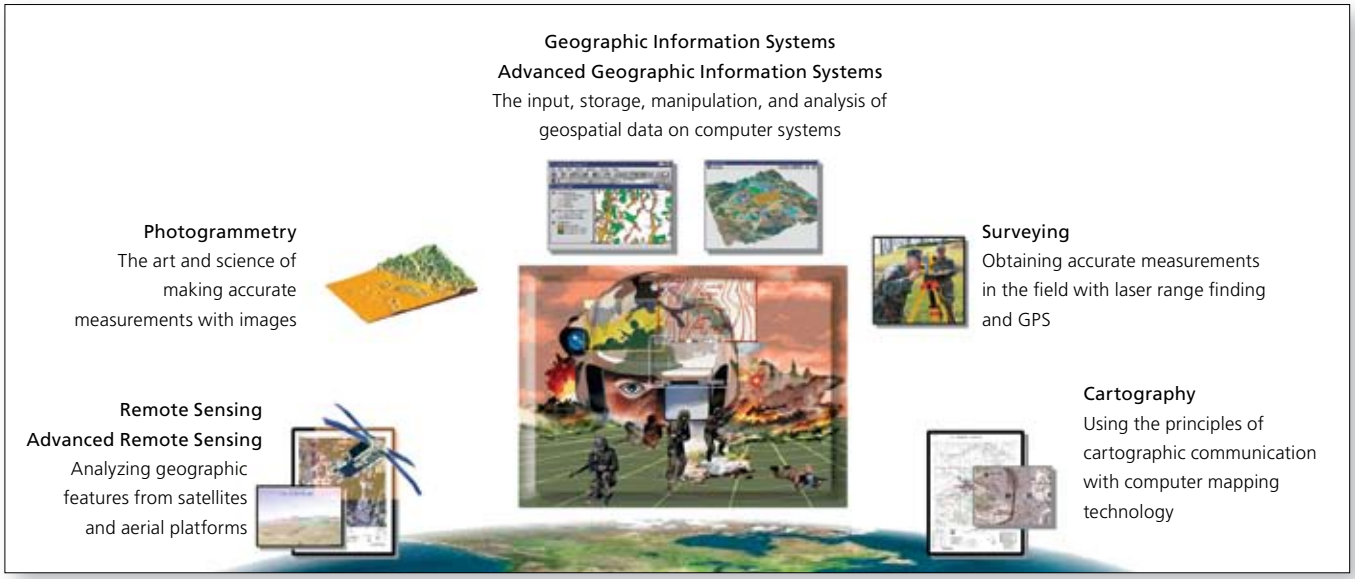


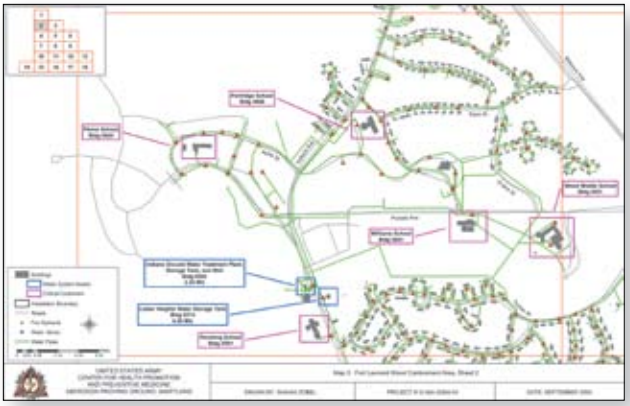
Faculty Research and Outreach

The program's faculty and cadets conduct research for and with a number of DoD organizations. Example research projects include (1) cover and concealment from satellite imagery with NGA; (2) remote sensing and GIS education with ARSTRAT; (3) image processing protocols and procedures with ARSTRAT; (4) security forces' role in C-CBRNE operations with INSS—the program's faculty also provides geospatial training sessions to outside agencies when requested; and (5) modeling the impact of geo-update validation delays on an organization's common view of the environment, Army G3, and modeling and modeling simulation.

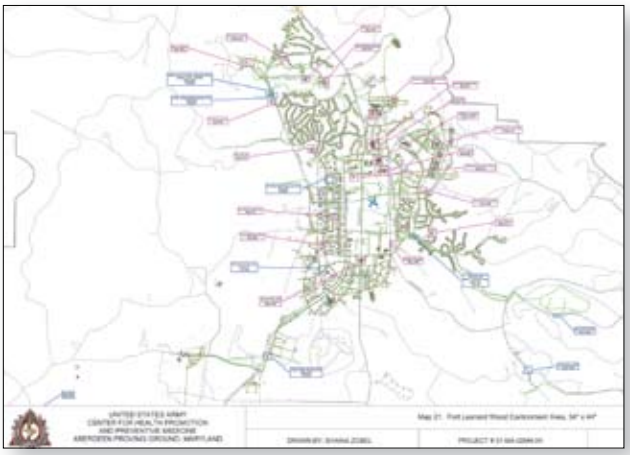
Department of Geography and Environmental Engineering
U.S. Military Academy

U.S. Army Center for Health Promotion and Preventive Medicine

Emergency Response Plan Mapping: Securing the Army's Water Systems



Small-scale view of Emergency Response Plan map



Large-scale view of Emergency Response Plan map

The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) provides worldwide scientific expertise and services in preventive medicine, environmental health, epidemiology and disease surveillance, and toxicology. USACHPPM supports readiness by keeping soldiers fit to fight, while also promoting wellness among their families and the federal civilian workforce.

USACHPPM has developed comprehensive Emergency Response Plans (ERPs) for U.S. Army installations, primarily in response to the Bioterrorism Act of 2002. This act requires water utilities to conduct Vulnerability Assessments (VAs) of their water systems and create or update their ERPs based on the VA findings. In addition to VAs, ERPs also aim to prepare an installation for an emergency. It will guide first responders by identifying roles and responsibilities of applicable installation organizations. ERPs also provide valuable information such as identifying critical water customers, offering an overview of the water system, and providing alternate water sources.

One significant component of ERPs is a series of maps. For each installation, maps of the entire water distribution network and individual detailed map sheets at 1:10,000 scale are created by the USACHPPM GIS Branch using ArcGIS® 9. In addition to standard basemap data, such as physical and human features, these maps highlight water system assets and a vital component: the locations of critical customers. The geospatial data presented in ERPs is essential to an efficient response in the event of a biohazardous emergency.

As part of the development of ERPs, the USACHPPM Water Supply Management Program conducts tabletop exercises that allow installation staff to become familiar with the new plan. Participants are provided copies of their ERPs that include the series of maps specific to the installation. These exercises have proven to be a very valuable resource to ensure the security of an installation's infrastructure, as evidenced by postexercise input from participating installations.

Contact Information

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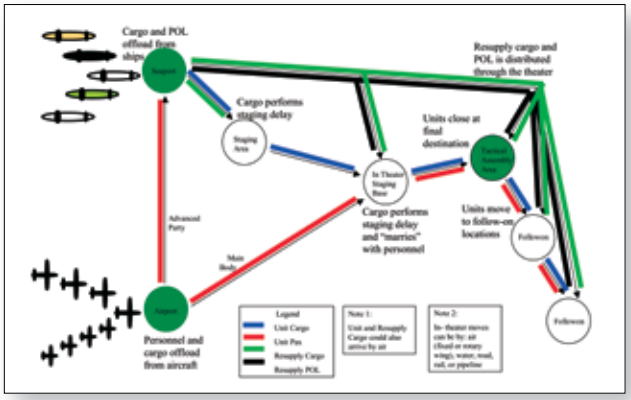
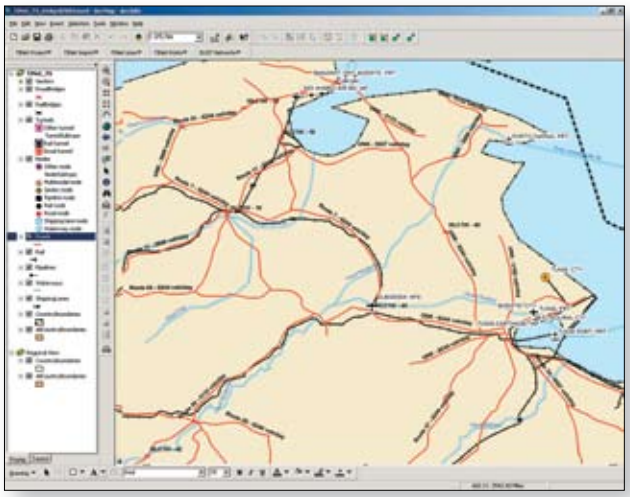
Web: http://chppm-www.apgea.army.mil

USACHPPM
Readiness thru Health

Transportation Infrastructure Network Builder



RSO&I processes modeled by ELIST



TINet-generated transportation networks for ELIST

Introduction

The Transportation Infrastructure Network Builder (TINet) will enable the Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) to use the power of ESRI ArcGIS to support the modeling and simulation of the Reception, Staging, Onward Movement, and Integration (RSO&I) processes for the joint deployment of U.S. military forces worldwide.

Capabilities

Geospatial analysts will use TINet to build and maintain transportation infrastructure databases from a variety of commercial and U.S. government sources including commercial GIS, commercial air- and space-based imagery, the Defense Intelligence Agency's (DIA) Modernized Integrated Database (MIDB), National Technical Means (NTM) imagery, and the National Geospatial-Intelligence Agency's (NGA) raster and vector product format (RPF and VPF) data. Planned capabilities include the following:

- Import all-source vector and raster data.
- Build and maintain all-source transportation infrastructure geospatial databases.
- Calculate the maximum, minimum, and weighted average slope of road and rail links.
- Calculate the military load classification (MLC) of highway bridges in accordance with U.S. Army doctrine FM 3-34.343, Military Nonstandard Fixed Bridging.
- Calculate scenario-specific, time-phased, and force-based highway throughput capacities.
- Export and import vector and raster data to and from the Enhanced Logistics Intratheater Support Tool (ELIST).

Benefits

SDDCTEA will use ELIST with TINet-generated transportation networks to evaluate the ability of theater infrastructure and assets to support the Combatant Commander's Movement Plan for a concept/operations plan, contingency, or crisis scenario. TINet will have the capability to import ELIST scenario results and identify the transportation links and their associated throughput capacities, bridges, and tunnels needed to support RSO&I for a given military force and scenario. It will facilitate sharing that data with the DoD planning community in standard commercial vector and raster GIS data formats, leading to detailed understanding of the impact of infrastructure capabilities on force deployability and the likelihood of successful war plans.

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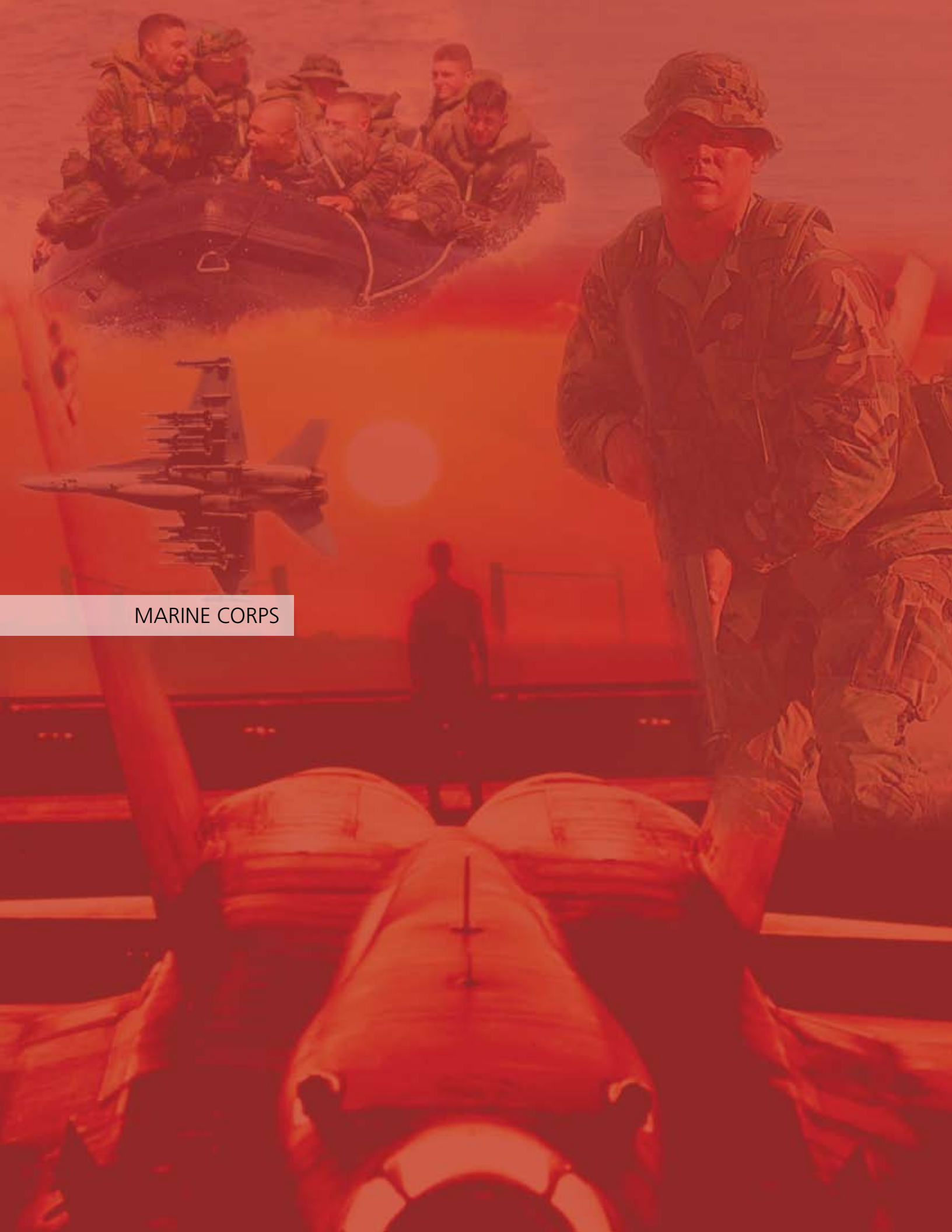
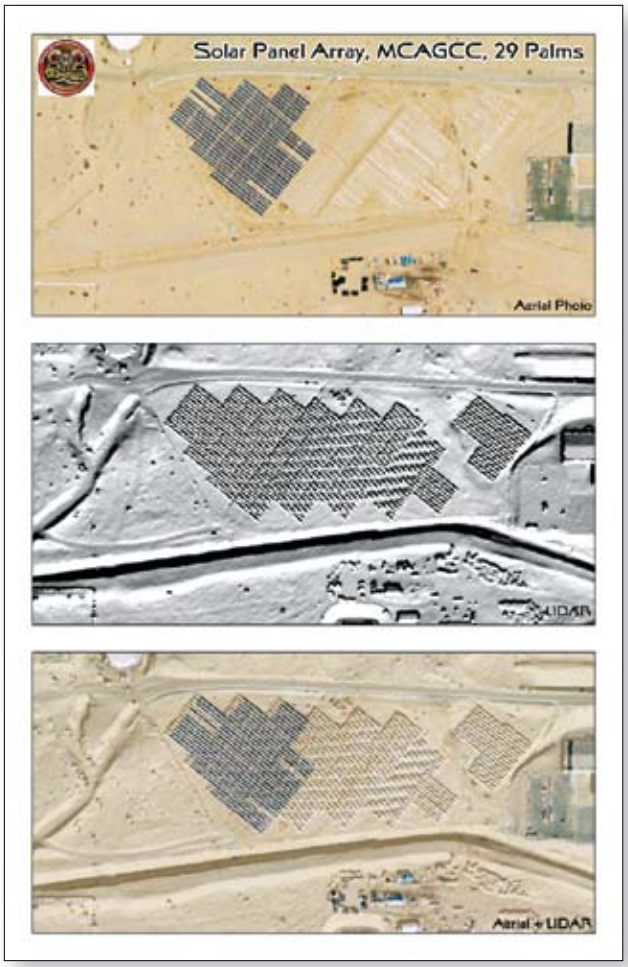


MARINE CORPS

MAGTFTC/MCAGCC

Twentynine Palms, California

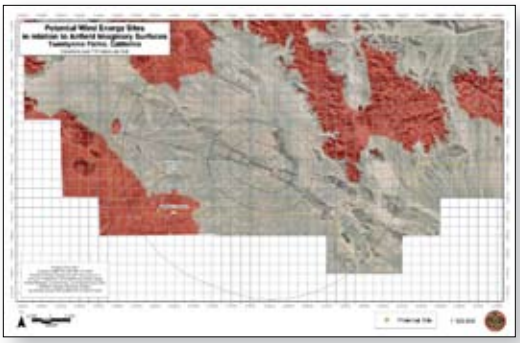


Aerial photography and lidar overlay

Overview

GIS is used for decision making and process improvement within the various organizations at the Marine Corps Air Ground Combat Center (MCAGCC). GIS plays a vital role in providing decision makers with tools that allow for an integrated approach to military training, land planning, and homeland security issues. As the population in Southern California's high desert continues to grow at a rapid pace, decision makers look at issues such as disaster preparedness, encroachment, infrastructure, and so forth, from a regional as well as a local point of view. At MCAGCC, GIS is used on a daily basis to help with such decisions.

GIS is used to show 3D views of established areas on the base as well as areas in potential development. Three-dimensional views integrated with digital elevation models allow decision makers to determine the best placement of future facilities and training areas. When the base engineers were considering the use of wind energy turbines, GIS was used to determine potential wind energy turbine sites in relation to airfield imaginary surfaces. In addition to site analysis, GIS and GPS have become instrumental in the inventory, analysis, and display of AT/FP and critical infrastructure features. GPS information is collected on a daily basis using SDSFIE-compliant ArcPad forms and downloaded directly into the GIS for instant visualization of features.



Potential wind energy sites

GIS applications making a difference in installation management

3D GIS example

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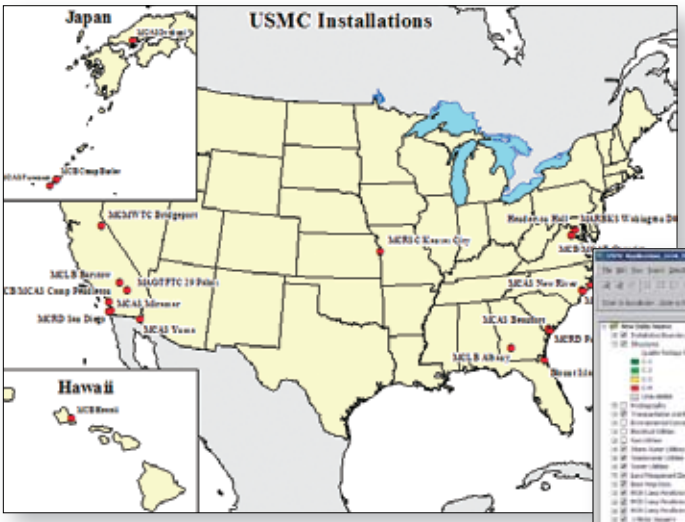
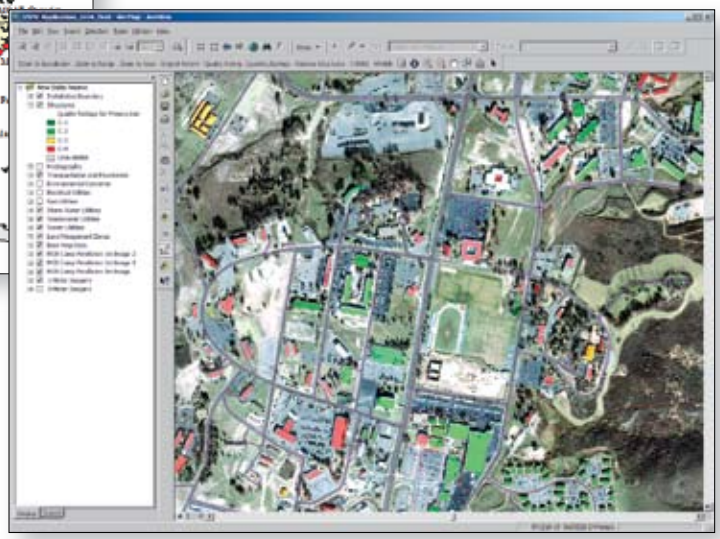
GEOFidelis



USMC installations



Facilities Management application

Overview

GEOFidelis is the Marine Corps Installation Spatial Data Infrastructure Program. GEOFidelis was created to provide leadership and functional advocacy for the USMC installation's geospatial efforts, promote Marine Corps-wide GIS awareness, develop goals and standards, provide guidance, encourage collaboration and partnering, act as a resource proponent for installation data, and act as a functional liaison with DoD and other government agencies. GEOFidelis supports the management of geospatial data in the USMC, provides overall situational awareness capability, and presents geospatial data from all Marine Corps installations in a single format that is easily accessible by USMC business processes and systems.

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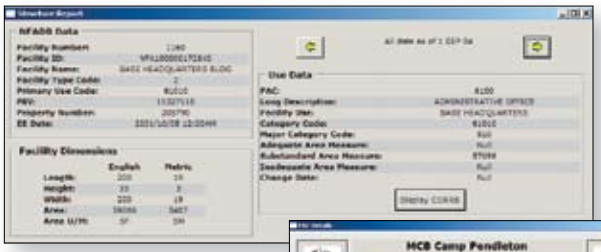
Mission Statement

The Marine Corps will have a geospatial information system (GIS) that provides precise and reliable information at the installation and enterprise levels. It will be based on a common infrastructure foundation that supports interoperability across the Marine Corps, enabling users to effectively manage their resources and accomplish the Marine Corps mission. In addition, it will support and contribute to the network of GIS data external to the Marine Corps to provide commanders the situational awareness required to respond to contingencies and coordinate consequence management responses.

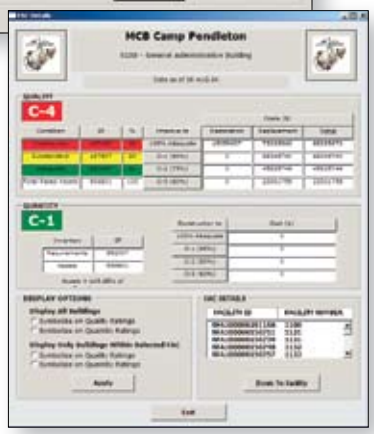
This Marine Corps geospatial data will support the geographic components of multiple decision support systems. This integration will incorporate and empower users—each "owning" their data—which translates to their owning responsibility for the accuracy and currency of the data.

Capabilities

Integration with decision support systems and the ability to provide USMC-wide situational awareness are accomplished via the GEOFidelis Central GIS Repository, which is populated with USMC installation data that is maintained by the installations. The repository is a USMC-wide geodatabase, designed to provide standard foundation GIS layers utilized by departments throughout the USMC command using ArcIMS.



iNFADS data integration



CORRS data integration

USMC foundation layers

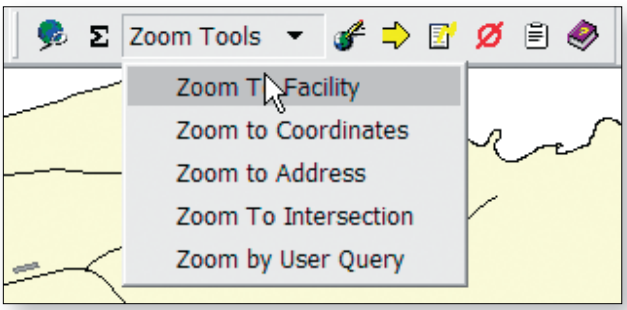
USMC bridge study

Benefits

The GEOFidelis Central GIS Repository was initially designed to support USMCmax, the USMC Enterprise IBM Maximo® Facilities Management Program, with GIS data integration. USMCmax is a Marine Corps-wide standardized Web-based facilities asset management system. USMCmax links to USMC GIS data through custom integration of ArcIMS with Maximo 5.2. Users are able to view and query GIS data related to assets, maintenance activity, and ratings across their installation.

The success of USMCmax has provided other USMC departments with accessible USMC GIS data. The USMC will eliminate redundant data calls and stovepipe GIS systems. Users will have access to accurate and current GIS information.

USMC GEOFidelis Tool Set



Zoom tools include predefined queries and the ability to develop ad hoc queries.

Example of Zoom to Intersection tool and results

Overview

In support of USMC business process modernization, Installation and Environment (I&E) established the GEOFidelis program to define its approach to enterprise geospatial systems. It is based on a common infrastructure foundation that supports interoperability across the Marine Corps. By establishing a uniform approach to GIS, GEOFidelis enables users to effectively manage their resources and accomplish the Marine Corps mission.

A survey of GIS managers in 2002 found redundancies in custom tool development as well as wide disparity in the availability of GIS resources among the installations. Moreover, many bases were facing the need to fund projects to upgrade tools to keep up with changes in the underlying technologies and the testing requirements for the Navy Marine Corps Intranet (NMCI). Based on these findings, the Marine Corps GIS Working Group (MCGWG) recommended the creation of a standardized Marine Corps GIS Tool Set. In 2004, Headquarters Marine Corps began development of the GEOFidelis Tool Set as part of its program to establish GIS standards for the Marine Corps.

The GEOFidelis Tool Set is based on common user requirements and processes. The long-term project goal is to develop a set of GIS tools that can be installed and used at any Marine Corps installation that meets minimum standards (i.e., use the CADD/GIS Technology Center's Spatial Data Standard for Facilities, Infrastructure and Environment—SDSFIE—for data storage and to comply with NMCI policies).

The first version of the Tool Set is a set of ArcGIS extensions, most of which are based on existing products. Wherever possible, the developers have reused existing codes to minimize costs and leverage the government's investments in technology. The cost of maintaining the Tool Set will be HQMC's responsibility, and the tools will be deployed to users' desktops through an NMCI or a Citrix® server. Guidelines for developing applications for the Tool Set and establishing a change control process for future enhancements and updates have been developed.

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Capabilities

The GEOFi Tool Set, version 1, consists of several ArcGIS extensions. The General GIS tools are intended for all GIS users. The others are more specialized applications for Noise Complaint Tracking and Anti-Terrorist/Force Protection (ATFP) planning.

The GEOFi General GIS tools augment the native ArcMap functions and provide shortcuts for commonly used processes. The General GIS tools are designed to work with shapefiles, personal geodatabases, and enterprise geodatabases and, as much as possible, be independent of the underlying data structures. The tools in this application include

- Data Loader, which allows the user to view a list of available shapefiles, layer files, and geodatabase tables in a user-friendly tree structure and select the datasets to be loaded; save a collection of datasets as named sets (i.e., a theme manager); and preview selected datasets before loading them to ArcMap.
- "Zoom to" tools, which include a Zoom to Road intersection and Facility locator. A new function allows the user to create and save commonly used "zoom to" queries.

The ATFP tools are intended to support military planners in the preparation of maps and plans for each security alert level. By using these tools, the planner will be able to

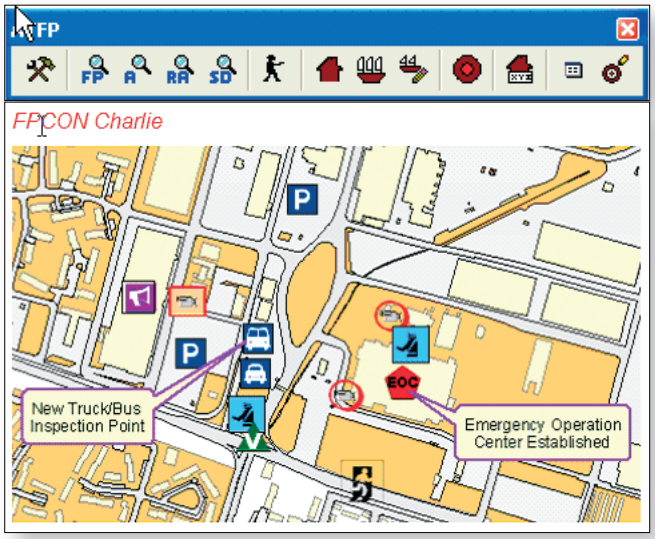
- Define values for various attributes required for different threat levels (e.g., stand-off distances).
- Define assets to be managed for ATFP including buildings, aircraft parking areas, and ships and manage the ATFP attributes associated with each feature.
- Display maps showing ATFP features automatically for a selected threat level.
- Generate reports including curtailment plans, lists of critical assets, and number of barriers required for a selected feature.
- Utilize the same common GIS dataset as all other users, but the ATFP attributes are stored in a secure database.

The Tool Set also includes Administrator and Edit applications for publishing a data catalog, batch exporting data, and editing shortcuts. The Noise Complaint tracker associates a noise complaint with an address and adds it to a point layer.

Benefits

The development of a common set of tools is expected to reduce development costs, ensure USMC-wide implementation of best-in-class GIS, and streamline the C4/NMCI application approval process. Deployment of the Tool Set will reduce the total number of applications in use, thereby furthering the goal of streamlining information management systems. By supporting application development and deployment at the HQ level, GEOFidelis ensures that money spent on software development benefits all GIS users in the Marine Corps. Decision makers are provided with tools that leverage their GIS data and make business processes more efficient.

Example of a user-defined "zoom" that can be saved, edited, and reused



The ATFP tool allows planners to develop maps for different levels of alert status.

This dialog box is an example of the user-friendly interface that allows the user to select layers to view and condition code to apply.

USMCmax

USMCmax Start Center with integrated GIS Viewer

USMCmax GIS Viewer

Contact Information

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Overview

USMCmax is the USMC Enterprise IBM Maximo® Facilities Management Program. USMCmax is a Marine Corps standard, Web-based asset management system used for installation and facilities management. To create an optimum configuration for Marine Corps Facilities Maintenance and Public Works departments, USMCmax incorporates "best business practices" from across the USMC. USMCmax links to USMC GEOFidelis central GIS repository GIS data through custom integration of ArcIMS with Maximo® 5.2. Users are able to view and query GIS data related to assets, maintenance activity, and ratings across their installations.

Benefits

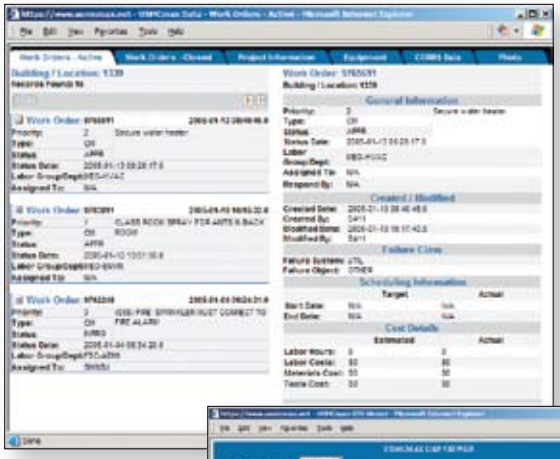
USMCmax enables the Facilities Maintenance and Public Works departments to develop and implement best business practices to support the USMC goal to "use reliable facilities management information to provide, operate, and maintain, in a cost-effective manner, the facilities necessary to support the Fleet Marine Force in both peace and war."

USMCmax provides the Marine Corps with the following advantages and benefits:

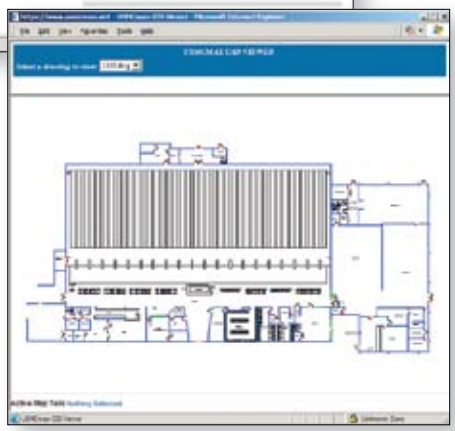
- Creates a single standardized Maximo environment for all bases
- Standardizes and upgrades all bases to the Maximo 5.x Web-enabled architecture
- Incorporates the public works process into the Maximo application
- Provides the capability to integrate with other USMC systems of record
- Reduces cost, since Maximo administration and support will be provided from a single location rather than at each base
- Consolidates reporting and provides the capability to evaluate trends across the USMC enterprise
- Eliminates the client/server environment, reducing desktop maintenance
- Permits single version certification in support of the Navy Marine Corps Intranet (NMCI) initiative
- Reduces licensing costs and permits sharing of global initiatives, such as mobile technologies, across all bases
- Reduces labor and multiple data entry requirements through integration of Maximo with other USMC systems (e.g., CORRS, iNFADS)

USMC GIS data integrated into USMCmax provides the following advantages and benefits:

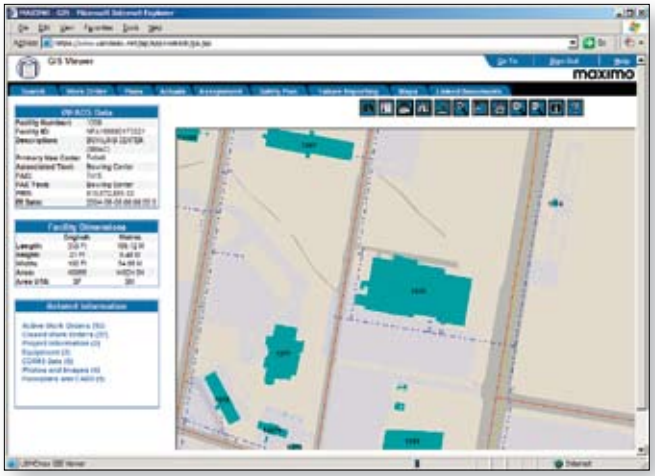
- Maintains Maximo thin client when embedding GIS capability
- Linkage for multisite systems/multigeographic locations/multiple time zones
- Utilizes the GEOFidelis central GIS repository
- Centralized Web-enabled application
- No client software, plug-ins, licenses
- Multiple map services to restrict data access
- Seamless integration of GIS and Maximo functionality and GUI using J2EE™
- Provides GIS capability within Maximo
- Synchronizes GIS and Maximo systems
- Provides visual access to locations within Maximo
- Locates facilities by address or facility ID
- Leverages current USMC GIS investment
- Reduces costs in maintaining data sources
- Improves facility operations
- Standardizes IT practice organization-wide
- Web-based N-tier architecture



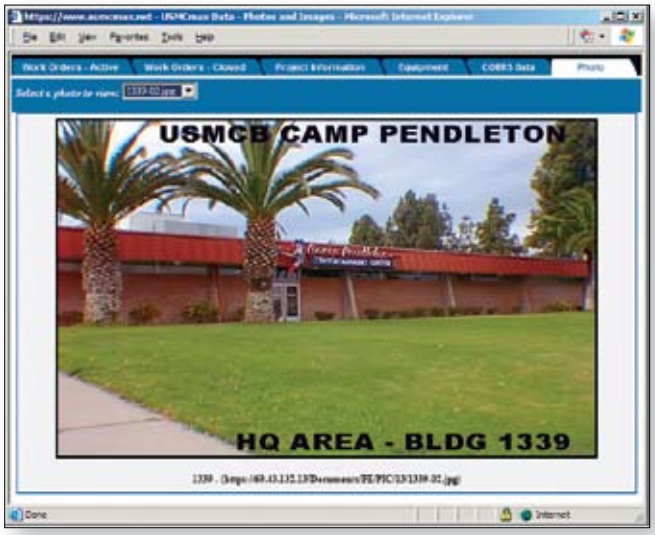
Work order data



Integrated CAD



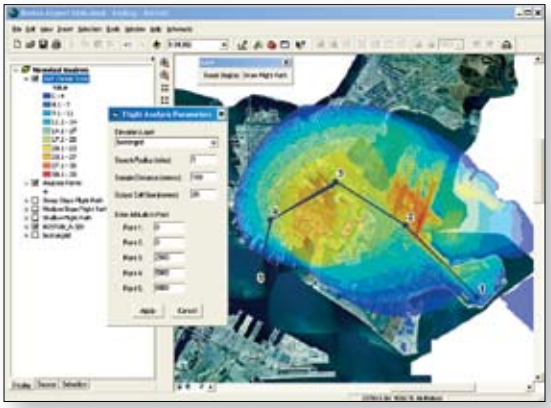
Selected facility with iNFADS data



Integrated photos and images

NAVY AND COAST GUARD

SafeSite Plan



Critical Asset Protection Planning

SafeSite Plan™ takes advantage of the best commercially available GIS and security software to intelligently manage the security readiness cycle: risk assessment, vulnerability analysis, mitigation strategies, operational security, and security advisory management. SafeSite Suite™ is an open system—a single command center that integrates all available assets into a single interface.

Using your GIS database as the foundation, this open architecture simplifies links to existing documents and systems, including as-built drawings, prefire surveys, hazmat locations, safety manuals, digital photos, and utility system schematics, placing necessary situational awareness information in the hands of the responders.

Technical Capabilities

Risk Assessment. SafeSite Plan implements standard methodologies (DSHARPP and Carver) to quantify the risk to each structure.

Deterrence Network Planning. Use a map-based interface to place access points, sentries, barricades, EOCs, K-9 units, sensors, and fencing and calculate accurate standoff distances without requiring GIS editing experience.

A 2D or 3D map interface quickly simulates security improvements by adding new devices, moving existing ones, or easily adjusting the number or location of personnel.

Surveillance

By modeling features in a real-world 3D environment, users will be able to quickly and easily plan various surveillance scenarios. These security scenarios can be compared by effectiveness or cost. Each camera, sensor, and sentry patrol processes a line-of-sight algorithm that is quickly merged into a surveillance view.

Weapon-Specific Threat Analysis

A comprehensive library of weapons allows users to create what-if scenarios by weapon. Specific tools have been created for weapons-based standoff distance and man-portable and laser analysis for aircraft protection.

Powered by ESRI, the ArcGIS 9 platform includes ArcGIS Spatial Analyst and ArcGIS 3D Analyst. G/I/S has been an ESRI corporate consultant and business partner for more than 11 years.

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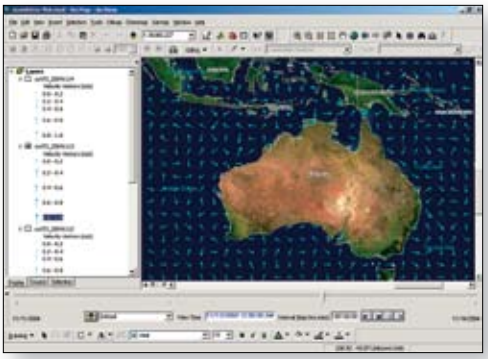
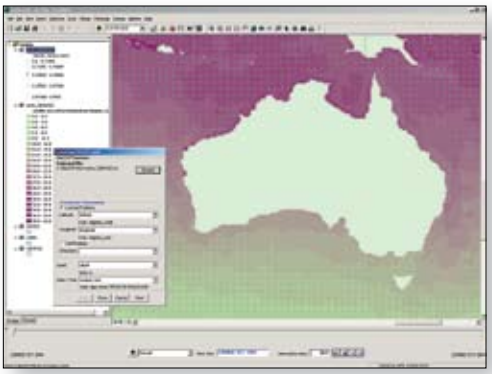
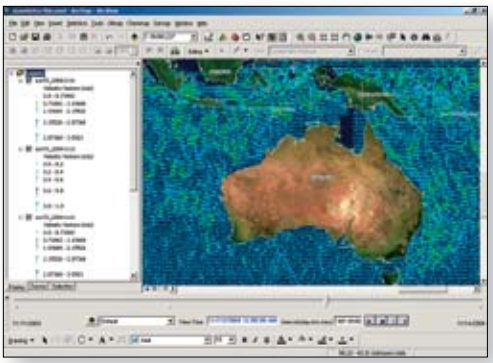
NetCDF and OPeNDAP Support for ArcGIS and C/JMTK







Overview

The Royal Australian Navy (RAN) uses GIS extensively to manage geographic data as well as meteorological and oceanographic (metocean) data. One of the difficulties it faced was the integration of NetCDF format metocean data with ArcGIS, so RAN scientists developed a variety of tools to import NetCDF data into GIS formats. However, this approach was not very efficient and created duplicate databases. In an attempt to address this issue, the Royal Australian Navy obtained the COASTMAP NetCDF extension for ArcGIS and C/JMTK.

The COASTMAP NetCDF layer extension allows NetCDF data that is COARDS and CF compliant to be viewed in ArcGIS for RAN operations. This data is generated by the Australian Science Agency, CSIRO, and Australian Bureau of Meteorology (BOM).

The extension includes the NetCDF custom layer and the Time toolbar and allows RAN staff to manage, display, animate, and analyze both scalar (salinity, temperature, elevation) and vector (current and wind) data in its native NetCDF format.

The next phase of the project has begun and will update the NetCDF extension to include direct OPeNDAP support of the CSIRO and BOM data.

Capabilities

COASTMAP is a suite of tools for managing metocean data and numerical models in a GIS framework. COASTMAP contains a number of components including

- COASTMAP Data Server and Web Services
- COASTMAP Thick Client
  - NetCDF and OPeNDAP Tools
  - Marine Models—OILMAP, CHEMMAP, SARMAP, and Others
  - Data Analysis Tools
  - Management of Time-Varying Data Layers
- COASTMAP Thin Client for Accessing ArcIMS Software-Based Applications

The NetCDF layer allows users to access and visualize NetCDF and OPeNDAP data in its native format within ArcGIS.

What Is NetCDF, and Why Is It So Important?

NetCDF was developed at the Unidata Program of the University Corporation for Atmospheric Research (UCAR) (http://my.unidata.ucar.edu). NetCDF has been adopted for use in earth, ocean, and atmospheric sciences in large part because it is a flexible, self-describing format capable of conveying large sets of array-oriented data.

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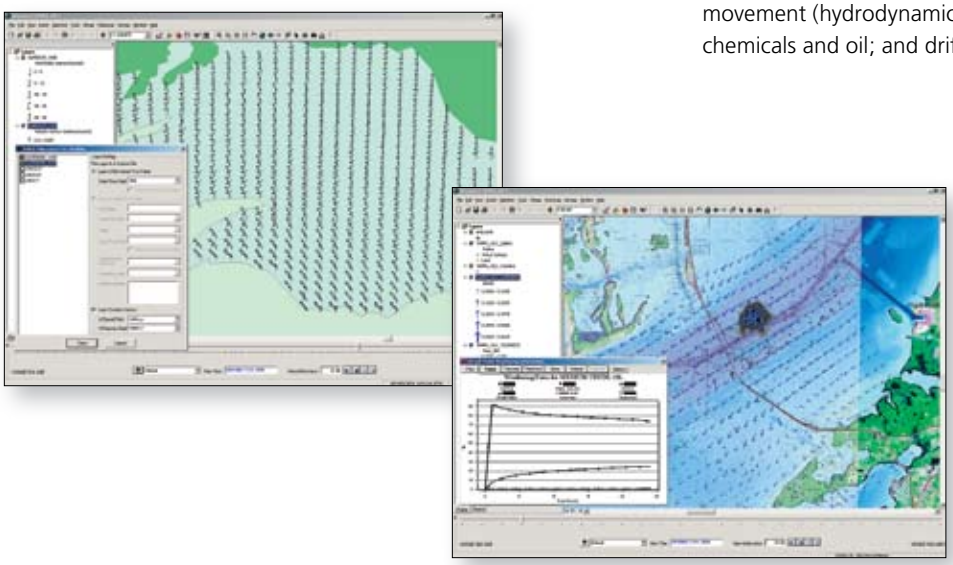
The flexibility provided by NetCDF has allowed data providers and users to create NetCDF schemas to suit their own particular needs. The downside of this flexibility is that there are many variations of NetCDF schemas in use, and many scientists use their own conventions. One of the problems in developing tools to support NetCDF is that there is a large amount of legacy data being generated in nonstandard formats.

The good news is that an initiative at UCAR has defined a number of NetCDF conventions, such as the Cooperative Ocean-Atmospheric Research Data Service convention and the Climate and Forecast (CF) metadata convention. These conventions provide extremely useful structure and metadata standards for NetCDF.

The COASTMAP NetCDF layer supports four CF-compliant schemas that can be used to manage a variety of time-varying gridded and nongridded data.

- Uniform rectangular gridded data for storing arrays of scalar or vector values—Very common for global and large-scale regional products.
- Nonuniform or randomly distributed time series data; data is temporal at each point, but each point is geostatic—Useful for storing observation data such as current meter data and other static observation devices.
- Unstructured, finite element, triangular, and quadrilateral grids—Can be used to store arrays of gridded scalar or vector data. Common format for regional models such as ADCIRC, POM, and RMA2.
- Moving particles in time and space—Useful for moving objects such as drifting objects, marine mammals, and vessels. Also used for particle models such as oil spill and chemical spill models.



Example Applications

Because the COASTMAP NetCDF layer provides native support for NetCDF data within ArcGIS, users can now rapidly integrate time-varying in situ observation data, remote-sensing data, and forecast models in a unified GIS framework, both for the client and server. Large global and regional NetCDF local data files may be viewed as well as remote data served by OPeNDAP servers. The data may be used for analysis as well as for specific modeling applications such as oil spill, chemical, LNG, and atmospheric modeling; search and rescue; and military decision aids.

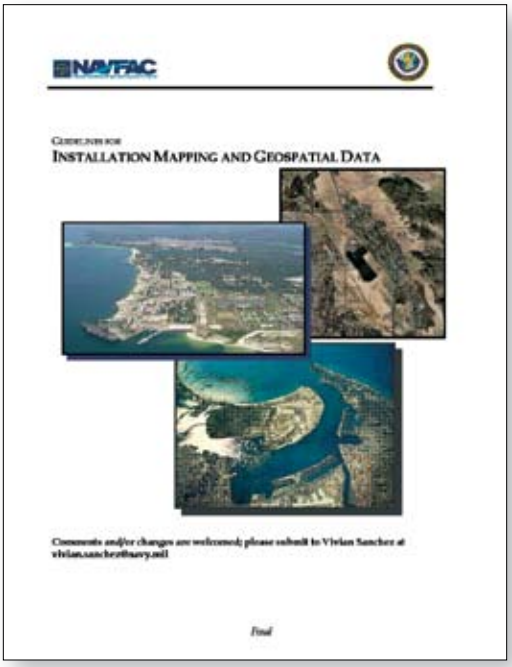
U.S. Coast Guard SAROPS

An integrated team consisting of ASA, Northrop Grumman Information Technology, and Metron Inc. is developing SAROPS, the next generation of software for national search and rescue operations. SAROPS uses COASTMAP components, including the NetCDF custom layer, to manage a variety of metocean data. The system allows the search planner to define the scenario, access environmental data (winds and currents) via Web services, and develop near-optimal search plans given the amount of searching effort available.

U.S. Navy COASTMAP

One of the primary requirements for emergency response and predictive modeling is access to environmental data. ASA provides Web services to allow users to connect to environmental data servers for the latest in oceanographic and meteorological conditions. The U.S. Navy Oceanographic Office (NAVOCEANO) uses a variety of ASA's COASTMAP modeling tools to integrate atmospheric and oceanographic observations and model output to determine global environmental conditions. This data is then further integrated with GIS-based models that simulate water movement (hydrodynamics); water-borne pollutants, including chemicals and oil; and drifting objects.

Department of the Navy Solidifies Its Programmatic Approach to Geospatial Information and Systems Management



The Navy GeoReadiness program is building a programmatic infrastructure to bridge gaps and deliver geospatial information. By establishing the institutional policy and system architecture frameworks, the geospatial community enhances both ashore and afloat mission readiness. In a time when military services are being challenged to operate more efficiently and effectively, GI&S is providing accurate information to make informed decisions. The GeoReadiness program helps by providing a Web-based repository for descriptive vector and raster information. The program also allows users from across the Navy to download critical geographic information as inputs into their operations and business processes.

The Navy's GI&S program

- Provides mission-critical information to business leaders
- Incorporates GI&S into the business process
- Realizes a return on investment
- Enforces DoD and federal data standards for sharing across functional business lines
- Implements a scalable architecture that supports interoperability at the field, regional, and HQ levels

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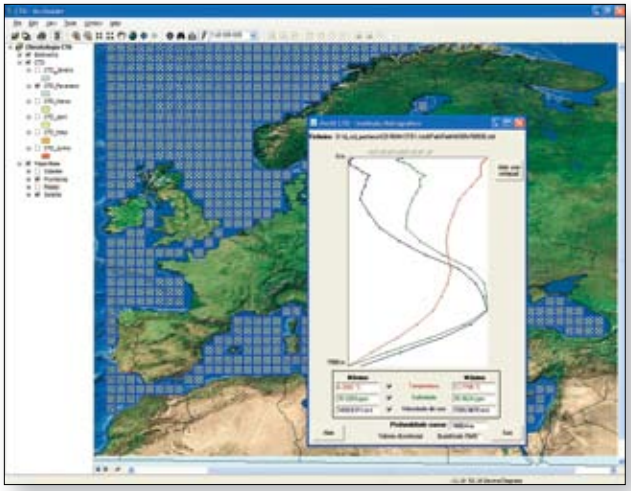
Portuguese Hydrographic Office GIS-Based Rapid Environmental Assessment



Basemap with one-degree areas of climatology information on hydrology and hyperlinked profile graphics of sea temperature, salinity, and underwater sound velocity as a function of depth of a particular site.

Rapid environmental assessment (REA) is a three-stage process for providing Portuguese navy warships with specific environmental knowledge to be considered in the sensor, weapon, and tactical decision-making process at sea. The first stage of REA includes the collection and compilation of climatology data for both oceanographic and meteorological conditions for a specific area of interest and is prepared well in advance of sea operations. Stages two and three occur just prior to and during the operations. Real-time data is gathered by all available sensors and transmitted to a data fusion center where oceanographic and meteorological models are run with these new conditions and predictions are made for short and medium periods of time. One of the most important parameters to track in antisubmarine warfare is the sound-velocity profile at sea (hydrology). The Portuguese Hydrographic Office is now providing stage one REA climatology data on hydrology to navy ships through GIS. Instead of exploring an extensive report with previously selected profile graphics, an interactive information system is now provided to users. It allows the selection of specific areas and months of interest and hyperlinks to sound-velocity profile graphics. The graphic application was produced in Visual Basic® and a distribution package included in the final product. This system was developed with ArcGIS Desktop and distributed in CD-ROM format with ArcReader™.

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Navy Region Northwest: Regional Shore Installation Management System

Map editing and search tools available in GeoAnalyzer

Data-mining and analysis capabilities available in GeoAnalyzer

The Regional Shore Installation Management System (RSIMS) provides Navy Region Northwest (NRNW) with an effective and protected decision support system by integrating and standardizing mission-essential spatial and tabular data into a unified, Web-enabled information portal. Technology Associates International Corporation (TAIC) supports the NRNW Center of Excellence (COE) from Naval Base Kitsap-Bangor, near Silverdale, Washington, in supporting the RSIMS program.

RSIMS for NRNW features a variety of GIS and database tools available to applications users from a browser-based interface.

RSIMS incorporates data for many base operations including

- Ordnance
- Environmental
- Engineering
- Housing
- Planning
- Port Operations
- Public Safety and Security
- Utilities
- Natural and Cultural Resources
- Region Operations Center (ROC) for Critical Infrastructure Protection
- Facilities Management

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RSIMS-related activities throughout Navy Region Northwest

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Scaled model of a Nimitz class carrier positioned next to a 3D model of a pier to determine if sufficient space is available to permit the carrier to dock

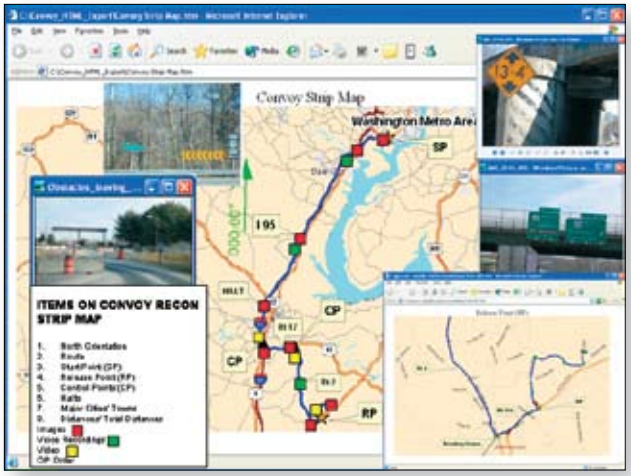
RSIMS portal applications

TAIC also developed the GeoAnalyzer™, a high-performance, browser-based application, to perform standard and ad hoc queries of all associated data systems within the enterprise GIS. Simple user interfaces have been designed to create complex database queries and return records that may be plotted on the map. Using the map to drill down to a specific facility allows easy access to all the associated enterprise data including real property, work order, and space management data. Focused analyses help optimize client/server transactions to keep map load times less than three to five seconds under heavy load conditions. The GeoAnalyzer also leverages XML messaging for real-time data updates for rendering dynamic Scalable Vector Graphics (SVG) content. This allows application users to collaborate in real-time when making changes to the map, which is highly beneficial during emergencies.

The enterprise data consolidation increases efficiency by reducing the time required to produce a multitude of complex GIS projects. For example, a 3D model of a wharf was constructed for the purpose of evaluating the spatial relationships between the wharf and specific Navy vessels. ESRI ArcGIS 3D Analyst was used to build a digital model of the installation, wharf, and crane from information obtained via existing AutoCAD drawings, hard-copy documents, and tabular data. A scaled model of a Nimitz class carrier was positioned next to a 3D model of the wharf to determine if the spatial relationships were sufficient to permit the docking of the Nimitz class carrier. Fly-through videos were produced using the animation tools in ArcGIS 3D Analyst subsequent to the construction of the 3D model. The 3D model of the installation continues to serve as an important analysis tool for NRNW.

INTELLIGENCE

GeoRover



The HTML product is easily created using the GeoRover Digital Data Tracker (DDT) Export HTML tool. Once the product is created and displayed, click on any of the colored icons on the browser display to view the collected data (i.e., videos, images, text documents, audio files). There is also a pop-up message that displays the name of the point and the coordinate (in whatever coordinate system the exporter chooses) when you place the mouse cursor above the points.

GeoRover® software is a suite of commercial software extensions for ESRI ArcGIS 8.x/9.x. GeoRover software runs in all levels of ArcGIS licensing (ArcView, ArcEditor™, and ArcInfo®) and enables you to quickly and easily create, import, and edit GIS data. In addition to importing text files, spreadsheets, and databases, GeoRover provides streamlined tools for importing field data collected with a GPS and a variety of collection devices. GeoRover software can be purchased on CD-ROM or installed on a complete field collection system.

Applications

Nearly every piece of information is more meaningful when seen within a geographic context. The best way to visualize location-based information, at any scale, is with GIS software. GIS provides a natural overview, or Common Operational Picture (COP), for a wide variety of applications. GeoRover software gets your real-world data into the GIS, so you can immediately convey meaning with points, lines, and areas of interest including linked documents or Web pages.

GeoRover software provides an interactive interface for the data to be accessed, analyzed, updated, and disseminated.

- Route Reconnaissance: Show the route and critical points of interest with links to details.
- Site Surveys: Show ingress and egress, utility junctions, functional zones, and deployment locations.
- Prepare Convoy Plans: Conduct convoy reconnaissance and prepare convoy strip maps.
- Vulnerability Assessments: Interactively present the vulnerabilities and remedy recommendations.
- Intelligence Plans and Collections: Clearly show status of each target and link collected data to target.
- DoD Crime Scene Investigation: Show overall scene with precise locations and photo evidence.
- Counterterrorism: Conduct reconnaissance for direct action on terrorist cells. GeoRover software can be integrated with SAIC Pathfinder to perform complex analytical queries.
- Emergency Response: Prepare detailed emergency response plans of key facilities with linked images, video clips, voice recordings, and other documents and integrate with SAIC CATS software through the use of ESRI software.

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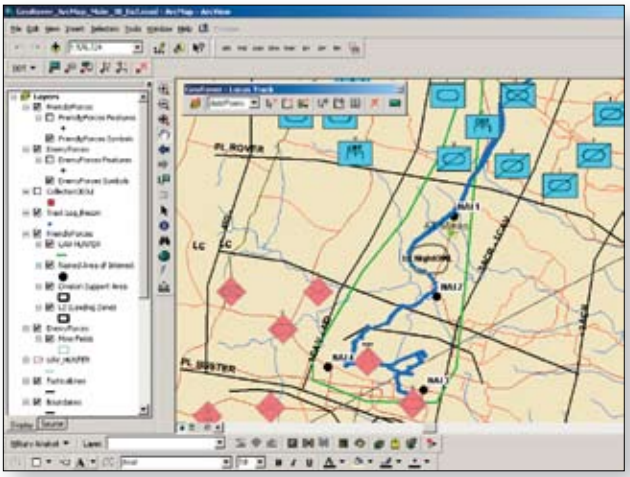
continued

Who Needs GeoRover Software?

GeoRover software enables soldiers, field agents, scouts, HUMINT/CI teams, emergency responders, defense attaches, combat engineers, civil support teams, and others to gather and disseminate actionable intelligence in a geospatial context. Specifically, multimedia intelligence data in the form of pictures, video clips, and sound recordings can be linked on digital maps for subsequent intelligence analysis.

Dissemination—HTML Export

GeoRover tools also provide the capability to create a self-contained HTML document to disseminate geospatial information to those not equipped with GeoRover and ArcGIS software for interactive briefings or use as an HTML link on a Web site.

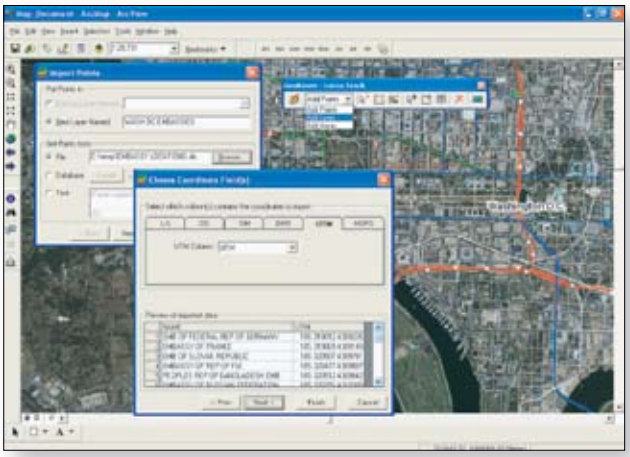


A Common Operational Picture can be displayed in ArcGIS (with MOLE™), and elements of field, HUMINT, and reconnaissance data collected with the GeoRover Digital Data Tracker extension can be displayed over tactical graphics to give the commander, staff, and analysts the complete picture of unit locations. This can be layered with the collection deck, mission platform tracks, and field-collected data that resulted from intelligence requirements in the collection plan. Multiple MGRS, DMS, DD, DM, and UTM coordinates can easily be imported from operations orders, intel summaries, and intelligence databases with the GeoRover import wizard.

Capabilities

GeoRover is fully compatible with other ESRI ArcGIS extensions and can be customized to meet any requirement. GeoRover software includes several extensions/tools that simplify, streamline, and enhance ArcGIS. These tools enable users to

- Create and update data within ArcView, ArcEditor, or ArcInfo using interactive (point-and-click) and coordinate-based tools.
- Import any delimited text (.csv, .txt, .tab, etc.), Microsoft Excel spreadsheet, database (Microsoft Access, Oracle, Microsoft SQL Server, etc.), or typed/pasted text files with coordinates.
- Accepts latitude/longitude, decimal degrees, degrees decimal minutes, degrees minutes seconds, UTM, and MGRS coordinates.
- Use the same tools for working with shapefiles and geodatabases (including ArcSDE enterprise geodatabases).
- Download and plot GPS track logs and waypoints, automatically linking to any data simultaneously collected by digital cameras (still/video), digital voice recorders, handheld computers, and so forth.
- Link any digital document, including Web sites, to any point, line, or area.
- Quickly zoom to specific locations or scale views.
- Export the GIS display and associated files to an HTML Web page for immediate dissemination or inclusion in a Web site.



The GeoRover Locus Track extension has a powerful and easy-to-import wizard for importing data from spreadsheets, databases, and text files. Locus Track supports five coordinate systems and works with shapefiles and geodatabases.

The GeoRover Digital Data Tracker extension automatically georeferences and plots data collected in the field as layers in ArcGIS. The GIS display can be converted to a Web page with one click. GeoRover software provides an interactive interface for the data to be accessed, analyzed, updated, and disseminated.

GeoRover Software Is a Component of USASFC Asymmetrical Software Kit

The Asymmetrical Software Kit (ASK) is a state-of-the-art information analysis and visualization capability used by the U.S. Army Special Forces Command (USASFC). ASK provides GIS, link/temporal analysis, tactical data collection, data mining, data management, and dissemination of actionable geospatial intelligence. Specifically, ASK is a collection of commercial software including i2 Analyst's Notebook®, ORION Magic®, and ArcView and its extensions (ArcGIS Spatial Analyst, ArcGIS 3D Analyst, ArcGIS Tracking Analyst, and ArcGIS Military Analyst) and GeoRover. ASK is intended to be the client-level subsystem of the Area Intelligence Special Tactical Operations Targeting Linked Environment (ARISTOTLE), an enterprise geospatial intelligence system under consideration for fielding to USASFC.

Benefits

GeoRover software streamlines many processes in ArcGIS Desktop, whether you are a new user or an experienced GIS professional. GeoRover software is mobile and can make use of practically any data collection device. GeoRover provides

- Discrete collection capability with no connection required in the field between GPS and data collection devices
- Significant training time reduction for fundamental ArcGIS editing operations
- Option to upgrade to a complete, ruggedized field system customized for your requirements and collection needs
- Simple installation via CD-ROM directly into ArcGIS—no additional software necessary
- Data sharing via standard shapefiles, geodatabases, and Web pages

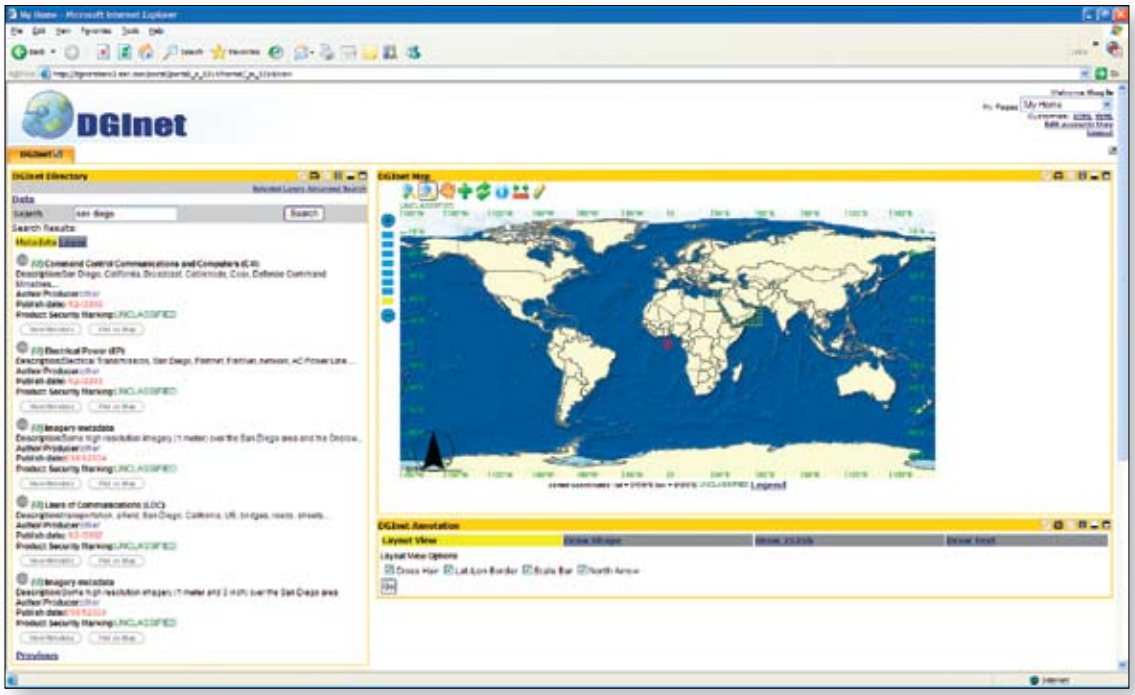
Coming in 2005

A new GeoRover for ArcGIS software release is planned for 2005. Major software enhancements will include multiple coordinate system and datum support, real-time GPS capabilities, and improved export options. Many of these new features will provide additional capabilities for DoD, intelligence, and federal/state/local government applications.

GeoRover® by SAIC

SAIC® An Employee-Owned Company

Distributed Geospatial Intelligence Network



Overview

Distributed Geospatial Intelligence Network (DGInet) technology can be employed by defense and intelligence organizations to provide an enterprise solution for geospatial intelligence data. DGInet was designed as a Web-based enterprise GIS for non-GIS-savvy intelligence analysts, military planners, and war fighters. It enables the utilization of thin clients to search massive amounts of geospatial and intelligence data, using very low bandwidth Web services, for data discovery, dissemination, and horizontal fusion of data and products. It also allows for discovery and utilization of GIS and non-GIS application Web services.

DGInet core technology has been deployed at several defense and intelligence community sites.

Features

DGInet provides

- A scalable Java™ Web service environment within which Web services can be easily utilized, added, exposed, maintained, and integrated with collaborative geospatial capabilities
- A powerful architecture that will satisfy every agency and organization's operational need for a geospatial enterprise system for dissemination within a robust collaborative environment
- A Services-Oriented Architecture (SOA) accessible via portlet-based browsers, applets, and heavy clients
- A collection of distributed Web services implemented as Java Web services
- Web map services and geoprocessing Web services across multiple organizations/nodes
- XML-based metadata broadcast search
- Selective data display/data fusion
- Data download capability
- Data management services

Contact Information

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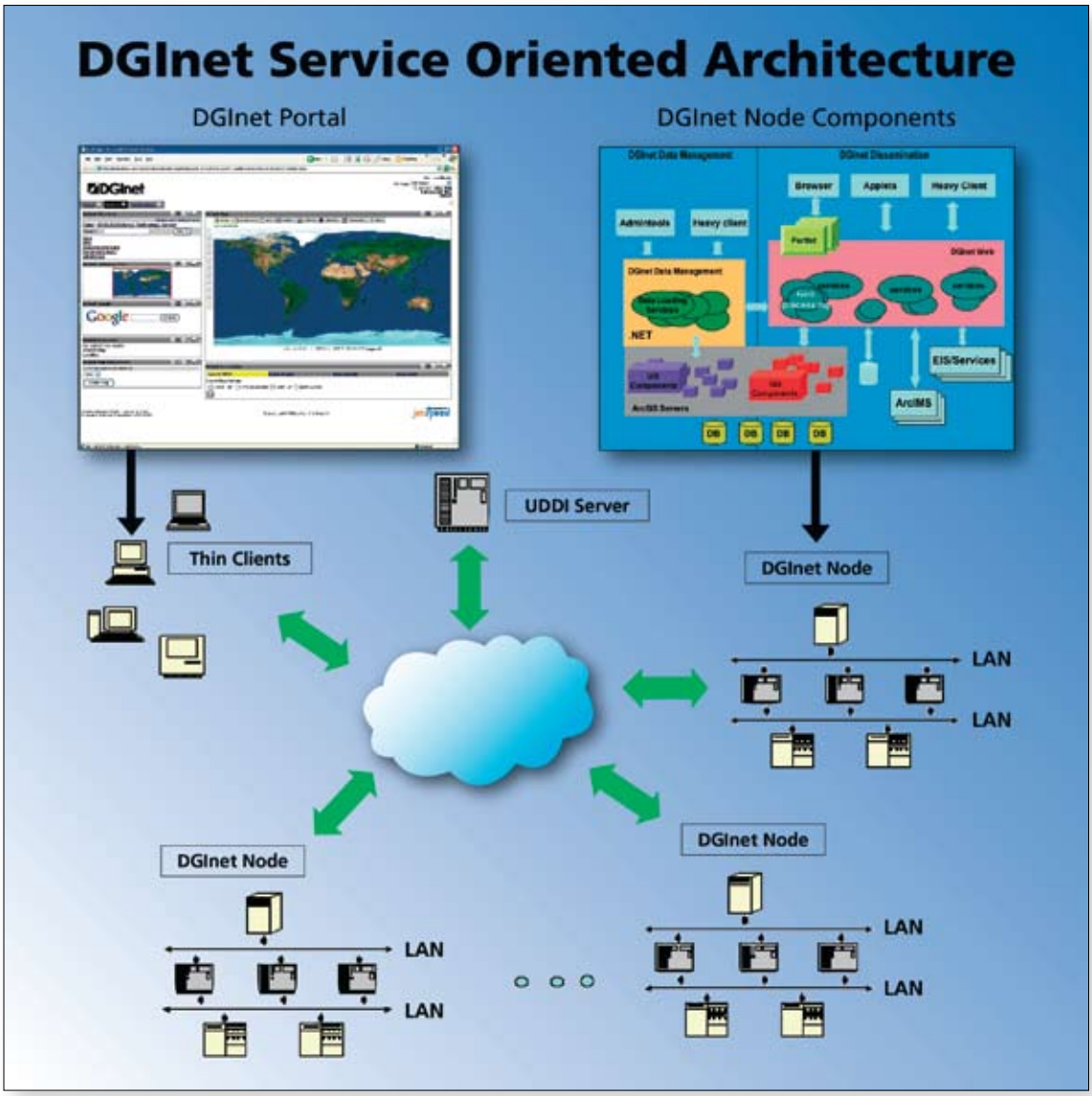
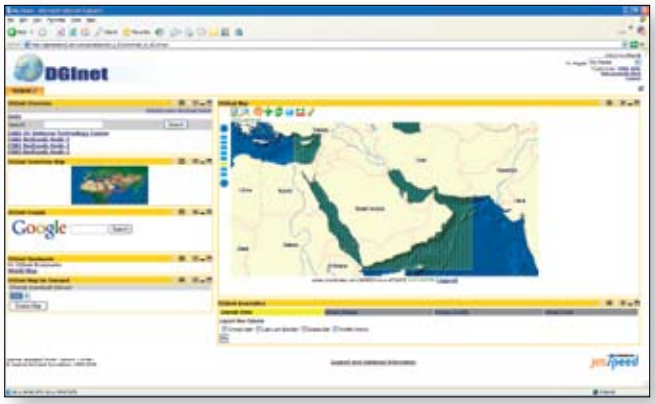
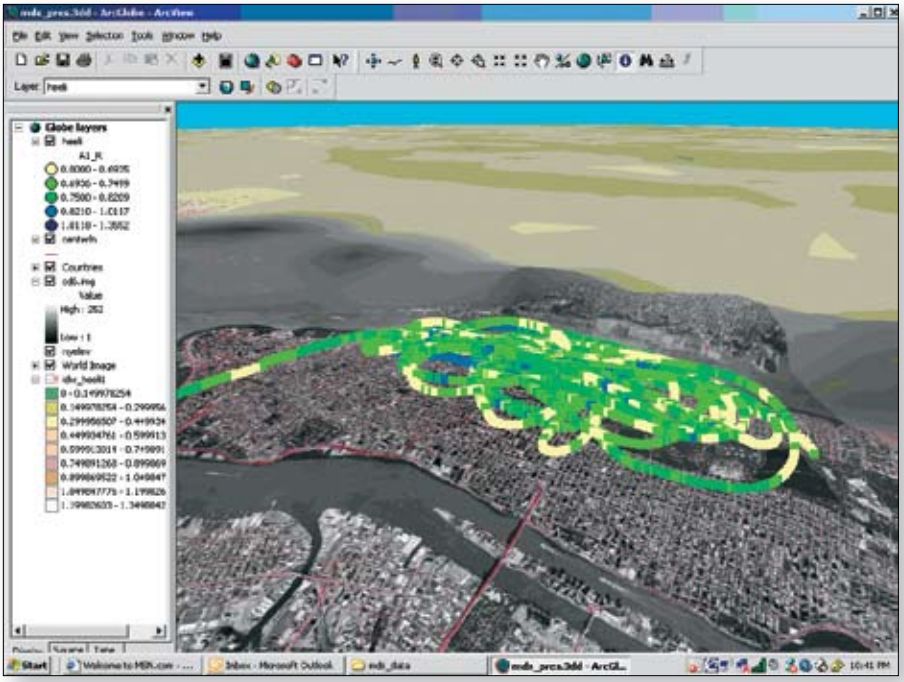


Benefits

DGInet technology provides a robust geospatial solution for the military/intelligence customer by making very large (multiterabyte) databases available through a common Web-based interface. It provides clients with the capability to quickly and easily find, overlay, and fuse georeferenced data from multiple sources via Web map services for use as map background displays or to support analytical functions.



Mobile Reconnaissance for WMD Response



Introduction

The ability to rapidly assess and provide initial detection at a Weapons of Mass Destruction (WMD) incident is one of the main missions of the Civil Support Teams (CSTs). CSTs deploy to an area of operation to assist the civil authorities at a domestic WMD incident site by identifying WMD substances/agents, assess current/projected consequences and advise on appropriate response measures, and assist with appropriate requests for state response. To assist this mission, CSTs have three core competencies: They provide analytical function to obtain, process, and presumptively identify unknown agents; establish and maintain a robust interagency communications capability; and provide the incident commander with an array of civil and military response options and advice.

Real-Time Solutions

The Mobile Detection System (MDS) is a modular, lightweight radiation reconnaissance system designed for use in air or ground space. It is optimized to detect and locate lost or stolen threatening gamma radiation sources or survey large areas that have been contaminated.

The system uses a large-volume plastic scintillator, combined with Natural Background Rejection (NBR) algorithms, to quickly and effectively distinguish between harmless levels of varying background gamma radiation and artificial radiation. Altitude

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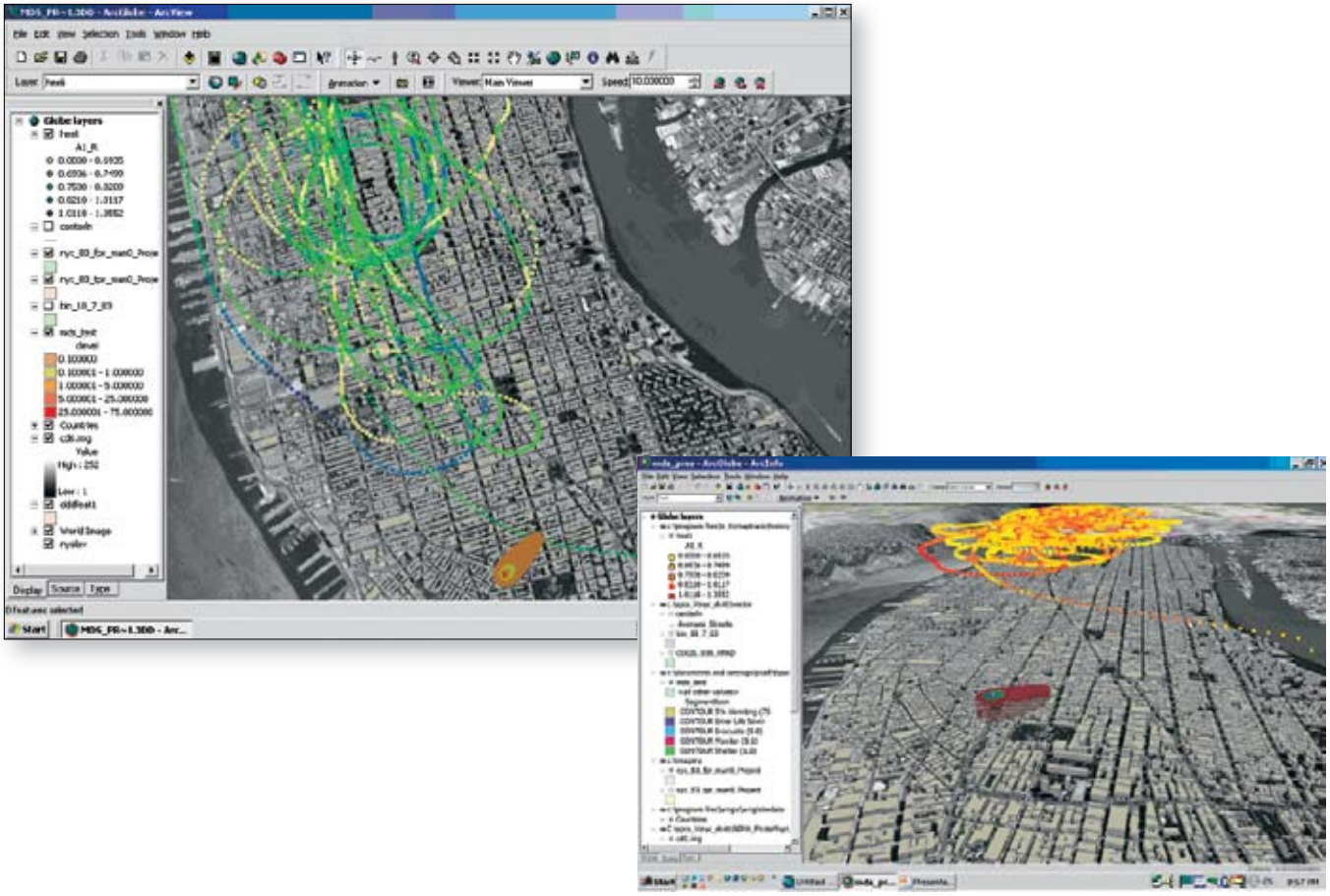


correction factors also enable the system to be used by helicopter to safely survey areas of widespread contamination and to detect and map localized hot spots. Additional external probes for neutron and alpha/beta detection and underwater surveying can also be implemented.

Real-time radiological data is transmitted to a notebook PC via serial connection for viewing locally in the onboard dynamic mapping software (Maptrack) or in ArcView. Data can also be transmitted wirelessly via radio modems or GSM wireless devices for remote control of the mission or to relay back to the incident commander.

Benefits

MDS was originally developed per request of the German Military Institute (WIS) and German Civil Defense and is currently in use by the German Army and Navy. The system carries a NATO stock number and meets military specification standards.

The system has been modified to suit the CST mission by bringing the radiological data into ArcView so that hazard models can be generated and viewed simultaneously alongside real-time data. Models can be instantly confirmed or denied on scene. The incident commander is provided with instant threat assessment and dynamic perimeter monitoring for the rapid establishment of an effective multitiered interagency response. All detection levels are documented with a time, date, and location stamp.

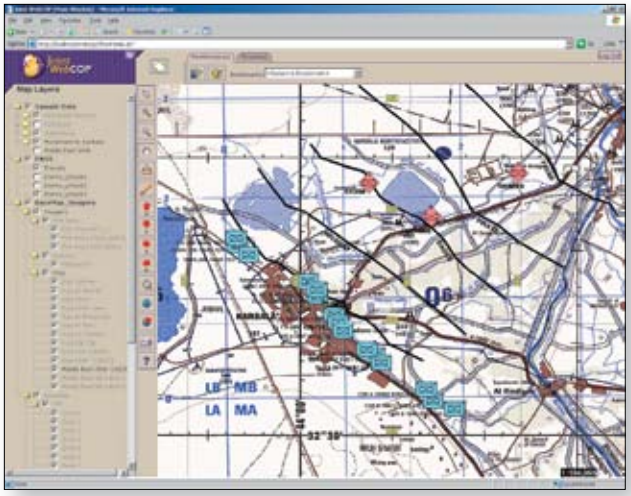
The simple, flexible platform allows for easy route navigation and radiological threat detection by a survey team, while providing standard format .dbf files for use by GIS analysts. Among the benefits of MDS are

- Navigational tool en route to incident
- Route reconnaissance
- Early warning device
- Establishes routine background levels
- Investigative tool
- Situational awareness
- Brings intelligence assets to bear
- Verification of the hazard model
- Can be used to refine the source term
- Provides a historical record

Thermo
ELECTRON CORPORATION

JOINT

Commercial Joint Mapping Toolkit



C/JMTK implementation for Joint WebCOP. Screen shot courtesy of Concurrent Technologies Corporation.

Overview

Northrop Grumman Information Technology (IT) sector is the prime contractor for the National Geospatial-Intelligence Agency's (NGA) Commercial Joint Mapping Toolkit (C/JMTK) program. The Northrop Grumman team includes ESRI, Leica Geosystems, and Analytical Graphics, Inc. (AGI).

C/JMTK is a standardized, commercial, comprehensive toolkit of software components for the management, analysis, and visualization of maps and map-related information.

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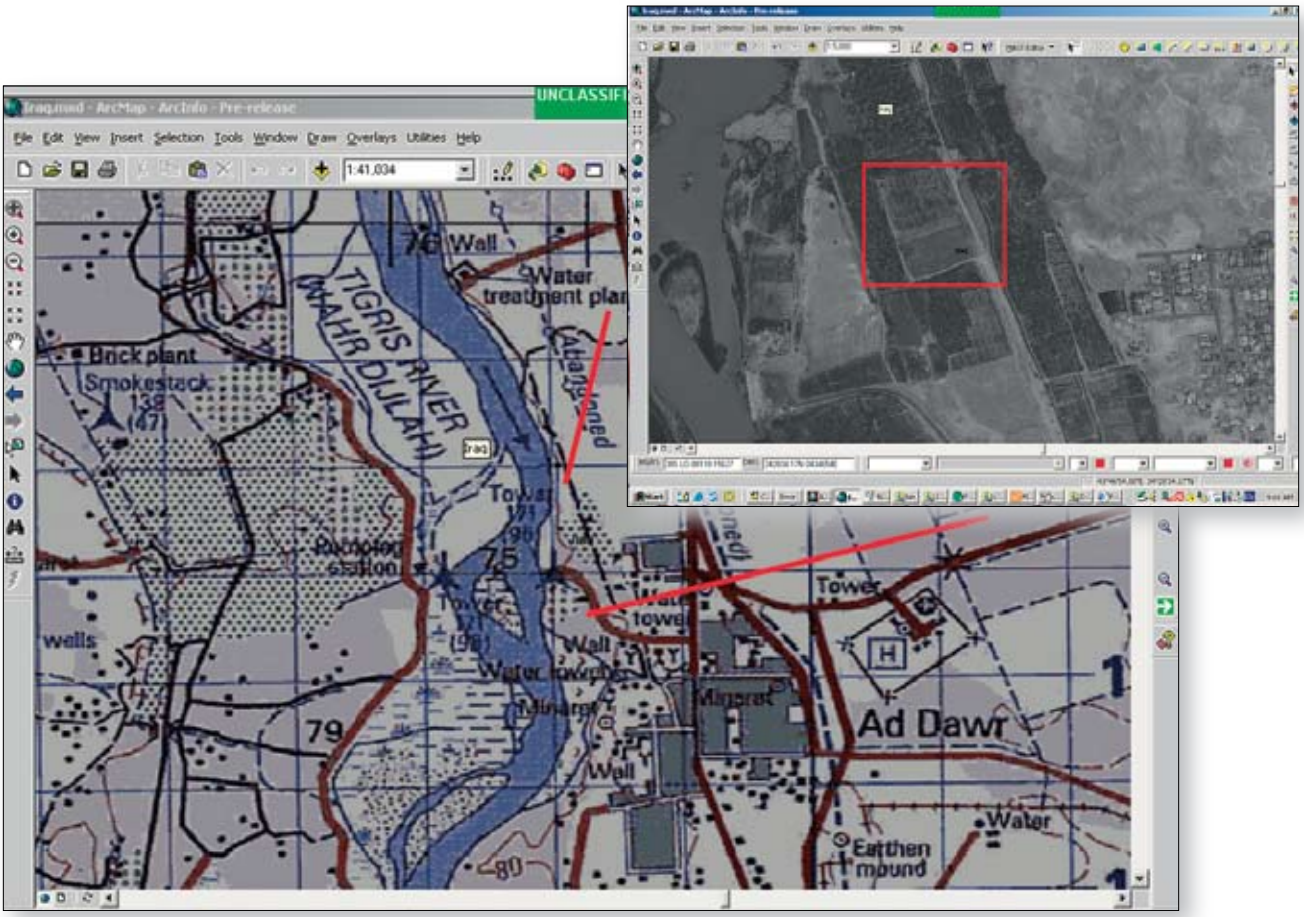
Commercial Joint Mapping Toolkit



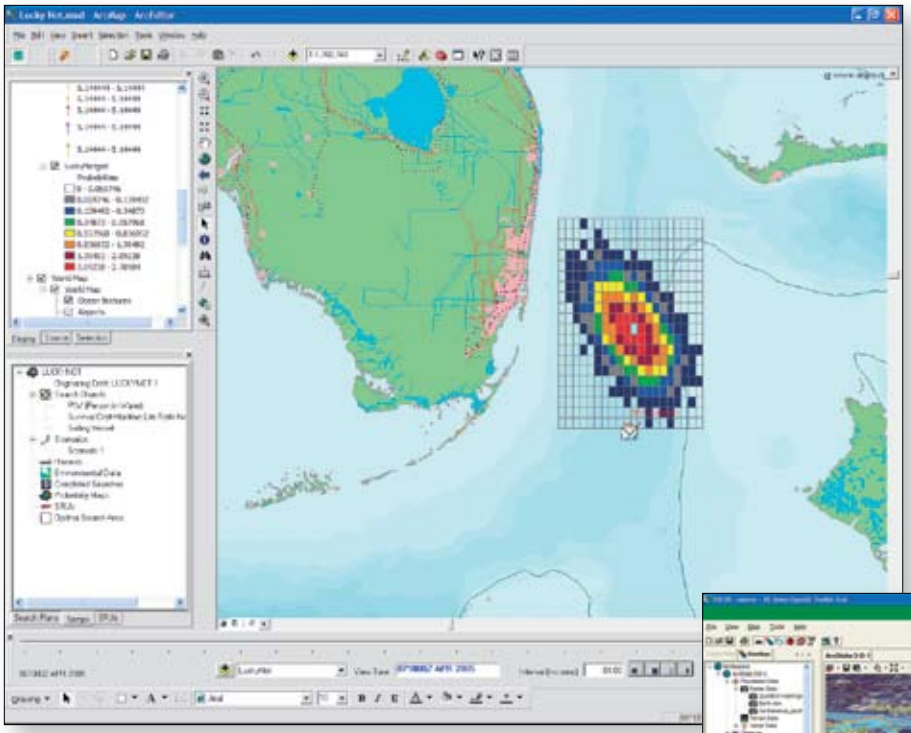
C/JMTK implementation for ASAS-L. Screen shots courtesy of Austin Info Systems.

Program Update

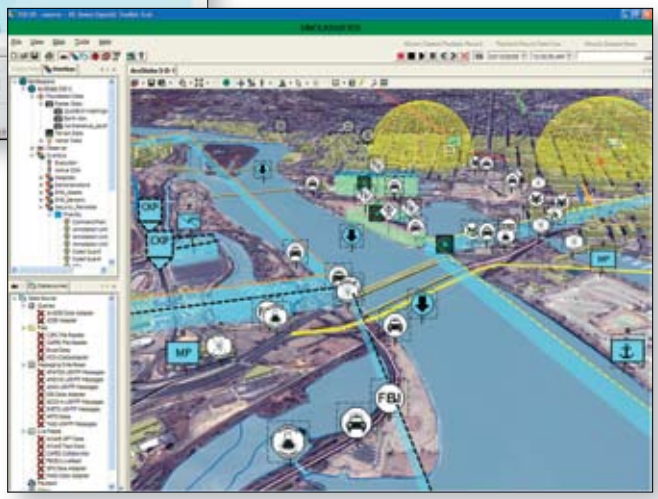
Following three years of migration support, the C/JMTK program is entering its first year of life-cycle support. Currently, more than 175 C2I mission applications for the Air Force, Army, Coast Guard, Marine Corps, and Navy are using C/JMTK. During the last six months, C/JMTK Version 9.0 has been released for both Windows® and Solaris™. Future releases will include ArcGIS Server and support for Red Hat® and SUSE Linux™.

C/JMTK Web Portal

The C/JMTK Web portal (www.cjmtk.com) provides valuable information and support capabilities to the customer community. Registered users can search and review requirements, FAQs, and documents; download C/JMTK segments and reference implementation samples; and use the online Help Desk for support.



C/JMTK implementation for SAROPS. Screen shot courtesy of Applied Science Associates, Northrop Grumman, and the U.S. Coast Guard.



C/JMTK implementation for TOC 3-D. Screen shot courtesy of Concurrent Technologies Corporation.

C/JMTK in Action

Programs implementing C/JMTK include Command and Control—PC (C2PC), Search and Rescue Operations (SAR-OPS), All Source Analysis System (ASAS), and Theater Battlespace Management Command System (TBMCS). As part of the ongoing migration support activities, the C/JMTK program is involved with the Net-Centric Capabilities Pilot (NCCP) program. A primary goal of NCCP is to develop initial capabilities to demonstrate that a Net-Centric Enterprise Services (NCES)-oriented architecture with Next Generation C2 (NGC2) applications will improve war fighting capabilities, agility, and interoperability and also reduce time to deliver new services. The C/JMTK program development effort of Web services for course of action, transportation, and movement planning services utilizes the ArcGIS Server.

C/JMTK Option Components Thick Clients

ArcGIS Engine extended by ArcSDE, ArcGIS Spatial Analyst, ArcGIS 3D Analyst, ArcGIS Military Analyst, and MOLE.

Thin Clients

MapObjects—Java Edition
Application Server
ArcIMS
ArcGIS Server (new toolkit component)
Data Server
ArcSDE

NORTHROP GRUMMAN
DEFINING THE FUTURE

Mapping and Charting Establishment Digital Response Section

A briefing map produced for Sierra Leone

Briefing map for Kosovo

The responsibility of providing base plant geomatic support to the Canadian Armed Forces was given to the Digital Response Section (DRS). DRS was created in 1998. The primary role of DRS within this organization is to provide rapid, one-of-a-kind specialty products that are not provided by the CF Map Depot. DRS provides a broad and more diverse range of products because of the uniqueness, urgency, and security of the information. The section has two components: classified and unclassified to handle the security level of the information being used to produce the products.

Mapping and Charting Establishment (MCE) provides baseplant support to its deployed geoteams as well as to other military and civilian clients. The three types of support provided are

Operational—Support to military operations such as those in Afghanistan, Bosnia, Kosovo, East Timor, and Sierra Leone

National—Support to national crises such as the Winnipeg flood, Swiss Air disaster, and 1998 ice storm as well as events such as the PanAm Games

Training—Time and space mock-up maps for Army, Navy, and Air Force.

All of the production has been broken down into three main focal points based on the detail of the data and time required to produce the product. In this way, most rapid response jobs that come into the unit can be handled. The following are the three operational focuses adopted by MCE.

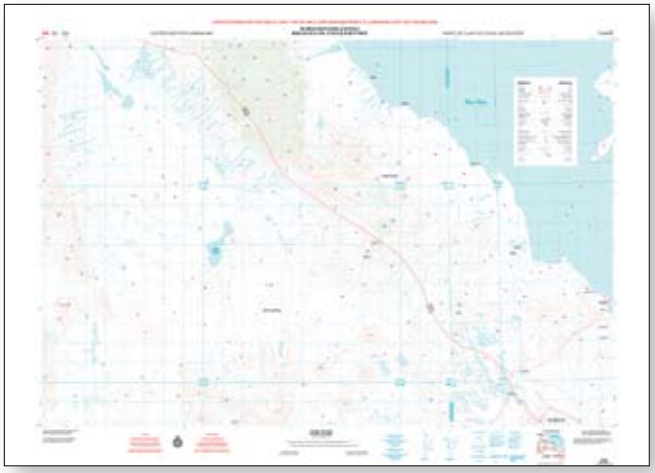
Initial Operational Dataset—IODS

These are products that are produced to satisfy a 24-hour response time. These are usually briefing maps produced at a scale of 1:1,000,000 using off-the-shelf sources obtained from hard-copy maps and Internet image files. The product that is produced is a raster product with map surround and some vector graphics. These are produced for briefing purposes and as aids to prereconnaissance.

Minimum Essential Dataset—MEDS

The seven-day response planning maps are produced at a scale of 1:250,000. The data used is from vector sources obtained through Vector Product Format (VPF) and/or by heads-up digitizing of geocoded data. The product is produced showing the "sandbox" or location where the operation is taking place along with map surround and more detailed graphics for an area. These are produced for reconnaissance purposes prior to the deployment of troops.

Below are two maps produced for the CF operation in Ethiopia and Eritrea.



Mission Specific Dataset—MSDS

The specialty maps are produced in 30 days at a scale of 1:50,000. This type of product outlines information specific to the area of interest with value-added information that could include perspective views, lines of sight, and 3D fly-throughs. They are used by the troops of a main body deployment.

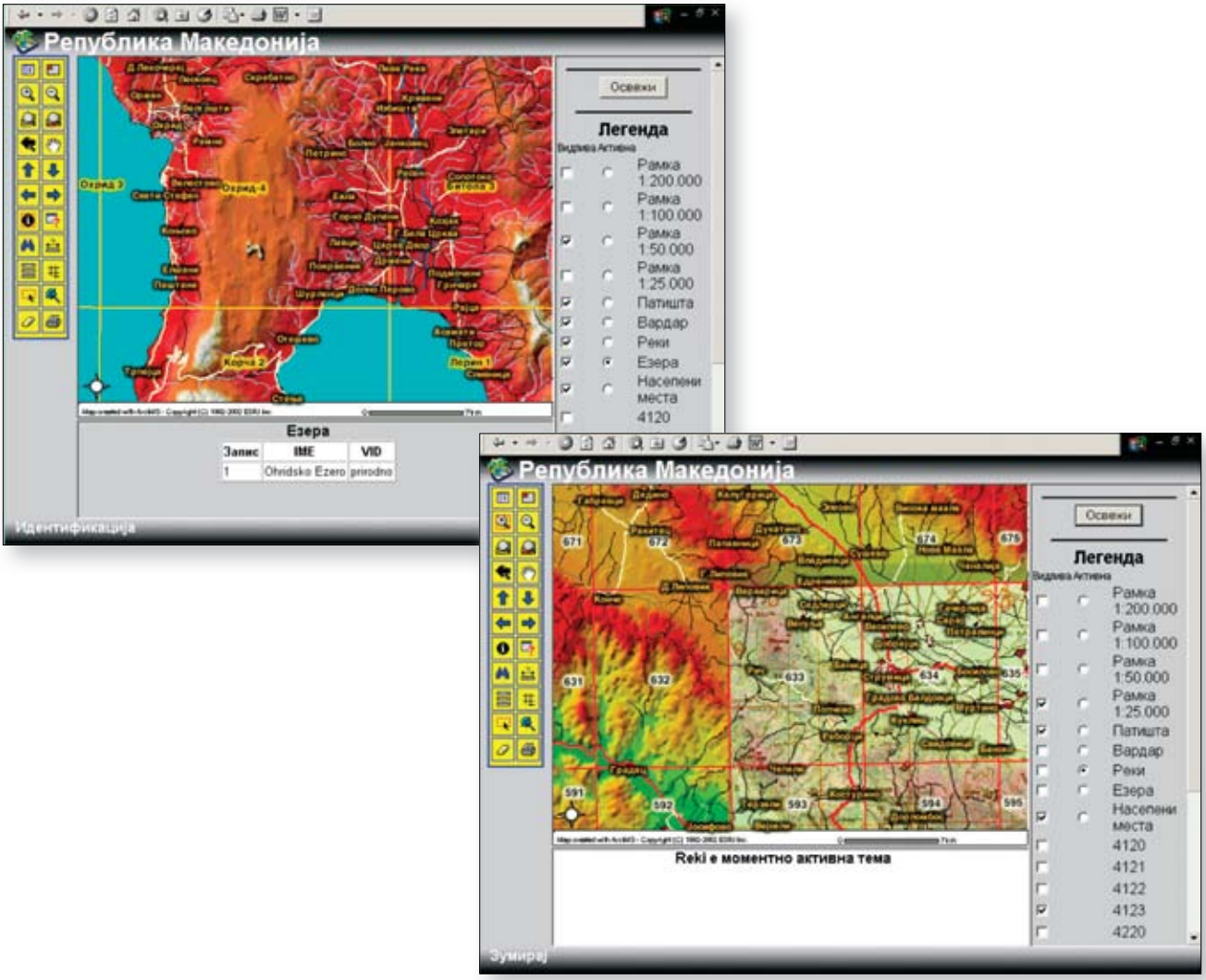
Satellite imagery map of Eritrea

Vector map of Montreal produced for a joint operation with RCMP

Because of the rapid nature of the work flow and the fast turn-around time, accountability is required at each level to ensure that complete and thorough checks are performed. In DRS, there can be up to six quality control checks performed before a job is released to a client.

Since its conception, the Digital Response Section of the Mapping and Charting Establishment has been able to produce a wide variety of products for both the Canadian Armed Forces and various civilian organizations. It is a fast-paced production area within the unit but very satisfying for soldiers because no two jobs are similar, and they have a chance to show off their GIS skills every day. DRS has been proven to be an important part of the unit's production capabilities through its rapid response time and current, qualified products that meet or exceed the expectations of MCE's clients.

Intranet GIS Application in Macedonian Ministry of Defence



Introduction

GISDATA d.o.o. designed, built, and implemented a geographic information system (GIS)-based ArcIMS application for the Macedonian Ministry of Defence (MORM).

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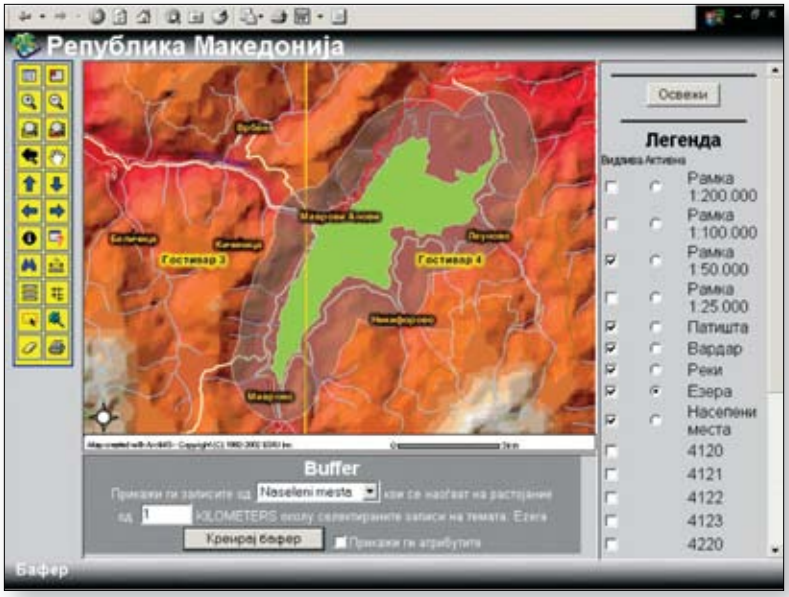


Overview

GIS technology is computer technology for managing, storing, and analyzing spatial (geographic) data.

ArcIMS software is the foundation for distributing GIS data and applications on the Internet. By providing a common platform for exchanging and sharing GIS resources, ArcIMS provides unique opportunities to leverage data from within the organization and to integrate information from other agencies.

With this GIS intranet application, users from MORM can manage (create, exchange, distribute) digital spatial data, geoprocessing services, and other related spatial information.

There are many benefits of using Internet mapping software such as data management, sharing, and distribution; elimination of data redundancy; and minimizing the loss of data or isolation and relevant information. The GIS unit in the K4 department in MORM is a user of ESRI GIS technology. The same unit is responsible for maintaining and updating the ArcIMS application. Using ArcIMS, all users can efficiently and effectively make decisions based on spatial data and topographic maps.

The needs of clients are constantly increasing by using this ArcIMS service. The transparency and scalability of this technology provide an opportunity for developing specific applications. For example, the client can create complex Internet and intranet applications, connect several ArcIMS services and servers in the network, exchange data between different servers, and implement the wireless exchange of GIS data and services using XML standard.

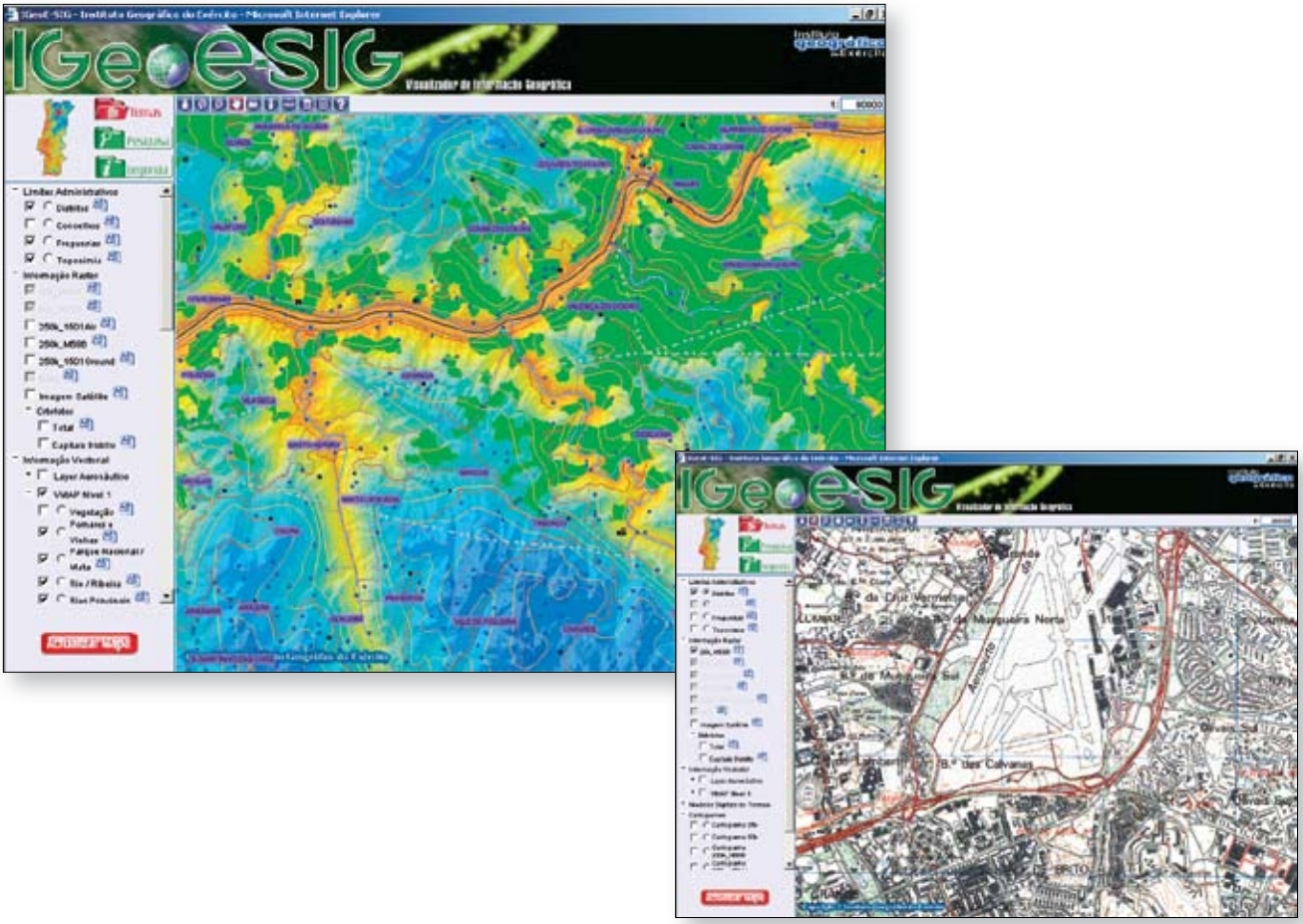
Accessing the ESRI ArcIMS application via an Internet browser GUI, MORM employees are becoming users of powerful GIS tools and services for managing spatial data. Without complex training for GIS, ArcIMS enables GIS technology to become personal and makes GIS data analysis easy, more effective, and successful for a large number of users. In other words, the users (employees) will use GIS without knowing that they are using GIS.

The functionality of ArcIMS is fast and effective for querying topographic maps at different scales of interest. The Republic of Macedonia is covered by six 1:200,000-scale maps and 18 1:100,000-scale maps. The initial interface of the application shows the whole country as the digital map. By simply clicking on a region of interest, the user gets information about the code name of the topographic map for that region, and it is displayed as an oriented map document. When the maps are displayed, additional spatial data, such as roads, hydrography, populated places, and other spatial data, is displayed.

ArcIMS gives the user solutions for spatial analysis by using intuitive and visually clear tools such as zoom in/out, identify, select, buffer creation, and measure distance. ArcIMS is built with an open architecture, enabling the addition of new spatial data created by the GIS unit in the K4 department in MORM or by other departments in MORM. By connecting the application with other IT technologies used in MORM, it promotes the exchange of data with other government organizations.

GISDATA Skopje is a Macedonian company established in 1998 as part of GISDATA offices in Slovenia, Croatia, Bosnia and Herzegovina, Serbia, and Montenegro. GISDATA is a pioneer in GIS technology, GPS, and remote sensing in Macedonia.

Implementation of a Geospatial Data Infrastructure in the Portuguese Military Geographic Institute



As a producer of digital geographic information (DGI), one of the endeavors of IGeoE is to update an integrated and continuous geographic database (GDB) of the entire territory that could contain almost all the products from several production flows, such as orthophotos (1:10K); cartography (1:50K, 250K, 500K); satellite imagery; military cadastre database; and standard military products, such as Vector Map levels 1 and 3 (VMap 1 and VMap 3), Digital Terrain Elevation Data levels 1 and 2 (DTED1 and DTED2), Compressed ARC Digitized Raster Graphics (CADRG), and GeoTIFF, and make them available to the general users. This project is currently under development and constitutes an ongoing goal for the institution. It has the foundations of an enterprise geographic database solution that can store several datasets existing in several formats and different coordinate systems; import, retrieve, and actualize them; create topology; and permit controlled access to differentiated users in several distinct ways.

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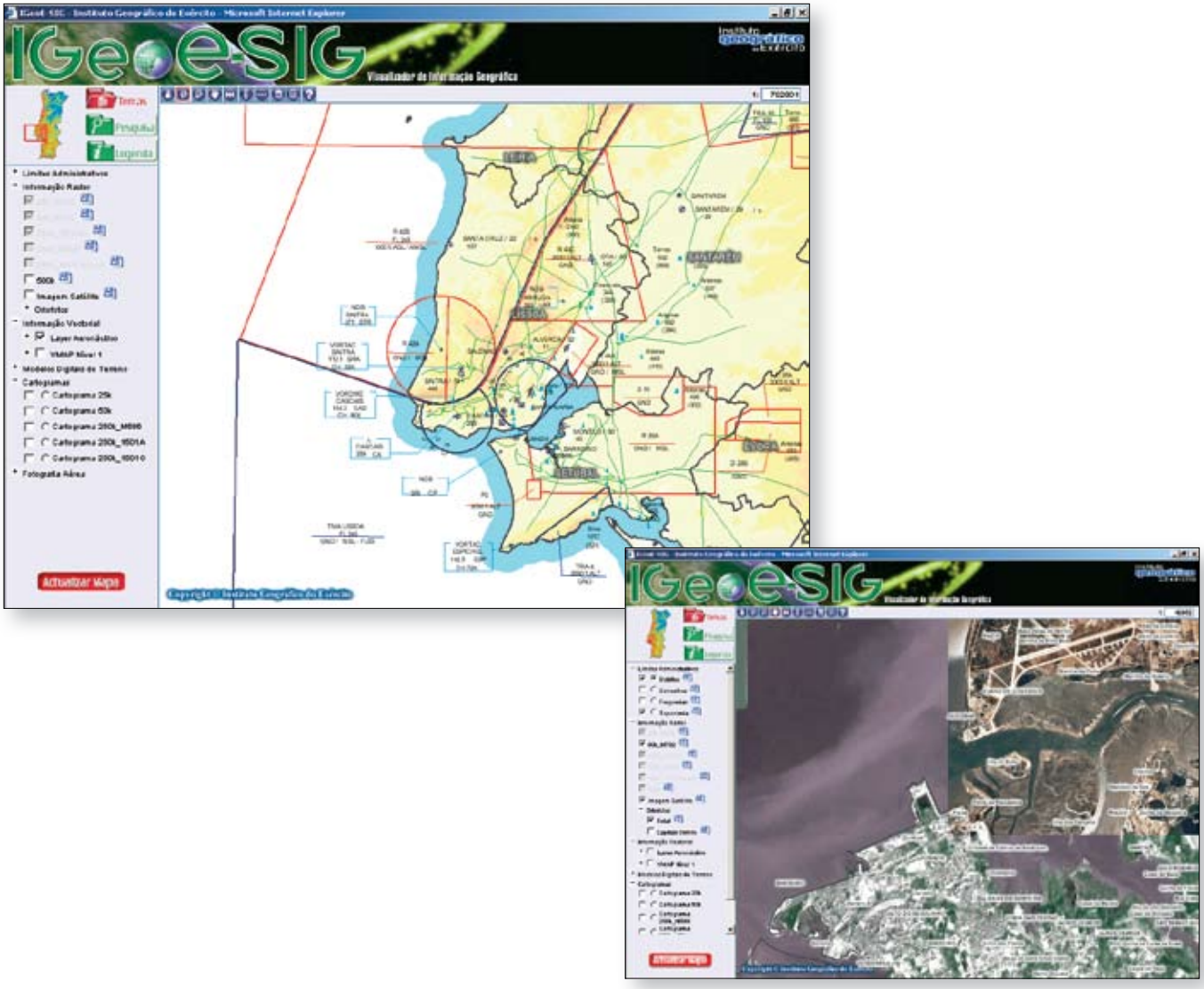

To achieve the implementation of such a system, it was decided to use commercial off-the-shelf (COTS) applications. Along with obvious advantages for the civilian community, the support of the Military Decision Process (MDP) is also an ongoing goal, which includes all levels of military hierarchy in peacekeeping, coalition, or civilian community support operations.

Another important task that has been developed by IGeoE is based on the concept of making a tool available to the general public and the military community that allows the visualization and exploitation of data produced. One of the ways to accomplish this would be to release it in the form of a stand-alone application with the capability to remotely access the GDB of IGeoE via the intranet, Internet, or digital radio transmission in a pervasive, ubiquitous, distributed, and central services environment.

In an increasingly demanding world in which the use of DGI is almost unavoidable and is present in our daily lives, the knowledge derived from this kind of project serves also to produce tailored products to more sophisticated customers and purposes. Examples of these are the use of DGI by Portuguese armed forces in a multinational coalition forces environment, such as in Afghanistan, Iraq, and East Timor, and by the National Guard, Civil Protection, and others in their daily routines. The use of DGI by major staffs, in military academies, and even in other branches of the armed forces is also a major goal of this project. This can lead to improved decision support and situation awareness in the military decision process, providing a common picture of the battlefield.

Submit Your Story for Print

Each article in this publication represents a real program that is making a difference to our defense and intelligence communities. Sharing experiences lessens program risk, reduces cost, and fosters understanding of the road map toward seamless spatial information infrastructures in defense.

It is our intent to reproduce this publication at least once a year. If you are interested in featuring your program in the next edition, please read the instructions below.

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We feature defense and intelligence programs from around the world that make use of GIS. The aim is to communicate capabilities and benefits of the program, not to advertise a system integrator or solution provider.

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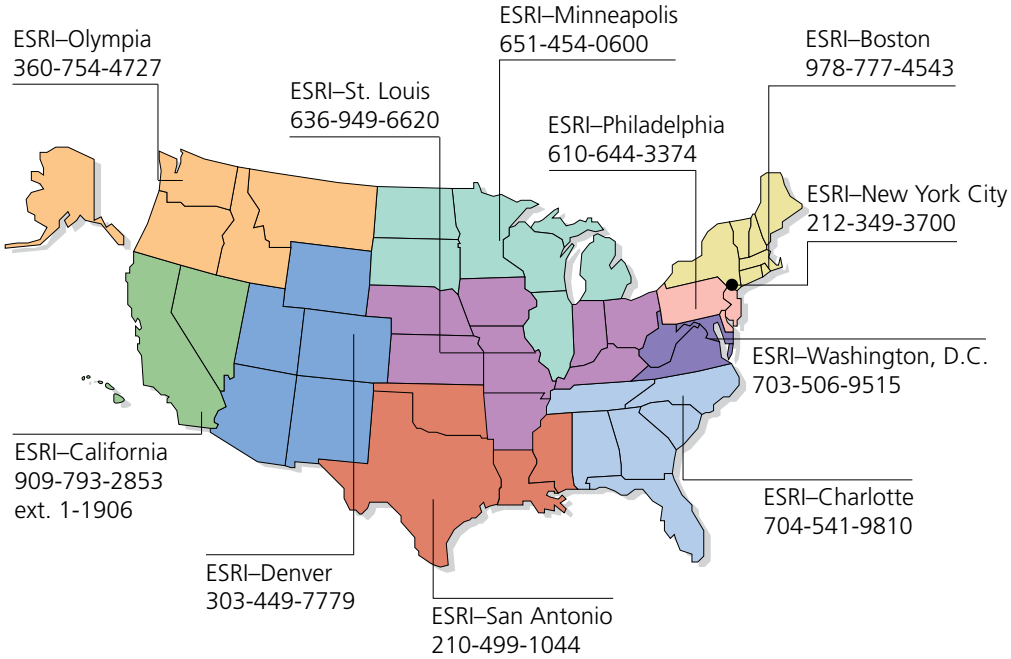

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