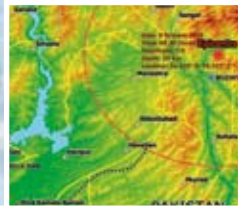
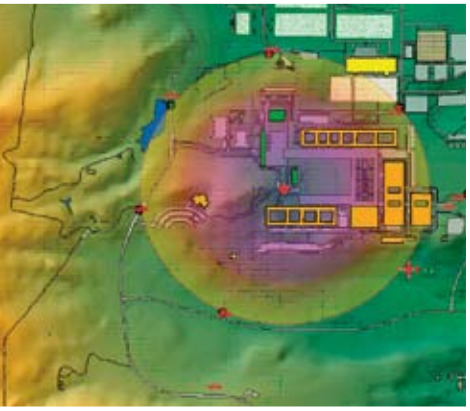
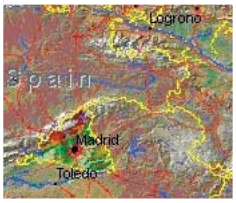
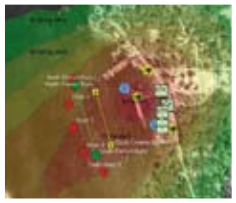
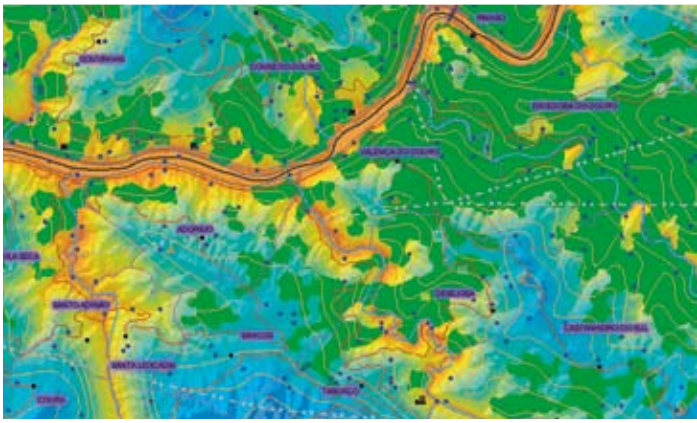
GIS in Defense Installation and Environmental Management











ESRI

Dear Colleagues:

The installations and environment (I&E) community was one of the first to use geographic information system (GIS) technology in the defense sector, so I have a particular fondness for the work you do. You have consistently led the way in implementing GIS to help effectively manage and administer stewardship of lands and property.

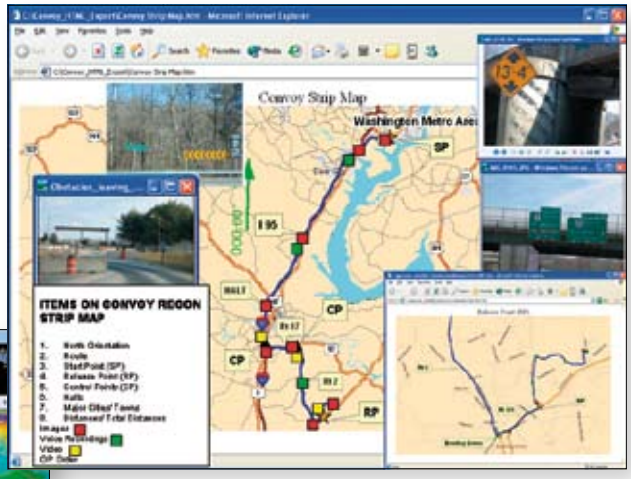
The I&E community manages a complex array of problems; indeed, your work could be equated to that of a medium-sized city, except you look after everything: the environment, facilities management, land-use planning, utilities, emergency response, and security. Your GIS implementations are truly world class in scope.

These stories detailing your work were first published in the GIS in the Defense and Intelligence Community series. We are recompiling the articles in a focused I&E publication because they communicate a powerful evolution in GIS deployment. The defense I&E community has gone from implementing GIS in stand-alone desktop applications to developing department-wide and installation-wide geospatial applications. You are now building a defensewide Installations Spatial Data Infrastructure. The impact of your work extends beyond defense and demonstrates pioneering models for global collaboration of spatial data.

I want to use this opportunity to thank you for the work you do—it is very important.

Warm regards,

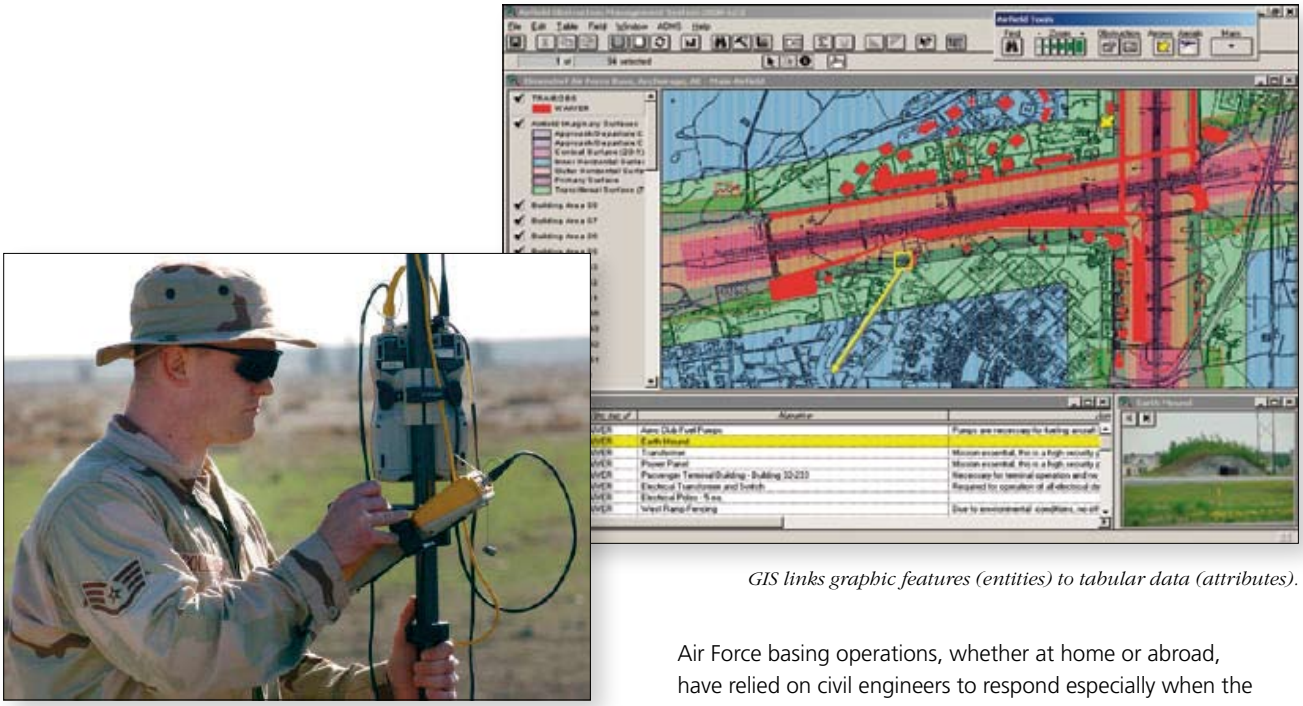
Jack Dangermond



Installation and Environment

U.S. Air Force GeoBase

One Installation...One Map



GIS links graphic features (entities) to tabular data (attributes).

Air Force basing operations, whether at home or abroad, have relied on civil engineers to respond especially when the mission called for a map. Since the creation of the "Installation Engineer" role in the early 1950s to the present, surveying and mapping have always been key civil engineering tools for managing the complex installation infrastructure. The USAF GeoBase program, launched in the summer of 2001 by the Air Force Civil Engineer, has transformed the traditional surveying and mapping process into an invaluable information resource for the larger installation mission, both at home air bases and in the deployed environment.

What is GeoBase? It is probably easiest to begin with what it is not. It is not just an information technology (IT) system that can be purchased over the counter at a software store. It is not a capability that can be achieved by buying computer hardware and GIS software and leaving it on organizational doorsteps to be implemented. Rather, shaped from lessons learned over the past 20 years, it is a radically different and surprisingly practical strategy for guiding Air Force organizations to make long-term, shared use of geospatial information or digital maps to accomplish the shared basing mission. Most important, it is a strategy that is working.

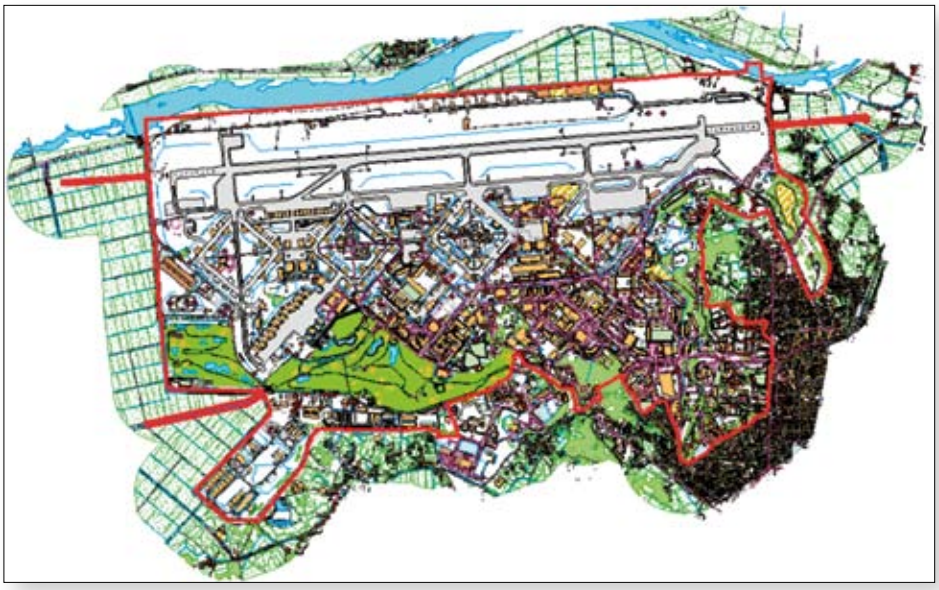
Aided by the convergence of innovations across the technology, policy, and academic research sectors and championed by the Air Force Civil Engineer, the GeoBase strategy has literally transformed traditional mapping. However GeoBase may be defined, in the wake of 9/11 events, the rapidly expanding demands for situational awareness within and around Air Force base operations show that the GeoBase program came just in time.

Building a Strong GeoBase Foundation

The comprehensive GeoBase program is based on guiding principles that echo Federal, Department of Defense, Air Force directives or widely recognized best practices for information management. These guidelines direct Air Force organizations to

- Recognize the value of assigning a dedicated GeoBase cadre to ensure that local geospatial information resources are identified, organized, and applied to help satisfy Air Force and DoD needs.
- Appreciate that paying attention to the necessary cultural and behavioral changes accompanying GeoBase, rather than information technology, will be the most critical factor in securing long-term success.
- Employ a strategic planning process to guide the development and assessment of the impacts of GeoBase investments to include phasing the implementation to both reduce risk and allow the Air Force culture to adapt to new ways of doing business.
- Adhere to a single set of Air Force-approved information technology and data standards as outlined in the GeoBase technical architecture to maximize interoperability, minimize new application development costs, and protect the GeoBase investment.
- Ensure current GeoBase information resources are accurately inventoried and then shared to the maximum extent allowable to avoid wasteful redundancies.
- Validate existing sources of geospatial information prior to investing in new data collection efforts.
- Provide all mission elements with controlled, ready access to a georeferenced common installation picture of the installation.
- Assign geospatial information stewards with the responsibility for maintaining and protecting their respective functional information.

In turn, Air Force organizations should put these principles into operation through their "pillars" of system and information architectures, financial management, policy and guidance, education and training, people, and work flow. Adhering to these guidelines will help ensure Air Force organizations successfully meet the rapidly growing expectations of the Air Force for the GeoBase program.



Common Installation Picture

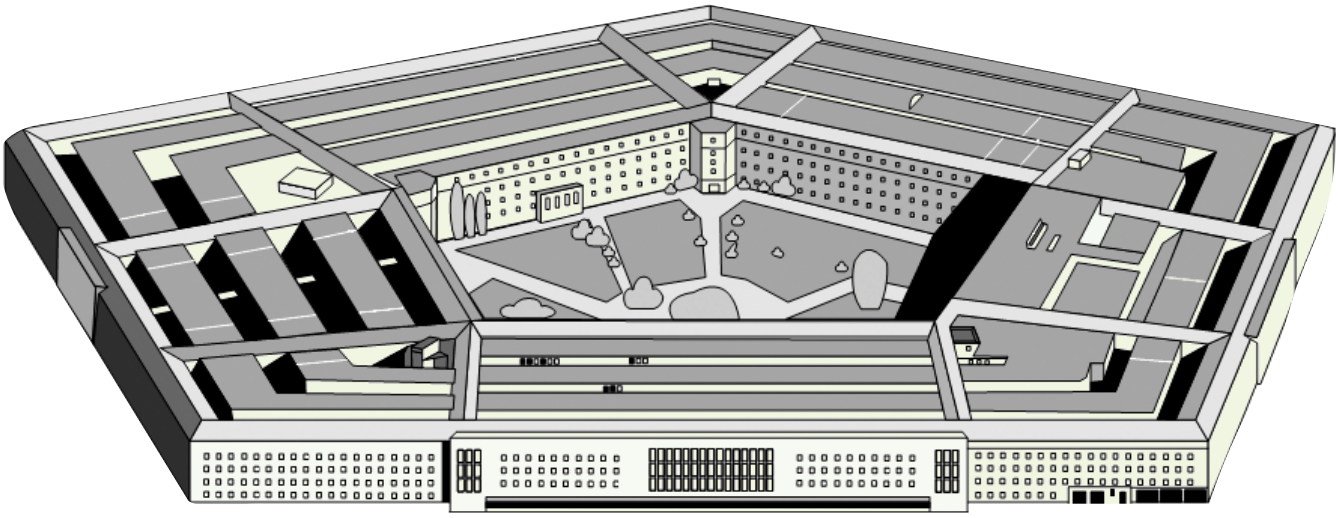
GeoBase Missions

Garrison GeoBase

Typically associated with fixed U.S. Army installations, Air Force doctrine uses the same term to describe one of two modes of Air Force basing. Garrison GeoBase enhances command and control by providing one installation map that delivers current situational awareness in a secure fashion via the base network. The Common Installation Picture (CIP) is a high-quality picture that allows viewers from their desktop computers to quickly visualize the complex built-up infrastructure using easy "point-and-click" steps. The Garrison GeoBase information technology architecture was approved by the Air Force Chief Information Officer in October 2002 and will allow current and emerging IT solutions across the Civil Engineer, Real Property, Command and Control, Security Forces, Weapons Safety, Environmental Management, and Communication sectors to make "one installation...one map" a reality.

Expeditionary GeoBase (GeoReach)

Expeditionary GeoBase supports the second Air Force basing mode. GeoReach is the name given to the expeditionary site mapping capability that involves sharing both classified and unclassified information of potential and actual forward operating locations (FOL). While the intelligence sector has focused on targeting "red force" targets within the battle space, GeoReach fills a key basing niche by allowing airmen with Secret access rights to view "blue force" FOL imagery and key infrastructure. Staff within the PACAF, ACC, and USAFE Geo-Integration Offices team with their respective operational planners from their regional areas of responsibility to optimize combat support and force deployment. The CIP again serves as the visual rallying point for compiling all expeditionary site survey data into a single view. The imagery is acquired through partnerships with the National Geospatial-Intelligence Agency and other branches of the military. Additional software tools enable operators, logisticians, and civil engineers with aircraft parking, fuel and munitions storage, and other force bed down requirements. Because of the GeoReach process, fewer airmen go forward prior to deployment where they may be exposed to hostile conditions, yet expeditionary site planning knowledge vastly increases.



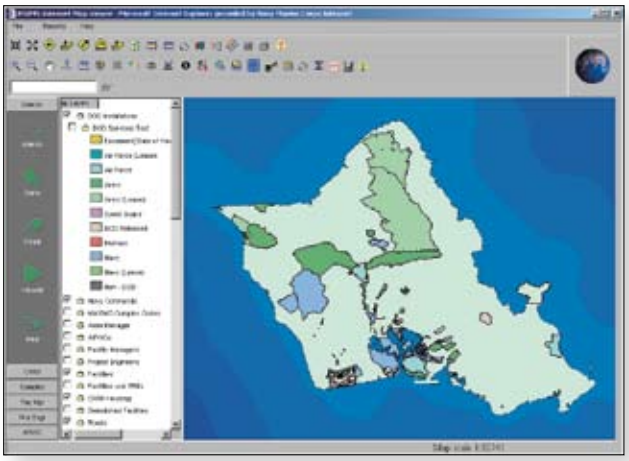
Strategic GeoBase

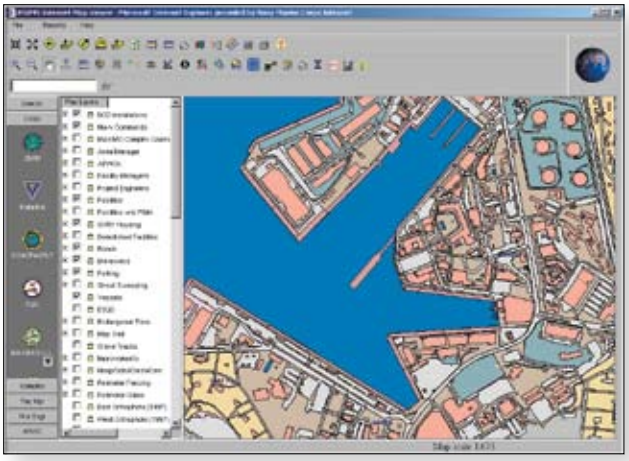
It did not take long for senior leaders on the Air Staff and the Air Force Secretariat to inquire as to how the GeoBase program could be extended to meet their needs. Therefore, the Strategic GeoBase program was launched in 2002 as a practical means to convey imagery and key data from Garrison GeoBase sources to satisfy strategic questions. Proximity of installations and ranges to other regions, such as urban areas, national parks, and other areas of political interest, is a frequent topic of discussion within the Pentagon. Strategic GeoBase is designed to serve as the single installation visualization tool by incorporating legacy Air Force geospatial information investments such as the range database maintained in Airspace and Ranges (AF/XOOR). In addition, Strategic GeoBase will also blend with emerging mapping solutions tied to homeland defense, force protection, and base realignments. Thanks to the Assistant of the Air Force for Installations, Environment and Logistics, the first Air Force-wide library of imagery acquired from commercial space-based satellites provided situational awareness to senior leaders in early 2004. As more Air Force members become aware of GeoBase capabilities, this new appreciation for the value of geospatial information will undoubtedly lead to more innovative uses.

The Future Defense Installation Spatial Data Infrastructure

In just a few years, the USAF GeoBase program has demonstrated how a mission-centric approach to GIS investment can rapidly be adopted across a worldwide enterprise. Senior Department of Defense (DoD) leaders have also gained a new appreciation for the value of GIS-enabled situational awareness. In July 2004, the Office of the Secretary of Defense established the Defense Installation Spatial Data Infrastructure (DISDI) office that will serve as a new DoD focal point for securing adoption and shared use of geospatial information resources across the DoD. The DISDI office will develop policies and facilitate coordination of spatial data standards, imagery, and associated geospatial technologies across the broad worldwide CADD/GIS user base in the defense sector. The DISDI effort will also ensure that critical mission sectors outside of installations and environment, such as homeland defense, are also making full access of the "one installation…one map" vision.

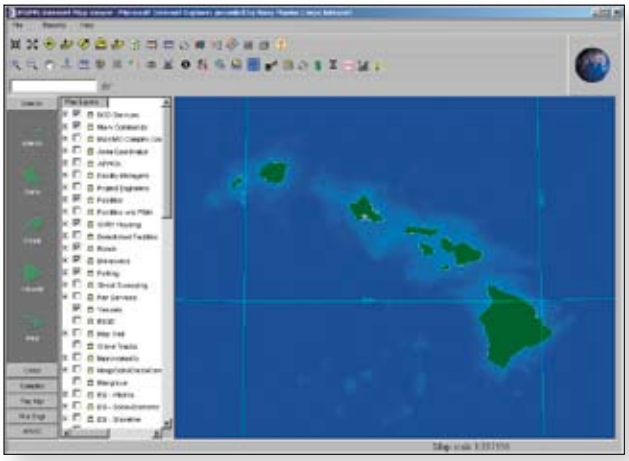
Navy Region Hawaii Uses GIS Technology for Facilities Management and Public Works Operations





Commander Navy Region Hawaii (COMNAVREG Hawaii) required a standardized process to keep track of its shore installation facilities and infrastructure and desired the capability for information retrieval and analysis to support facilities planning, management, and public works efforts. To accomplish this goal, it created a component-based GIS application called Regional Shore Installation Management System (RSIMS).

RSIMS combines spatial data with tabular information to provide its users with a visual tool that allows them to intuitively perform reporting and analysis functions for regional planning and facilities management. RSIMS links the region's spatial data to databases such as Naval Facilities Assets (NFA) that contain real property inventory for land, buildings, structures, and utilities owned or leased by the Department of the Navy. RSIMS is also linked to MAXIMO, an Oracle®-based maintenance management system that tracks and manages repair, maintenance, and service work orders for many military activities in Hawaii. Energy consumption data is also available through a link to CUBIC, an Oracle-based system that stores electrical as well as water and sewer metered data. The integration of GIS technology with operations databases results in an easy-to-use, interactive graphical interface allowing users to navigate and retrieve information via a map. It also provides reporting and analysis functionality for work orders, equipment inventory, preventive maintenance inspections, and job plans for recurring work.



Through RSIMS, multiple users can instantly access spatial data in real time from their desks and are able to overlay various data types onto each other. It has increased worker efficiency and improved response time. Users are now able to do data analyses and see relationships between different data sets, all of which were difficult or impossible when the data existed as paper maps and stand-alone databases. Other benefits RSIMS has provided are the ability to share data among various departments, thus eliminating data redundancy and fragmentation, as well as streamlining data maintenance by making it easier, faster, and more cost-effective to update the maps.

RSIMS utilizes a spectrum of spatial data required for facilities and installation management.

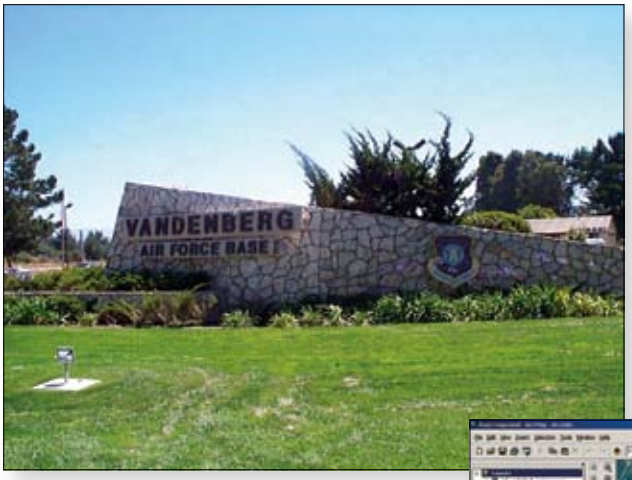
- General installation maps: military facilities and dwelling units, transportation routes, naval vessels, piers, cadastre, bathymetry, and hypsography
- Utilities: electrical, wastewater, potable water, steam, compressed air, and saltwater
- Environmental constraints: wetlands, shoreline sensitivities, refuges, endangered species, electromagnetic radiation arcs, explosive safe distance arcs, hazardous materials storage, and remediation zones
- Public safety: tsunami and flood inundation zones, emergency services locations, oil spill contingencies, street geocoding for emergency dispatch, and secured perimeter boundaries

RSIMS also includes raster imagery such as orthorectified aerial photography and USGS topographic line maps. The vector spatial data served by RSIMS is stored either as ESRI's ArcInfo® shapefiles or in ESRI's ArcSDE® geodatabase, and the data is maintained using ESRI's ArcGIS® Desktop (ArcMap™, ArcCatalog™, ArcToolbox™) and ArcInfo Workstation. The raster images in RSIMS are compressed using LizardTech's MrSID® and displayed as SID files.

RSIMS is accessed via the Internet based on ESRI's ArcIMS® software. RSIMS is fully component based and data driven allowing for rapid development of customized applications for specific user needs. All configuration data is stored in an extensive Oracle schema that is maintained through an administrative module.

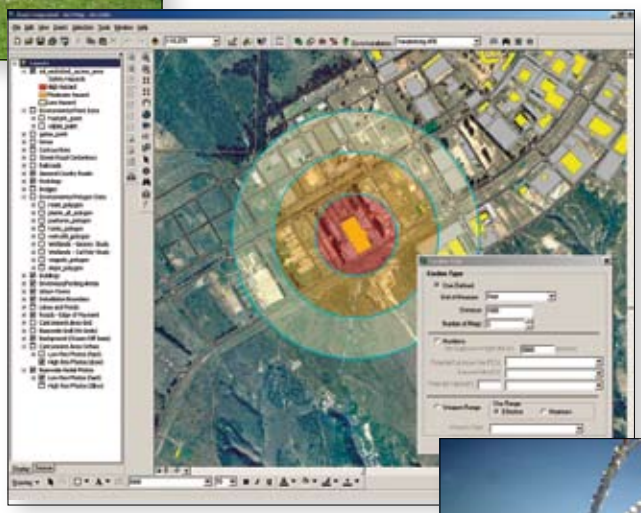
The standardization of the ESRI® file formats allows the same set of spatial data to be used by the Navy for complementary purposes. The RSIMS spatial data is therefore accessible in a mobile environment for on-site investigations using ESRI's ArcPad® and a Pocket PC handheld device. Accessing the data through ESRI's ArcScene™ and IMAGINE® by ERDAS allows the Navy 3D visualization capabilities to verify view channels between buildings, study height regulations, and model harbor depths for ship passage.

Vandenberg Air Force Base Geo-Integration Office



Overview

The Vandenberg Air Force Base Geo-Integration Office provides AF GeoBase support to the USAF Space Command and the 30th Space Wing. For the past 10 years, Vandenberg AFB has been a pioneer and leader in GIS implementation and deployment for the USAF. During this time, Vandenberg AFB has compiled one of the largest GIS databases in the Air Force. Its commitment is to provide the 30th Space Wing and all supporting agencies with up-to-date mapping support using the latest technology and equipment in GIS technology.



U.S. AIR FORCE

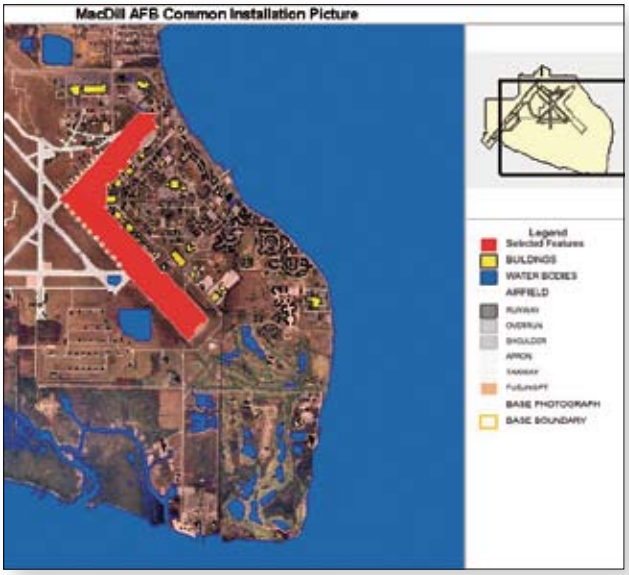
Capabilities

The GIS data sets developed at Vandenberg AFB provide multidisciplined GIS support for the 99,000-acre Vandenberg AFB. From mission critical support of space and missile launches to environmental concerns and fire management, ESRI ArcGIS products have supported the following:

- Comprehensive planning
- Command Post/Disaster Control Group
- Launch Control Center
- Disaster Response Van
- Security Forces Dispatch Center
- Explosive Ordnance Disposal Management
- Airfield obstructions analysis
- Natural and cultural resources
- NRO mission planning
- Hotshots
- Fire department fire modeling (FARSite)
- Flood modeling
- Safety
- Environmental planning
- Environmental restoration (IRP) and compliance
- Engineering project management
- Toxic hazard modeling
- Utilities operations and maintenance
- Communications operations and maintenance
- Disaster preparedness
- Emergency response
- Base safety
- Bioenvironmental
- Real estate management
- Wildlife management
- Weather

Advances in GIS technology, including GPS receivers/base stations, high-resolution orthorectified color photography, and light detection and ranging (LIDAR)-derived hyperaccurate topography have provided the Vandenberg Geo-Integration Office with the necessary tools to ensure that data sets are of the highest accuracy. These advances, along with an excellent GIS support staff, are in line with the highest standards of the U.S. Air Force.

MacDill Air Force Base GeoBase Program



Overview

GeoBase uses an enterprise GIS as its backbone, providing accurate base infrastructure and operational information for real-time situational awareness. MacDill's GeoBase implementation focuses on two mission sectors: Garrison GeoBase and Strategic GeoBase. Implementation efforts began at MacDill AFB in September 2003. Although it is relatively early in the process, the deliberate and systematic approach taken at MacDill has already paid off in huge dividends.

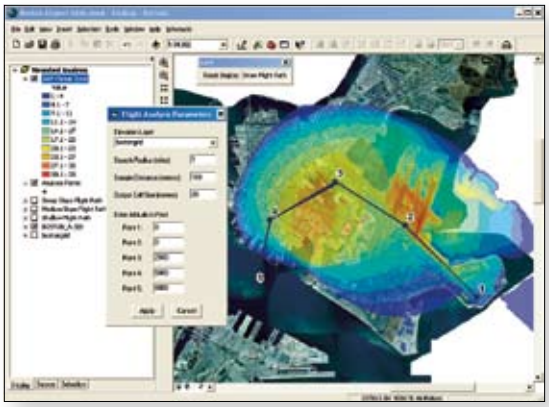
Garrison GeoBase

This is an innovative program enabling cross functional information sharing through a variety of IT solutions. It ultimately enhances the efficiency and accuracy in which current situational assessments are presented to the MacDill AFB decision makers. The foundation of Garrison GeoBase is the Common Installation Picture (CIP). Essentially, CIP is the base layout map provided in a spatial environment. All other basemapping programs use The CIP as its basic map data set. Data displayed on top of The CIP is called Mission Data Sets (MDS). Currently MacDill AFB users access, print, and manipulate the CIP and MDS information through browsers on the base Intranet. In a matter of months, GeoBase has already become a vital working part of many MacDill AFB functions.

Strategic GeoBase

This program provides senior leadership an Installation Visualization Tool (IVT) and the means necessary to answer strategic questions. The MacDill AFB IVT was used to answer the Base Realignment and Closure (BRAC) committee's questions concerning base infrastructure, land usage, base construction constraints, and other critical information. The MacDill community planner and real property manager both stated, "Without the GeoBase service, answering the BRAC inquiries would have been much more difficult and highly time-consuming."

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.

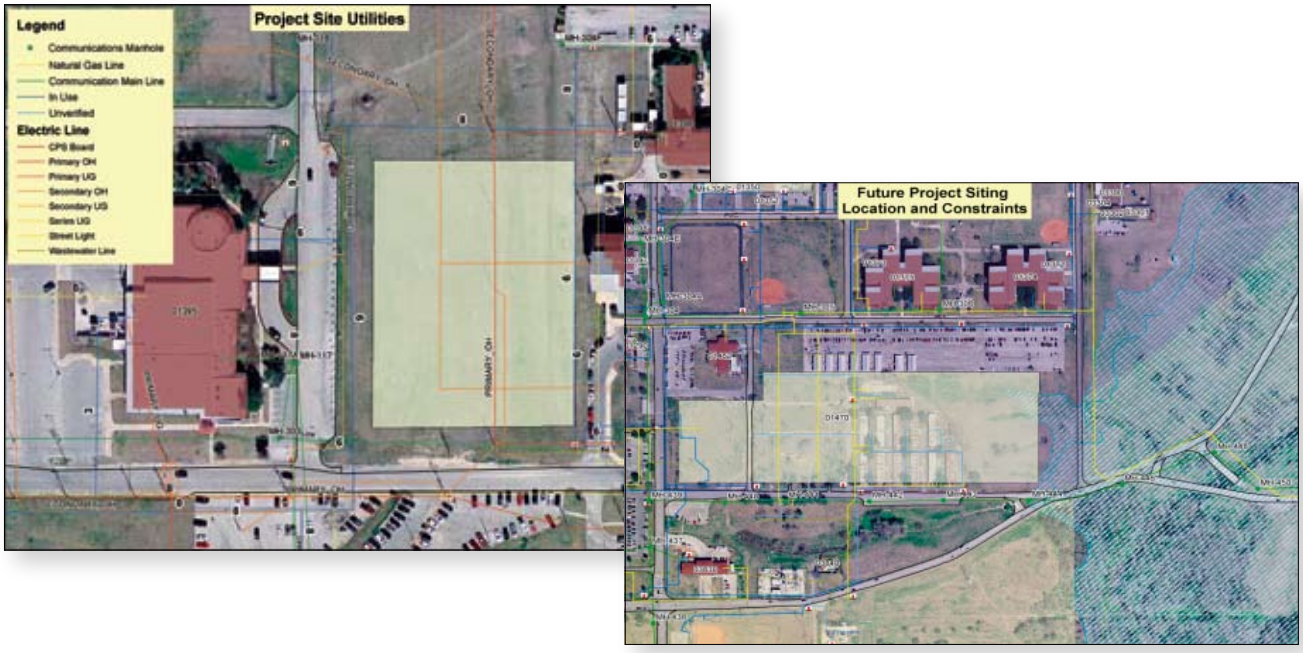
Weapon-Specific Threat Analysis

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.

G/I/S

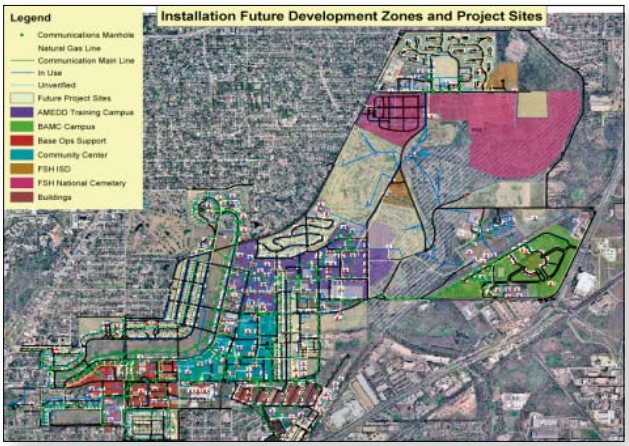
Enterprise GIS for Fort Sam Houston Installation Management



The Fort Sam Houston Enterprise GIS (EGIS) is an integrated installation-level GIS that gives users broad access to geospatial information. The primary distribution of the centrally managed, secured GIS is Web-based. EGIS is integrated with numerous legacy systems, encompasses data from disparate sources, and supports critical business functions being shared across the organization. As a decision support and planning tool, EGIS ties the data to mission requirements and displays the data in a common and standards-compliant mapping format that can be shared, compared, analyzed, and viewed throughout the installation.

Installation Applications

- Master planning
- Integrated facilities management
- Environmental and natural resources management
- Cultural resource management (architecture, archaeology)
- Installation status report (infrastructure and training lands)
- Real property management
- CADD/Mapping integration
- Force protection planning
- Physical security integration
- Fire and emergency services support and planning
- Emergency operations management
- Disaster response and preparedness



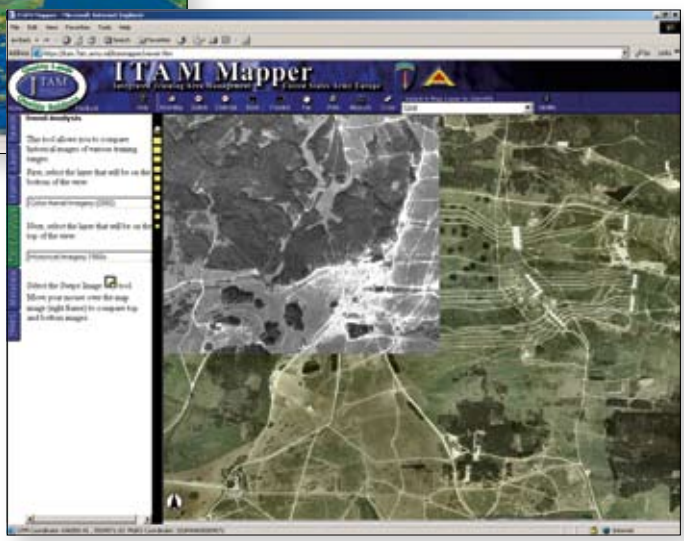
Master Planning and Future Development

- Understanding and visualizing your surroundings
- Seeing the big picture for development opportunities
- Siting future projects in relation to mission
- Identifying natural and environmental constraints
- Getting site details before design begins
- Picturing the new facility

U.S. Army Europe—Integrated Training Area Management Program

USAREUR ITAM Mapper allows users to search by coordinate, training area, range, country, or dynamically zooming in on an area.

ITAM GIS Users Planning Training Events



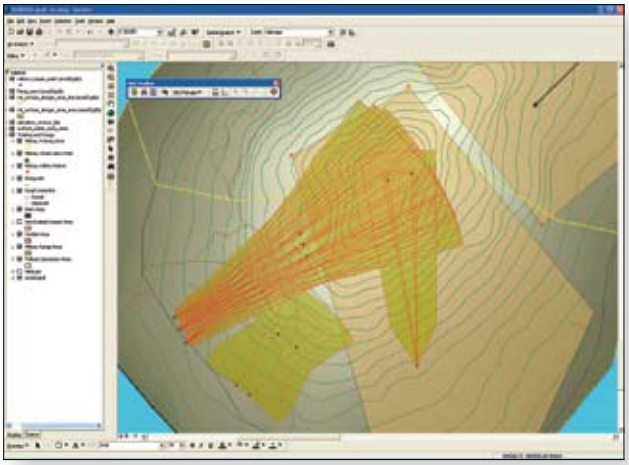
Trend analysis function allows users to dynamically "swipe" temporal data. In this example, Grafenwoehr's Range 301 black-and-white image from 1963 is swiped over the 2002 color image.

Heavy Maneuvers in the "Box" at CMTC Hohenfels

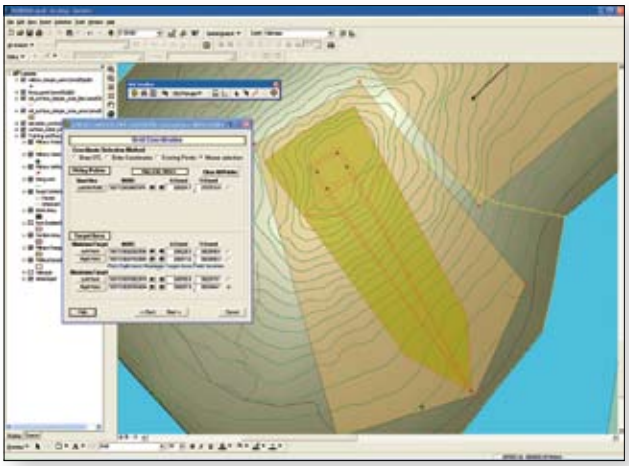
The United States Army Europe (USAREUR)/7A Integrated Training Area Management (ITAM) program provides a management and decision making process that integrates training and other mission requirements for land use with sound natural resource management practices. The overall goal of the Army's ITAM program is to achieve optimum, sustainable use of the training lands by implementing a uniform land management program.

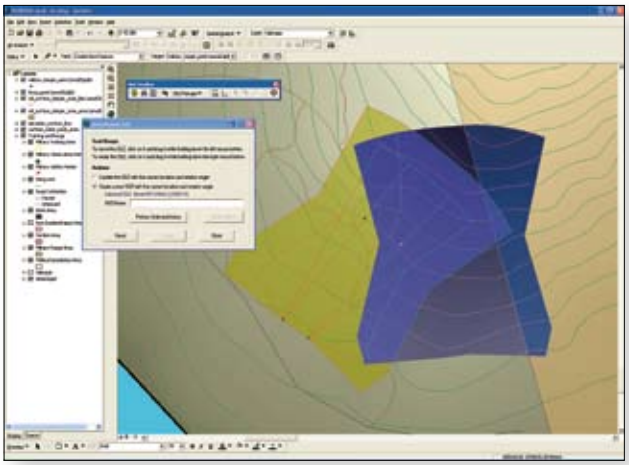
Standard information products, such as the ITAM Viewer and ITAM Mapper, provide readily accessible dissemination tools for the ITAM GIS program. The Web-based ITAM Mapper delivers orthoimagery, satellite imagery, topographic maps, elevation models, and vector data to military trainers and resource managers.

Surface Danger Zone Tool



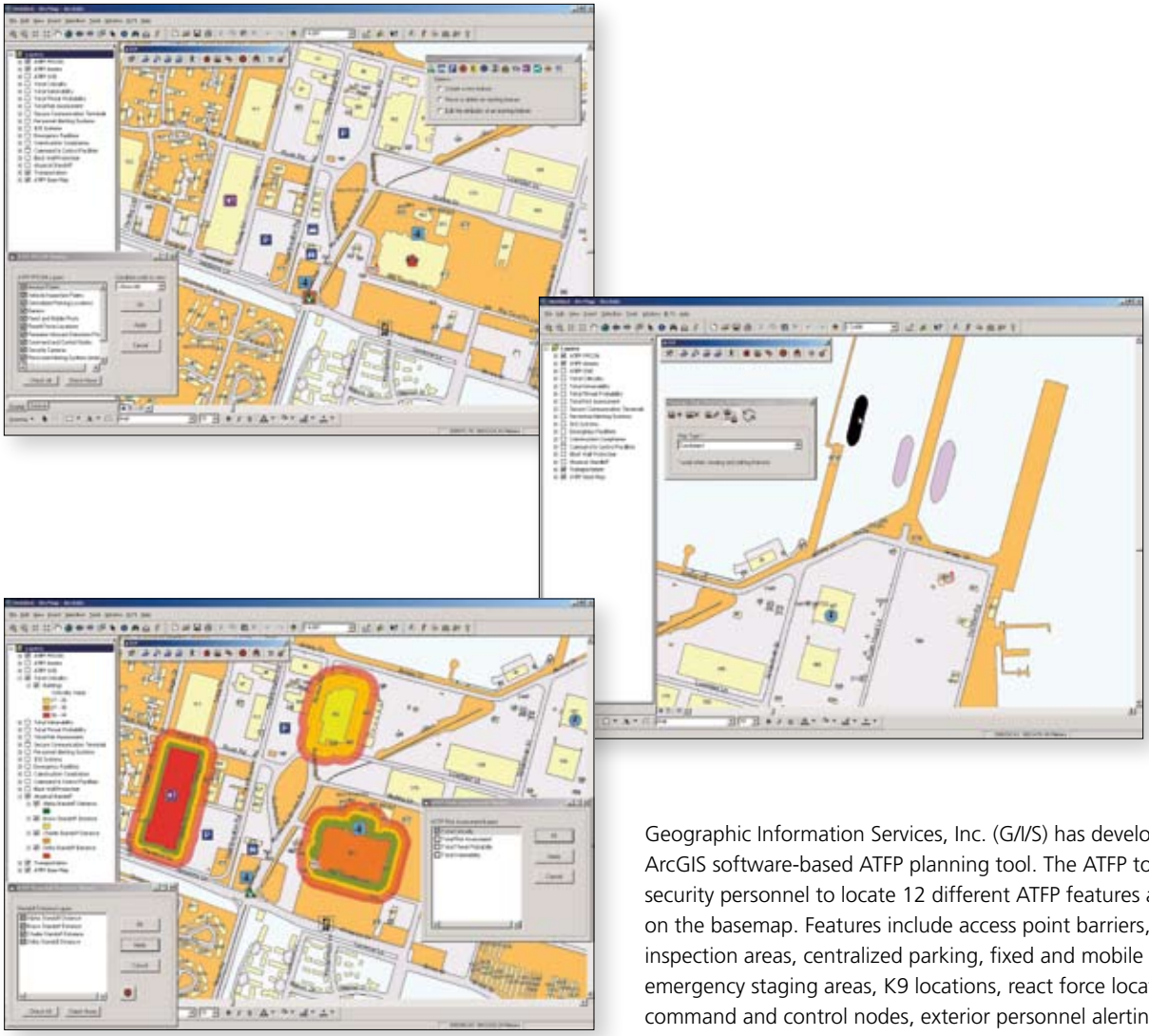
Geographic Information Services, Inc. (G/I/S), has developed an ArcGIS (8.3 or 9) toolbar that creates surface danger zones (SDZ) for weapons systems defined in DA PAM 385-63. This tool allows range safety officers and range control officers to interactively create SDZs by selecting weapons systems, target points, target media, and firing points. Users are able to identify firing and target locations in the map interface by entering MGRS grid coordinates or selecting existing points. The tool also allows users to create SDZs for Combined Armed Live Fire Exercises (CALFEX) by combining individual SDZs. The underlying data structure allows users to keep track of which SDZs were developed for specific training exercises. The parameters used to draw the SDZs are stored in related data files. Recent additions to the SDZTool include interactive editing of SDZs. This work was performed under contract with the U.S. Army Environmental Center in support of the ITAM program and the U.S. Marine Corps.





G/I/S

U.S. Navy Antiterrorism/Force Protection

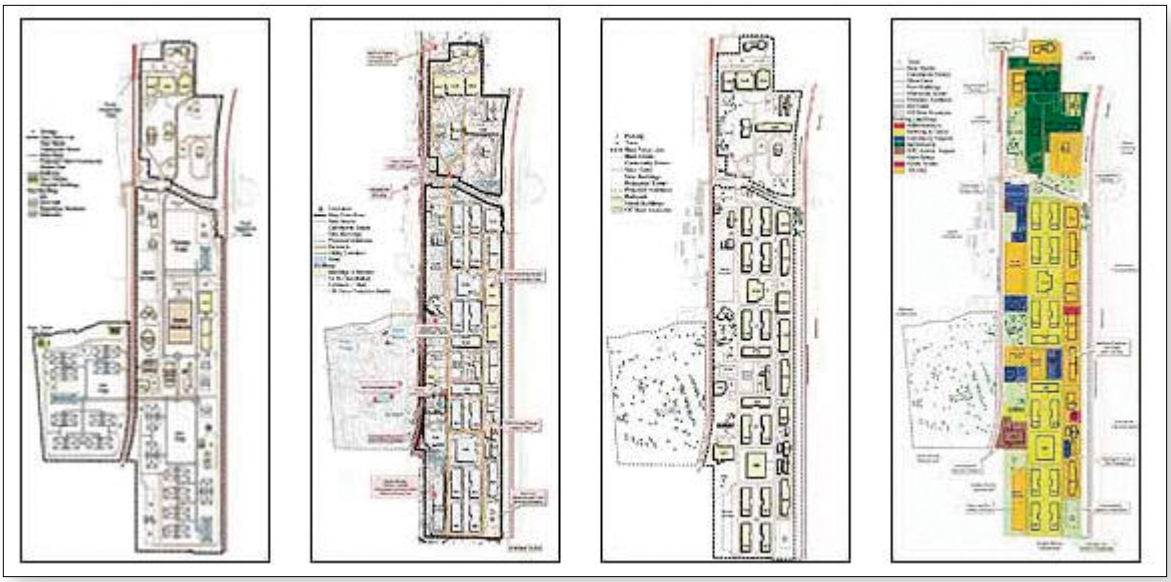


Geographic Information Services, Inc. (G/I/S) has developed an ArcGIS software-based ATFP planning tool. The ATFP tool allows security personnel to locate 12 different ATFP features anywhere on the basemap. Features include access point barriers, vehicle inspection areas, centralized parking, fixed and mobile posts, emergency staging areas, K9 locations, react force locations, command and control nodes, exterior personnel alerting systems, security cameras, and perimeter intrusion detectors. Positions for all features are set for each of four force protection conditions (Alpha, Bravo, Charlie, Delta). Security personnel can also assign ATFP attributes to existing features such as buildings and ships, identifying to blast compliance values, setting standoff distances, etc. A risk component allows users to assign threat, vulnerability, and likelihood of attack values to any feature for assessing risks of attack. The data viewer component allows users to see ATFP configurations for each condition. This work was performed under contract for the U.S. Navy Region Japan Public Work Center.

G/I/S

Navy Site Planning

Recruit Training Command Great Lakes



This map is part of a series used in the analysis of the possible site redevelopment at the U.S. Naval Recruit Training Command (RTC) Great Lakes located in northeastern Illinois. The installation houses approximately 54,000 recruits each year. The barracks are overcrowded and need to be replaced because the facilities are out-of-date, the structures are deteriorating, and there is insufficient utility capacity.

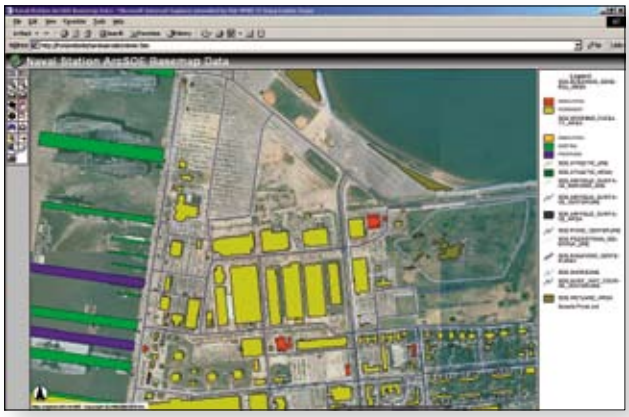
RTC Great Lakes requested a site analysis of the installation to prepare proposed site redevelopment plans illustrating environmentally sound solutions for improving and managing the land and facilities while supporting the RTC mission. Several planning guidelines were set such as the creation of a campus environment, segregation of vehicles from recruit pedestrian traffic, incorporation of antiterrorism/force protection setbacks, minimizing negative impacts to the adjacent community, and consolidation of common land use functions into activity corridors.

In addition to the design criteria, planners were required to maintain a constant berthing capacity for 16,000 recruits, minimize the adverse impacts to recruit training activity, and maximize the use of existing infrastructure. To help in this process, the maps identified proposed functional districts and land use zones within RTC; utility corridors; facility/building locations; natural resource features; and transportation, vehicular, and pedestrian circulation modes.

Norfolk Naval Station: From Zero to ArcIMS in 30 Days

Geographic Information Services, Inc. (G/I/S) recently completed a rapid-paced project for the Public Works Center (PWC) at Norfolk Naval Station in Virginia that involved migrating CAD data to an SDSFIE-compliant geodatabase being served through an ArcIMS site. From start to finish, the project was completed in less than 30 days and now serves as the foundation for the PWC GeoReadiness Center for the mid-Atlantic region of the Navy.

Yvonne Mingee, director of the newly created Regional GIS Division, recognized that she needed to quickly demonstrate the power of GIS and the ease of implementation to overcome many historical barriers to funding. She contracted G/I/S to create a prototype database that would demonstrate both the utility of GIS in the PWC regional environment and the ability to deploy useful GIS systems quickly. To provide the biggest bang for the buck, she selected the central facility for the region, Norfolk Naval Station, for the initial effort.



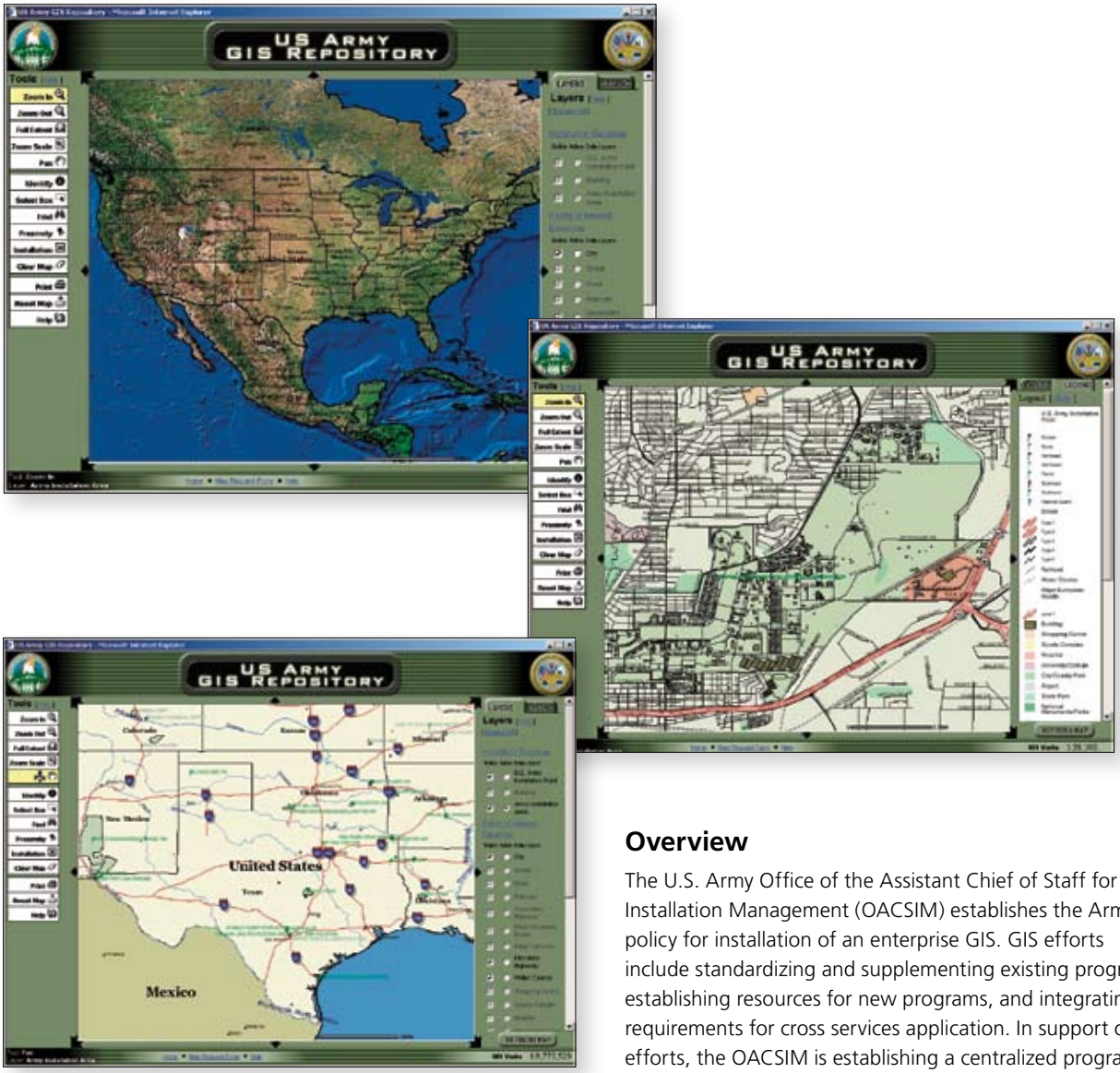
G/I/S immediately set to work evaluating the available CAD data and digital aerial photography. It was apparent early on that the CAD data and the imagery data had been processed differently at some point, causing a regular shift of the CAD data when compared to the aerial imagery. In fact, PWC felt this data was not usable because of this problem. The errors were corrected through a reprojection process: taking the data back to its original state and properly projecting it to State Plane NAD83. The data was then migrated to an SDSFIE-compliant personal geodatabase. Because of G/I/S's experience in spatial data standard (SDS) geodatabase migrations (more than 35 military installations in the past two years), it was able to complete this task within two and one-half weeks. This migration included establishing the data linkages to the iNFADS database tables used for property management by PWC. This immediately integrated the new GIS data with existing mission critical databases providing a spatial interface for query and analysis.

Working simultaneously with the planimetric data migration was an effort to convert the basemap image data from file-based data (TIFs) into an ArcSDE image geodatabase. Both the imagery and the planimetric data were delivered and deployed as an enterprise ArcSDE geodatabase during the fourth week of the project.

Several ArcIMS sites were developed and served as soon as the databases were up and running including an ArcIMS image service serving all ArcSDE basemap data, an ArcMap map service serving an MXD, and a cultural and natural resources Internet map server (IMS) application built by the Corps of Engineers in ArcIMS 3.1 that was later migrated to version 4. These now provide widespread access to the data through the Intranet within Norfolk Naval Station and LANTDIV. The Atlantic Division LANTDIV is one of four Engineering Field Divisions of the Naval Facilities Engineering Command.

PWC is now able to demonstrate the viability of GIS as an affordable and achievable solution to the regional needs of PWC Norfolk. With this, PWC was able to secure additional funding needed to build the GeoReadiness Center, which will include data for all the bases in the mid-Atlantic region, additional ArcIMS applications, linkages to existing tabular data, and GIS data maintenance operations.

U.S. Army Office of the Assistant Chief of Staff for Installation Management



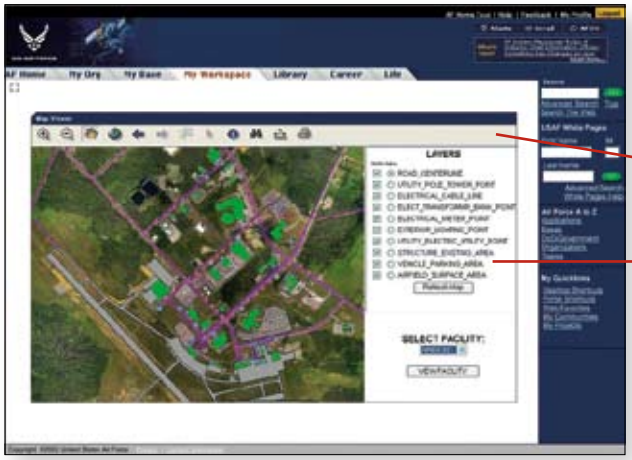
Overview

The U.S. Army Office of the Assistant Chief of Staff for Installation Management (OACSIM) establishes the Army's policy for installation of an enterprise GIS. GIS efforts include standardizing and supplementing existing programs, establishing resources for new programs, and integrating requirements for cross services application. In support of these efforts, the OACSIM is establishing a centralized program that includes a GIS repository (GISR).

Benefits

- Implementing an Army-wide enterprise GIS to support Installation Management
- Cross service coordination in support of the Installation Visualization Tool (IVT)
- Integration of stovepipe GIS implementation into a sustained service-wide resource
- Increased situational awareness at all levels at one or many locations

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.

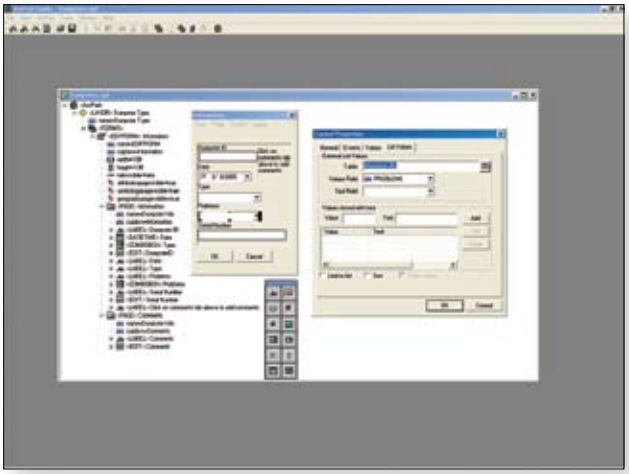
Colonel Hal Tinsley now pilots the HAF GIO, and his focus is to operationalize GeoBase—to put the capability (for unclassified resources) into the hands of all USAF personnel, from airmen to general officers to all civilian, military, and contractor support personnel in between. The vehicle for bringing 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.

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.

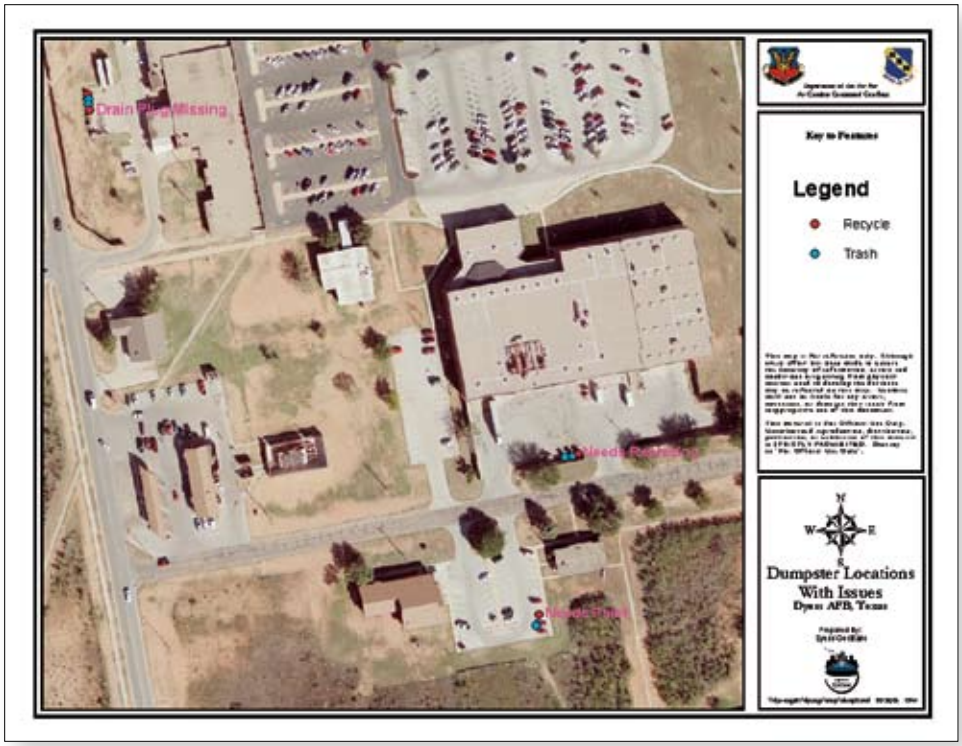
Mission

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



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.

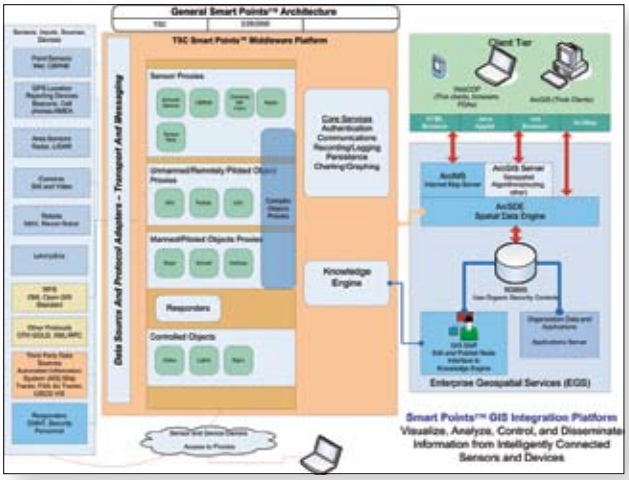
Result

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

Dyess GeoBase

Smart Points



Smart Points platform

Introduction

The purpose of the Smart Points™ GIS integration platform, coupled with ESRI's GIS software components, is to provide an inclusive information framework for integrating, controlling, visualizing, analyzing, connecting, and disseminating information among intelligently connected sensors, devices, objects, and personnel.

The Smart Points platform was created in response to experience gained during Defense Threat Reduction Agency (DTRA) Integrated Technology Demonstrations (ITDs) conducted from early 2003 to the present. These ITDs required the integration of multiple sensors, robots, responders, and other objects, developed by many different sponsors, into a common operational picture (COP). Smart Points evolved as a technology platform to accommodate this wide variety of heterogeneous systems and provide a means for them to operate within an ESRI client environment and interact with each other and the system users.

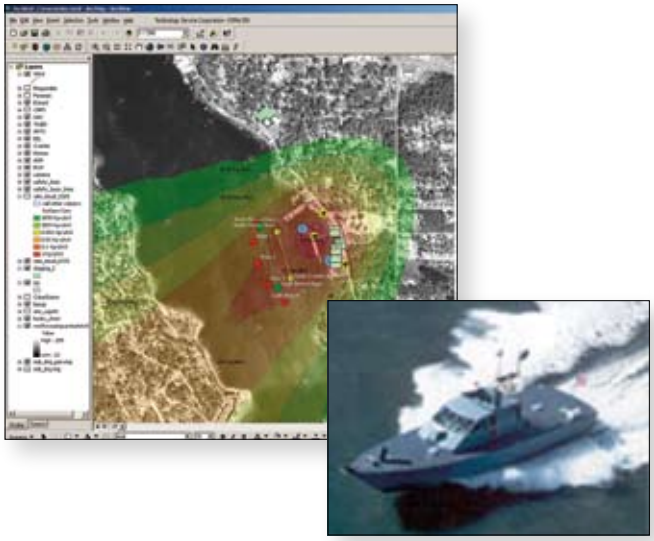
Architectural Support

The TSC Smart Points architecture augments and operates within the ESRI ArcGIS Server, ArcSDE, and ArcIMS back-office framework. This implementation ensures that these objects can not only operate but also interact with other elements within the geospatial context of an operation as well as with other sensors or objects that are integrated in the system.

Each sensor or object is connected to this back-office framework through Java connectors and software proxies of these objects. This implementation provides the necessary abstraction of the physical device so that it can be assigned behaviors and interactions with other sensors or devices in the information system. Once in the information system as addressable objects, the sensors and devices can operate and persist, providing continuous support and updates to their clients. As information elements, the sensors and devices can operate as smart objects so that, for instance, a chemical agent sensor could alarm, transmit a message to personnel or organizations that need to know that the alarm has occurred, prompt the reading of local meteorological sensors, and trigger the creation of a chemical plume model that is introduced to the system with little or no manual intervention.

DTRA Integrated Technology Demonstrations

The Smart Points framework was developed over time as part of the DTRA ITD process that began in late 2002. A hallmark of these ITDs was the necessary integration of a wide variety of devices and sensors within a COP. Smart Points served as the integrating component used to make the various systems operate together for the customer. The success of this implementation was proven as part of the Joint Warrior Interoperability Demonstration 2004, the political conventions of 2004, the Super Bowl and Inauguration in 2005, and the Coalition Warrior Interoperability Demonstration in 2005.



Navy Center for Asymmetric Warfare

The Navy Center for Asymmetric Warfare is implementing a shore-based ESRI geospatial infrastructure that will be used to support its asymmetric warfare initiatives. The geospatial infrastructure will be augmented with Smart Points to connect to a fast patrol craft with multiple sensors and potentially unmanned vehicles launched from the boat.

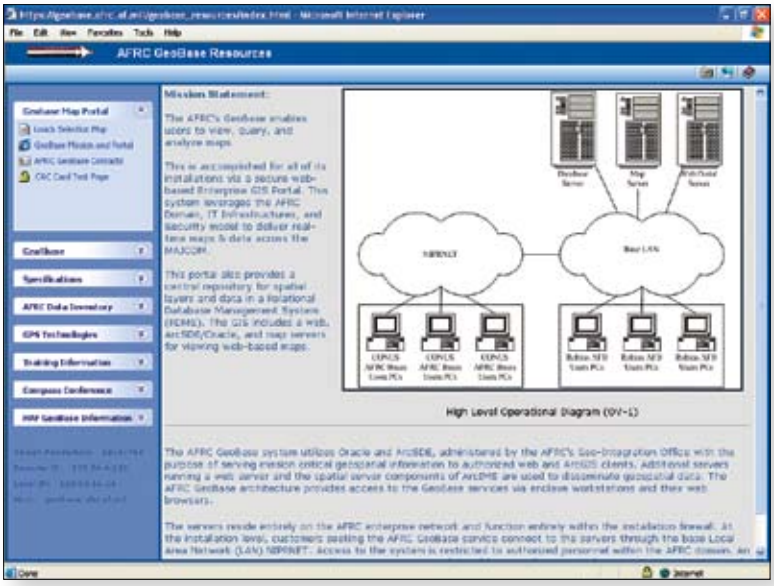
Airport Security Display Processor

TSC is building an airport perimeter security system that takes advantage of the Airport Surface Detection Equipment (ASDE) radar to track anomalous objects within the radar's field of view. This radar, coupled with Smart Points, provides system capabilities that can accommodate new sensors such as video, acoustic, and motion detection. Each of these sensors can be cued by the ASDE radar.

Department of Energy SensorNet

During the DTRA ITD 4 activity of June 2005, the Smart Points team integrated DoE SensorNet components via the DoE Web Feature Service (WFS) implementation into the ITD systems. This capability utilized the SensorNet framework to discover and display physical location, detection, and alerts from a variety of networked sensors into an enterprise GIS architecture.

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.

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

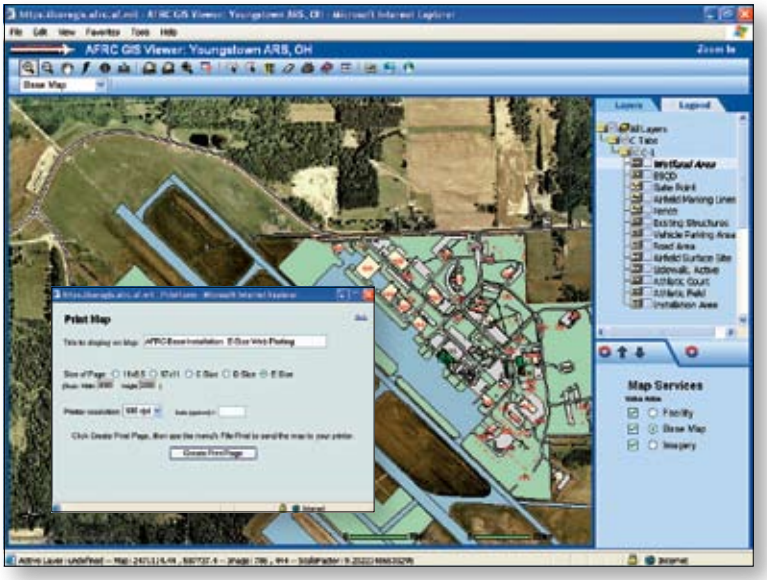
AIR FORCE RESERVE COMMAND

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 database 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 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.

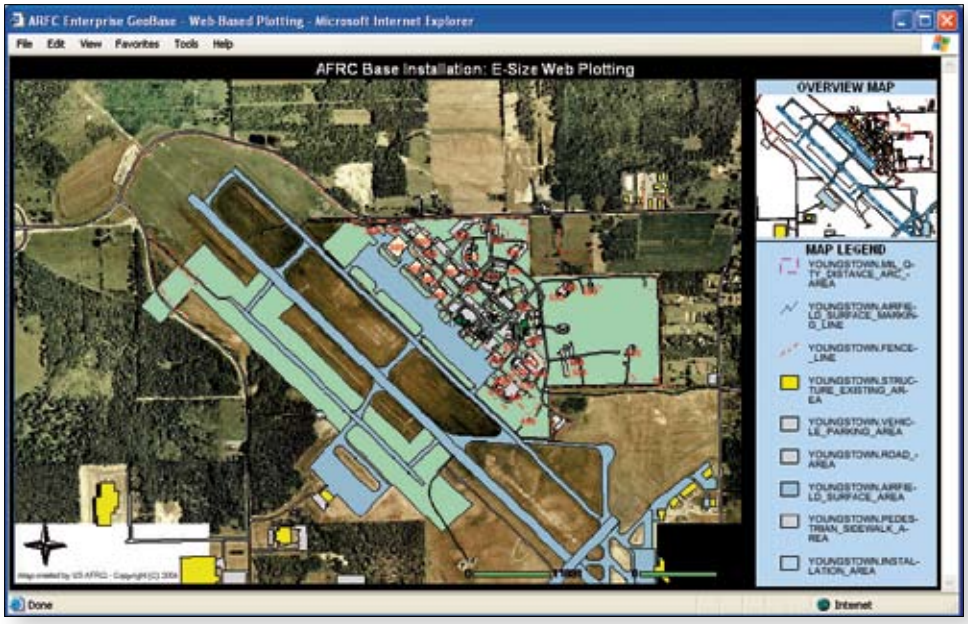
When printing large-format plots from the Web, it is important to increase the memory size that ArcIMS allocates to its map services. This is important when dynamically sized large prints are generated.

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.

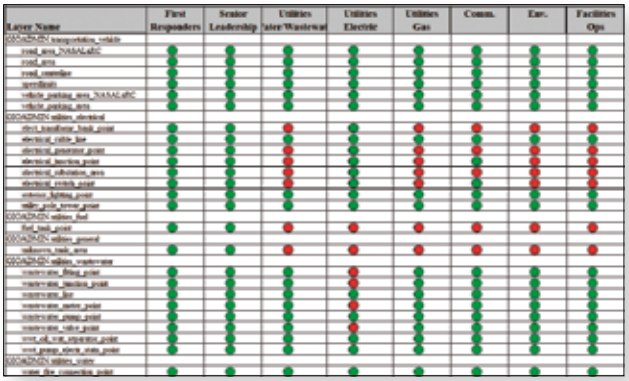


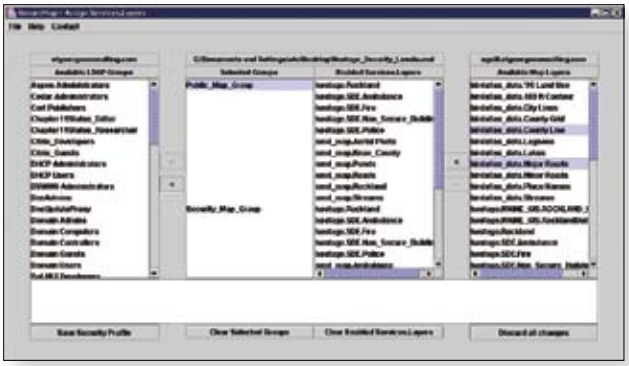
Final plotter output from AFRC's multiservice Web interface

U.S. AIR FORCE

AIR FORCE RESERVE COMMAND

Layer-Level Security for Langley AFB SDI

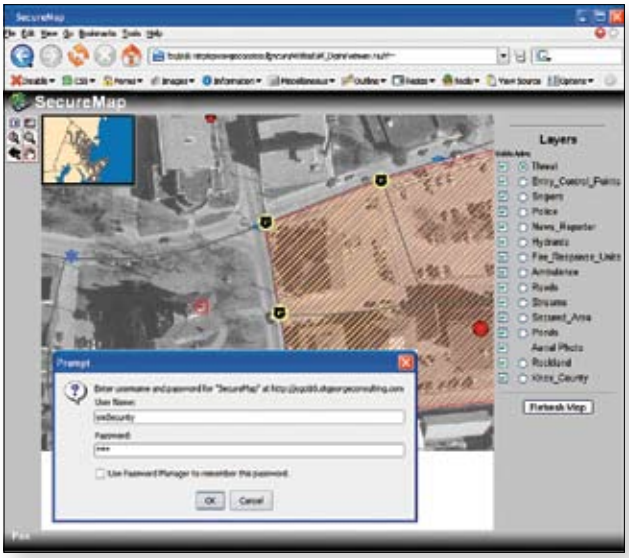




The Geo-Integration Office at Langley Air Force Base manages a mix of environmental, engineering, mission, and operational layers within its GeoBase GIS. Many of these layers are highly sensitive and require multitiered security and authentication.

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.

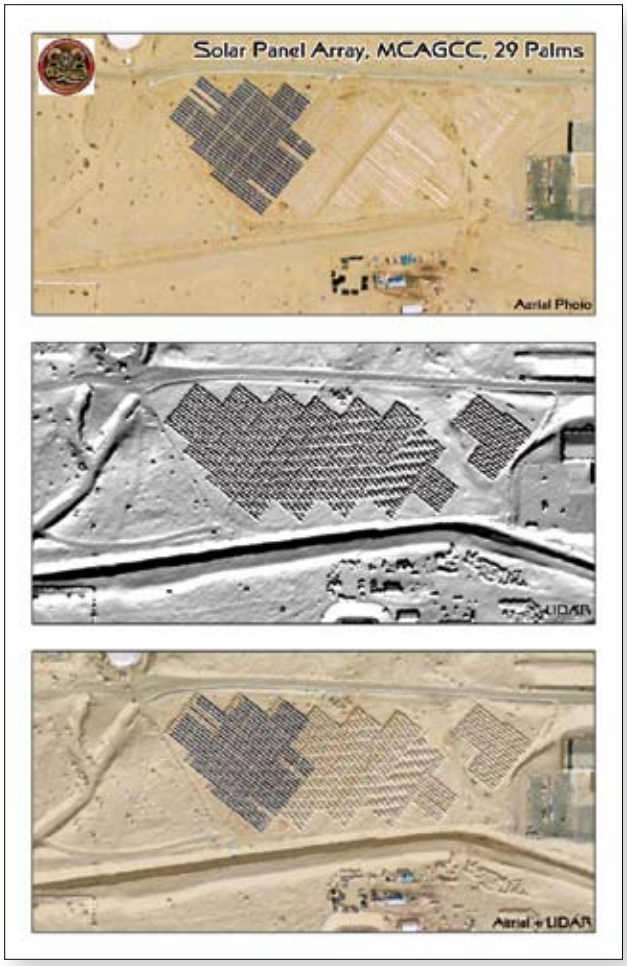
Successful implementation of the security matrix demanded a map services infrastructure that was highly secure and also provided maximum flexibility and low maintenance overhead for GIO staff members. To accomplish this, McSherry contracted Penobscot Bay Media to deploy SecureMap for ArcIMS. This extension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



Penobscot Bay MEDIA

MAGTFTC/MCAGCC

Twentynine Palms, California



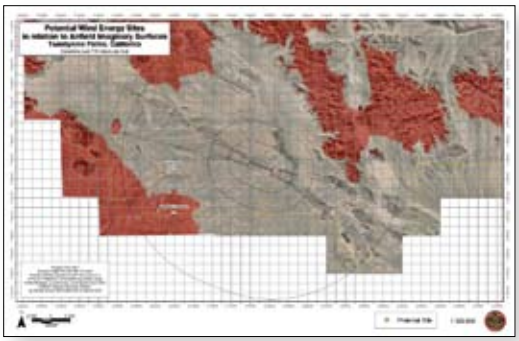
Aerial photography and lidar overlay

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.

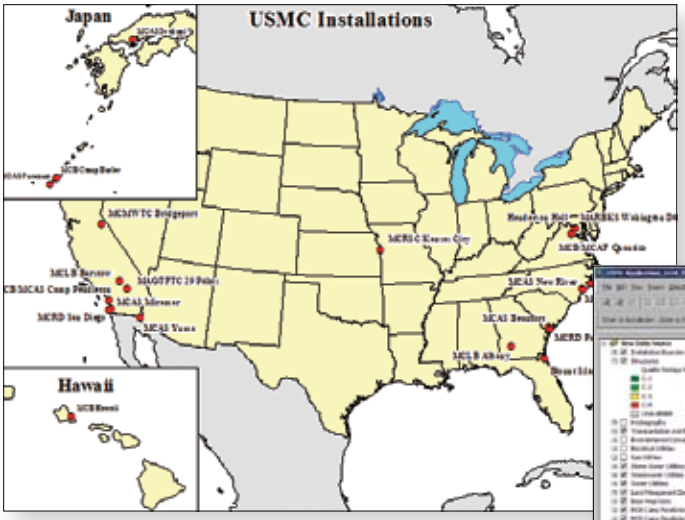
GIS applications making a difference in installation management



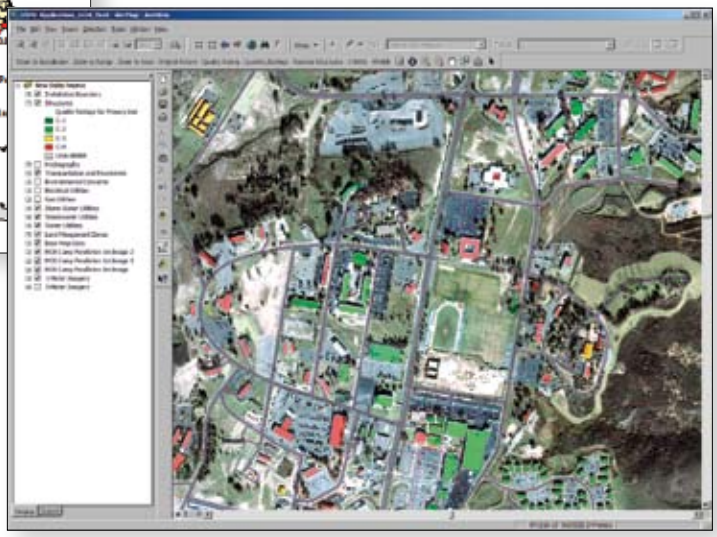
Potential wind energy sites

3D GIS example

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.

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.

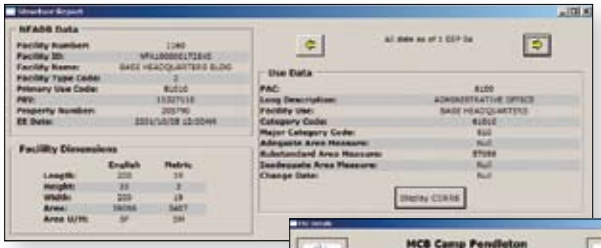
This Marine Corps geospatial data will support the geographic components of multiple decision support systems. This integration will incorporate and empower users—each "owning" their data—which translates to their owning responsibility for the accuracy and currency of the data.

Capabilities

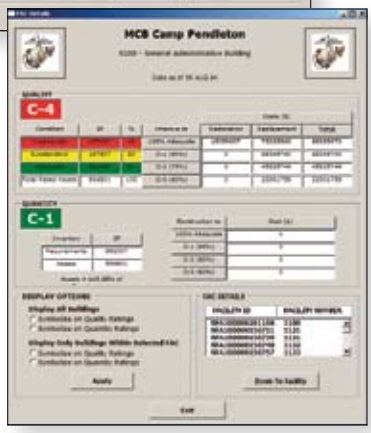
Integration with decision support systems and the ability to provide USMC-wide situational awareness are accomplished via the GEOFidelis Central GIS Repository, which is populated with USMC installation data that is maintained by the installations. The repository is a USMC-wide geodatabase, designed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

USMC foundation layers

USMC bridge study



iNFADS data integration



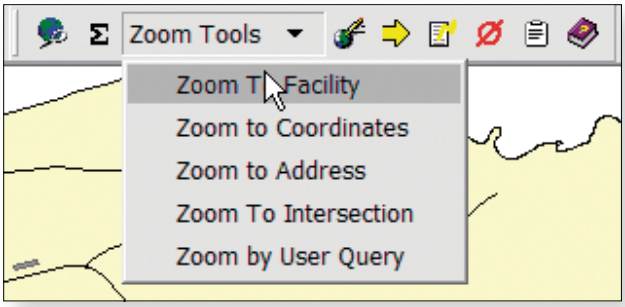
CORRS data integration

Benefits

The GEOFidelis Central GIS Repository was initially designed to support USMCmax, the USMC Enterprise 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.

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

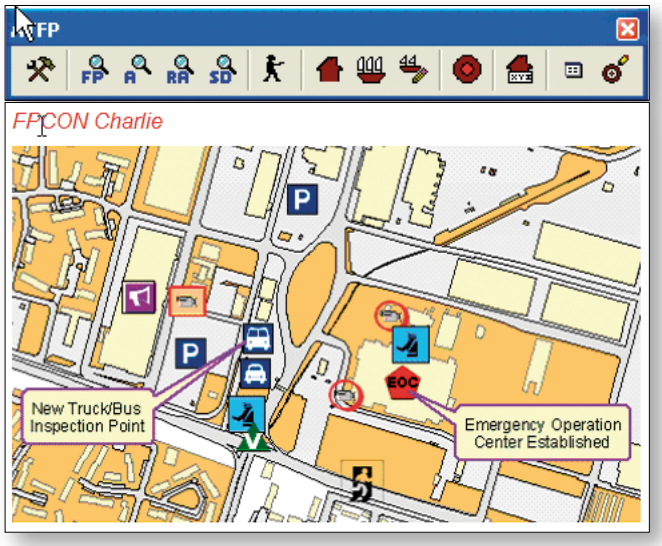
- Define values for various attributes required for different threat levels (e.g., stand-off distances).
- Define assets to be managed for ATFP including buildings, aircraft parking areas, and ships and manage the ATFP attributes associated with each feature.
- Display maps showing ATFP features automatically 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

Overview

USMCmax is the USMC Enterprise 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

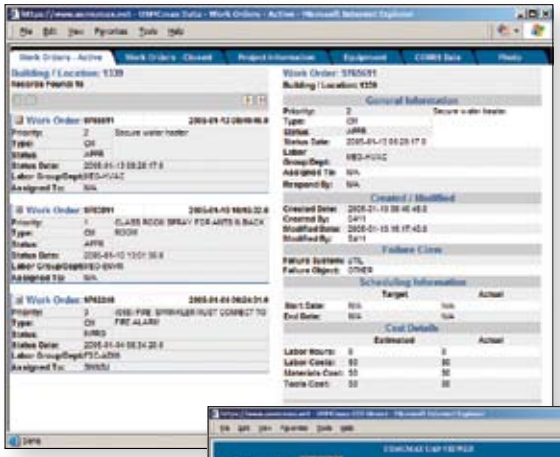
USMCmax enables the Facilities Maintenance and Public Works departments to develop and implement best business practices to support the USMC goal to "use reliable facilities management information to provide, operate, and maintain, in a cost-effective manner, the facilities necessary to support the Fleet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

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

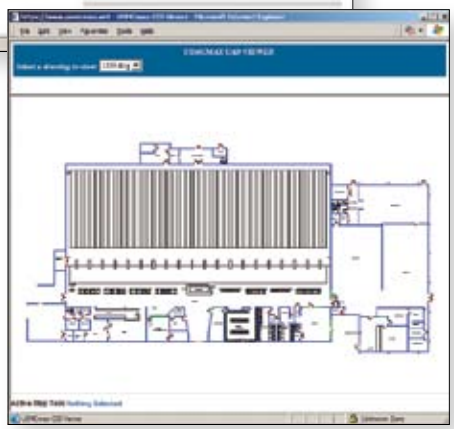
- Creates a single standardized MAXIMO environment for all bases
- Standardizes and upgrades all bases to the MAXIMO 5.x Web-enabled architecture
- Incorporates the public works process into the MAXIMO application
- Provides the capability to integrate with other USMC systems of record
- Reduces cost, 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:

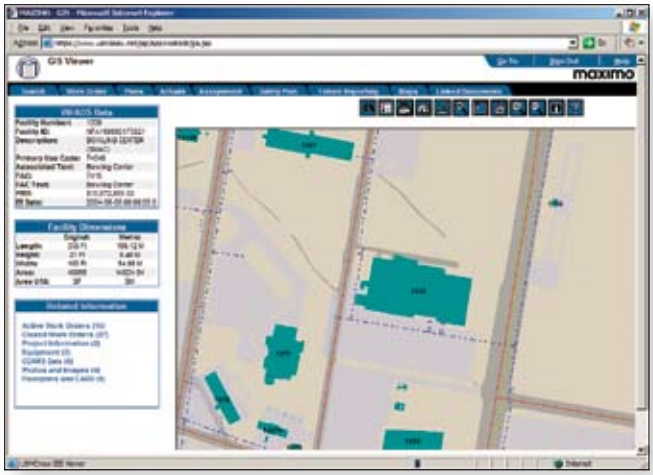
- Maintains MAXIMO thin client when embedding GIS capability
- Linkage for multisite systems/multigeographic locations/ multiple time zones
- Utilizes the GEOFidelis central GIS repository
- Centralized Web-enabled application
- No client software, plug-ins, licenses
- Multiple map services to restrict 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



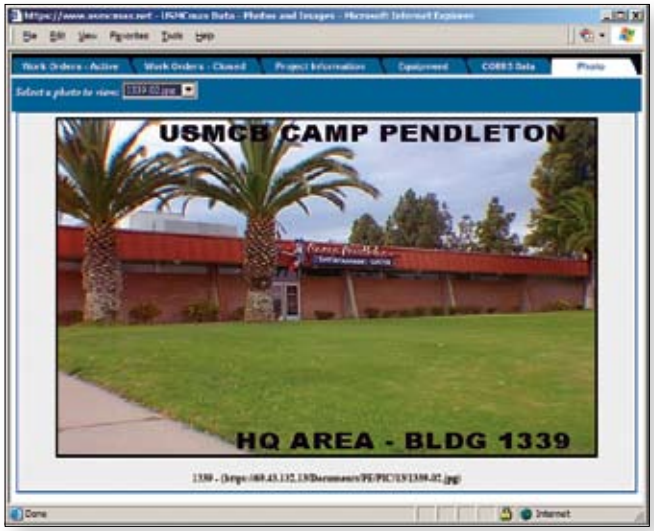
Work order data



Integrated CAD



Selected facility with iNFADS data



Integrated photos and images

Navy 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

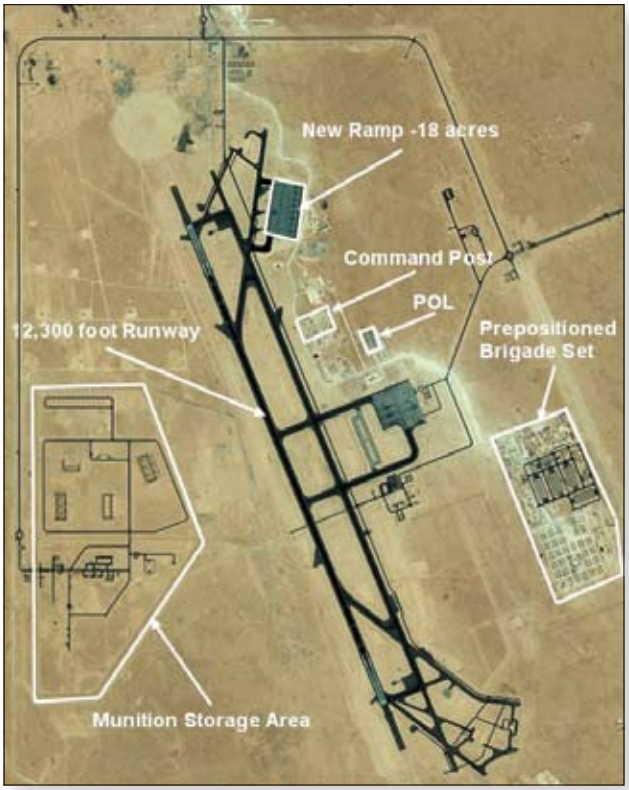
Scaled model of a Nimitz class carrier positioned next to a 3D model of a pier to determine if sufficient space is available to permit the carrier to dock

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.

C/JMTK Enables the GeoReach System

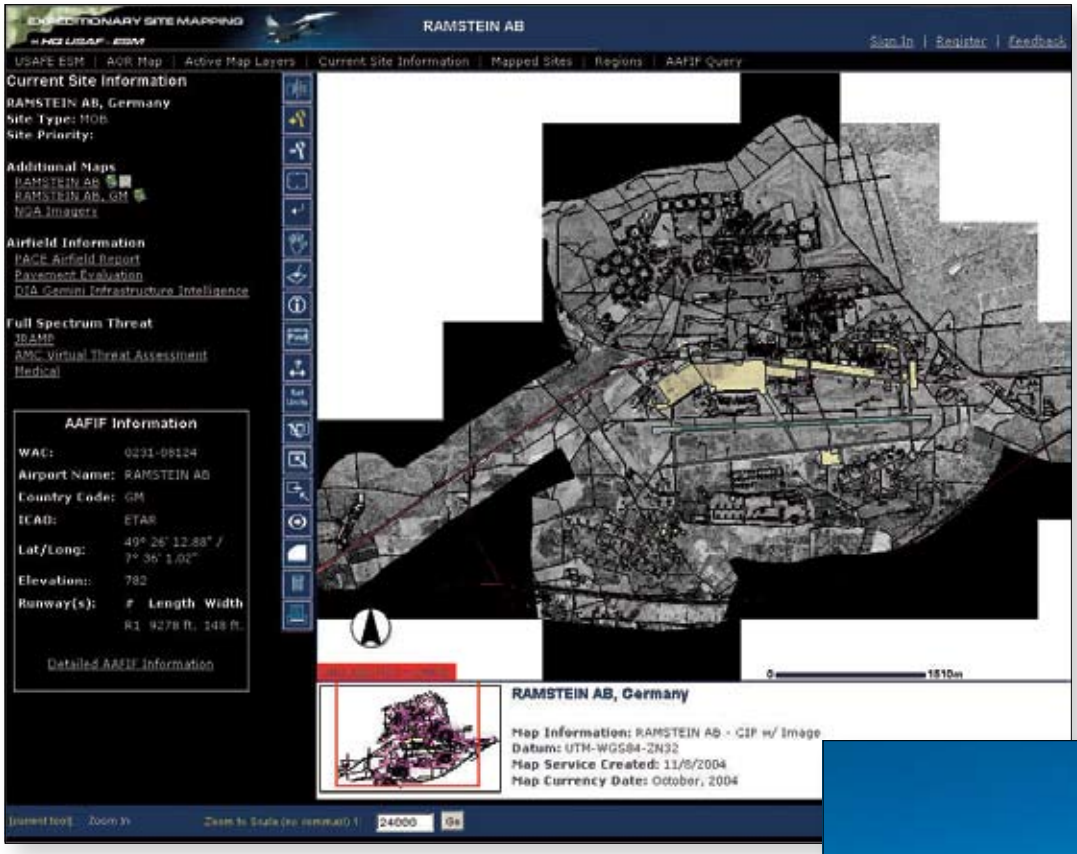


GeoReach (Expeditionary GeoBase)

GeoReach is the name given to the expeditionary site mapping (ESM) capability that involves sharing both classified and unclassified information of potential and actual forward operating locations (FOL). While the intelligence sector has focused on "red force" targets within the battle space, GeoReach fills a key basing niche by allowing airmen with secret access rights to view "blue force" FOL imagery and key infrastructure data. With GeoReach, fewer airmen go forward prior to deployment where they may be exposed to hostile conditions, yet expeditionary site-planning knowledge vastly increases. GeoReach cells within the Combat Air Forces (CAF) Geo Integration Offices (GIO) work with their operational planners to optimize combat support and force deployment.

The GeoReach system is composed of people, processes, doctrine, software, and hardware employing geospatial information to enhance siting and initial bare base bed-down planning activities at FOLs during contingency operations. This system helps shape basing operations through four phases:

- **Locating** the optimal sites for basing through integration with other logistics planning tools
- **Collecting** the most accurate and recent imagery and related data from all available resources and further enriching the site maps through wide use of portable GPS technology by advanced site survey teams
- **Assessing** the imaged sites using planning tools to build aircraft parking, munitions, and other force bed-down plans
- **Enabling** the compiled basing intelligence on the Web via the Secure Internet Protocol Router Network (SIPRNET) to allow this knowledge to be shared with logistics planners, operations, and personnel scheduled for deployment to the site in a netcentric manner



The resulting Common Installation Picture (CIP) serves as the visual rallying point for compiling expeditionary site survey data into a single view.

A cornerstone of this system is integrating C/JMTK segments. This provides interoperability via a common geospatial software development framework for command, control, and intelligence (C2I) mission applications. C/JMTK uses a common services-based software architecture to increase efficiency and improve spatial and analysis capabilities. The use of C/JMTK provides the system format and architecture to manipulate geospatial information that will provide a robust geospatial processing and management capability for joint force operations. As a command and control capability, ESM requires the use of C/JMTK for deployment of mapping applications. Whether aiding in agile combat support or command and control, all USAF organizations are encouraged to consider use of C/JMTK when developing applications and mapping-enabled systems where feasible.

The United States Air Force Geospatial Information System Support Center: Leveraging GeoBase to "Fight the Base"

GIS has traditionally been a static product for data storage with a geospatial component. By integrating dynamic components (real-time AVL, imagery, etc.), the notion of GIS is changing through the addition of time (the fourth dimension). The originally envisioned GIS was never intended to function in this manner, but technology and requirements are marching along and GIS continues to evolve to meet user needs.

The layered development concept of GIS as it evolves from a static map to a collaborative dynamic map that meets the total vision of the Air Force GeoBase program. The end result is the Commanders Geospatial Decision Support System with a variety of user interfaces meeting the needs of a wide-ranging user community.

Background

As the birthplace of the USAF GeoBase program, it is no surprise that the USAF Academy (USAFA) continues to push the envelope of GIS development and vision for the Air Force. Here is an abbreviated historical flashback of USAFA's GeoBase program involvement. In 1998, the Institute for Information Technology Applications (IITA) provided seed funding and supported Lieutenant Colonel Brian Cullis during a research sabbatical to explore the concept of "One Installation, One Map." This resulted in the framework for the GeoBase program as well as the GeoBase Simulator briefing presented during the 2000 CORONA conference. This briefing led to the establishment of the Headquarters Air Force Geo Integration Office (HAF/GIO) with Colonel Cullis at the helm. In 2002, the HAF/GIO received plus-up funding as a result of the 9/11 attacks. In 2003, the IITA hosted the first GeoBase Compass Conference, and in 2004, Colonel Cullis' vision spread across the Department of Defense with the establishment of the Office of the Secretary of Defense (OSD) Defense Installation Spatial Data Infrastructure (DISDI) office with Colonel Cullis leading the charge. On July 7, 2005, the HAF/GIO established the Installation Mapping and Visualization (IM&V) council Geospatial Information System Support Center (GISSC) within IITA.

Mission

The GIS Support Center's primary mission is to develop and field a low-cost system leveraging the Air Force GeoBase investment to enhance real-time situational awareness, decision making, and command and control for day-to-day and crisis response operations to "Fight the Base." In addition to this, the GISSC is also tasked to provide technical support for the IM&V council as tasked through the HAF/GIO.

Capabilities

Geographic information systems were originally intended to combine datasets with a geospatial component to provide a visual context to information. This allowed an immediate sense of understanding for users who could rapidly recognize an area (map) and attribute information to specific locations on the map to better understand how information was interrelated. Traditional GIS does an outstanding job of correlating these items and running queries on these respective datasets. The GISSC is further addressing data organization by recategorizing data into two key areas or data streams—asset data (fixed and slow changing such as installation boundaries, utility lines, and cultural areas) and event data (updated real time such as video feeds and sensors that have a temporal component) and incorporating these two data streams into a traditional GIS such as the Air Force GeoBase program.

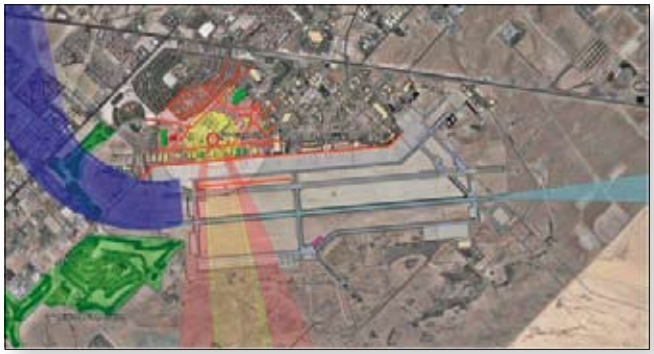
Once the concept of recategorizing data streams is accepted and allowed for in the GeoBase data architecture, the door is open to integrate numerous new capabilities into the GeoBase program. Commercial off-the-shelf tools and capabilities for emergency response and crisis management can be fully integrated into the GeoBase concept of operations. With these items fully integrated into the GeoBase program, a Commanders Geospatial Decision Support System (CGDSS) has been developed. The concept of emergency response tools in GIS is not unique, and several rudimentary systems have been developed with significant downfalls. They have been costly, require excessive training, can't be expanded, haven't fully leveraged available technology, and don't serve the entire installation in an effective manner. A fully integrated system allows for asset and event data streams as well as the push and pull of data to a multitude of users with varying requirements. A wide variety of users will access the system simultaneously from varying locations and publish their actions to the system while collaboratively displaying ongoing actions in response to daily activities or crisis response situations. The new CGDSS has the ability to handle the needs of hard-core analysts (ESRI ArcGIS Desktop) as well as casual users gaining situational awareness (ESRI ArcExplorer™) concerning, for instance, a traffic accident and lane closures on the installation. This is the forecast of where GIS transforms from a static analysis product to a collaborative, dynamic system on every desktop at the installation and effectively serves a much larger audience.

Benefits

Initiated as a civil engineering-centric program, the GeoBase program is the geospatial foundation on which numerous other Air Force communities can be built. For example, the flying community can use GeoBase as a backdrop for approach and departure corridors on airfields and ranges to enhance training. Similarly, the Bird Aircraft Strike Hazard (BASH) information and commercial air traffic corridors could be added to the system to give a three-dimensional understanding of air traffic in a region. This is only one example of the capability that can be built on the GeoBase foundation. Every community on the installation that has a paper map stuck in a drawer can build on the readily available GeoBase foundation. The Air Force has invested hundreds of millions of dollars in geospatial information systems (GeoBase) to include data capture, software and hardware purchases, network investment, manpower, and training. While this investment saved money in the long run by reducing duplication of effort (One Installation, One Map), the payoff has not yet been fully realized. Now is the time to fully leverage the Air Force investment in the GeoBase program and realize the full payoff. GeoBase serves as an excellent foundation for command and control, decision making, and situational awareness. For example, automated vehicle location (AVL) is being integrated in the GeoBase foundation. This may lead to geospatial-enabled, consolidated emergency response (911) dispatch centers and would naturally follow with fully integrated GIS/GeoBase-enabled command posts that can rapidly hand off information and provide the best support available for the commander and Crisis Action Team (CAT) in response to a real-world crisis. It is only natural that, as leaders in the geospatial community, the Air Force would act as an integrator with local and regional communities by making the CIP available to local and state governments so that crisis and disaster response actions can be handled smoothly and interoperable agencies can communicate clearly.

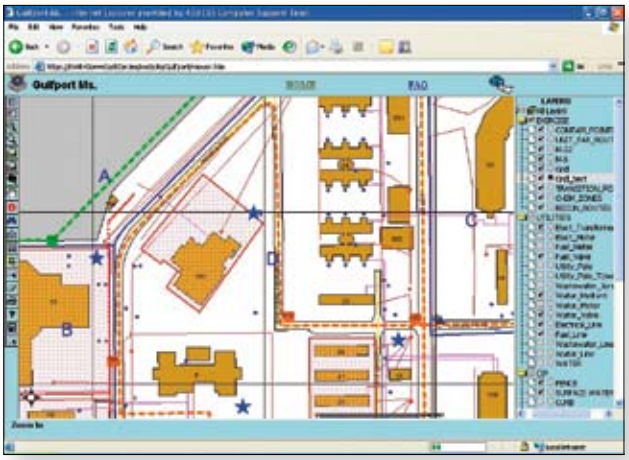
Summary

The Geospatial Information System Support Center is an advocate and technology integrator working toward realizing the total vision of the Air Force GeoBase program. The center is located at USAFA in Colorado, and this unique location allows the center to take advantage of a pool of faculty and cadet researchers interested in GIS technologies and integrate them into the Air Force GeoBase program. Further, the Rocky Mountain Front Range is an excellent GIS technology hub, hosting numerous firms with exceptional GIS and associated technology expertise that is leveraged as contractor support and through Cooperative Research and Development Agreements (CRADAs). Lastly, Colorado Springs is a significant military hub hosting U.S. NORAD/NORTHCOM, Peterson AFB, HQ Space Command, Cheyenne Mountain AFS, Schriever AFB, and USAFA. This provides the center with a proving ground to field newly developed applications for local testing prior to large-scale deployment. This all leads back to the center's primary mission to develop and field a low-cost system leveraging the Air Force GeoBase investment to enhance real-time situational awareness, decision making, and command and control for day-to-day and crisis response operations to "Fight the Base."



National aircraft incident at Nellis AFB, demonstrating approach and departure corridors, plume modeling, traffic control, and building evacuation status

Pope AFB Expeditionary GeoBase Achieves an Air Force "First"

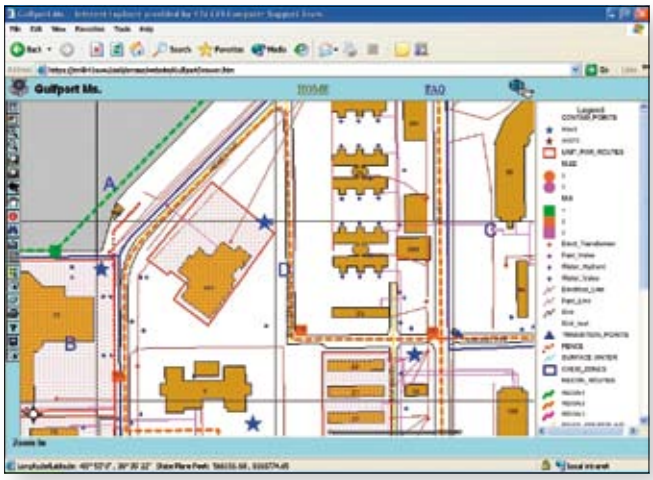


What is Expeditionary GeoBase? Better yet, what is GeoBase? The primary mission of GeoBase within the U.S. Air Force is to enhance command and control by providing one highly integrated high-fidelity installation map in a secure fashion over the base network. GeoBase uses an enterprise GIS as its backbone, allowing Air Force personnel to view and analyze spatially referenced information of the installation infrastructure using easy-to-use point and click tools. The foundation of GeoBase is the Common Installation Picture (CIP), essentially the base layout map provided in a digital environment. Expeditionary GeoBase deals with the use of this innovative concept in deployed contingency environments. It involves sharing both classified and unclassified information of potential and actual forward operating locations (FOL). The CIP again serves as the visual rallying point for compiling all expeditionary site survey data into a single view.

Pope Air Force Base (AFB) was tasked with an Operational Readiness Inspection (ORI) requiring it to deploy to Air National Guard (ANG) Combat Readiness Training Center (CRTC) in Gulfport, Mississippi. An ORI simulates wartime scenarios, ensuring that U.S. Air Force war fighters are properly prepared for today's challenges. Every aspect of a deployment is tested and evaluated, from initial deployment stage to responding to enemy threats or attacks. Situational awareness is paramount during all phases of the ORI or any contingency, for that matter.

Until the Gulfport ORI tasking, the Pope GeoBase office had focused on mapping the main operating base in North Carolina. However, once tasked with the ORI, the engineering career field of the 43rd Civil Engineer Squadron quickly switched gears and treated this as a real-world tasking, thus beginning the GeoReach process. GeoReach provides senior planners and airmen alike with new intelligence, enabling improved FOL selection, time-phased force deployment data (TPFDD) planning, and accelerated bed-down.

The initial phase requires determining what data is available and possibly creating a CIP for the deployed location. During actual deployments, this information is normally available from GeoReach sources, secure data banks of possible forward deployed locations, maintained by three major commands within the Air Force. However, because this deployed location was the CRTC in Gulfport, Mississippi, information was not readily available. There were several roadblocks encountered during the information-gathering stage, but each roadblock was quickly turned into just a detour. The journey ended with a working partnership between Pope AFB and the ANG HQ GeoBase office. The ANG Southeast Regional GeoBase coordinator, Charlene Rice, provided good points of contact



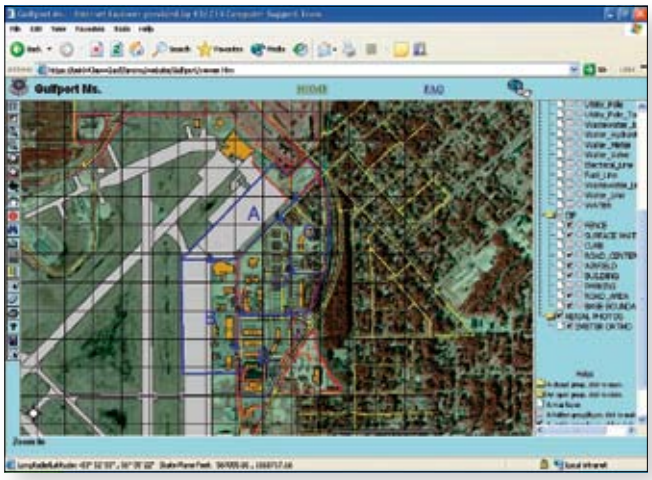
and aided in acquiring aerial photography, site drawings, and other technical assistance. With these documents in hand, the Pope GeoBase office, under the direction of SSgt. Dayne Lewis, began building the CIP for Gulfport and creating ArcIMS services for the contingency site.

During the development of Gulfport CRTC CIP, the Pope GeoBase office exchanged spatial data with other Air Mobility Command (AMC) bases planning exercises at the same location. This allowed these other bases to improve their mapping and situational awareness capabilities. Moreover, it provided Pope with firsthand feedback on required changes to the data. SSgt. Lewis, along with Rice, led a site mapping team to validate existing information and acquire missing infrastructure data. Through the partnership between Pope AFB and the ANG Southeast Regional GeoBase office with inputs from Scott AFB and McConnell AFB engineers, a completely Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE)-compliant CIP was produced. This landmark achievement has been lauded, and the procedure is now being replicated at other locations (e.g., Savannah CRTC). This completed Gulfport CRTC CIP has been turned over to the ANG and will be the first nonactive duty colocated ANG installation and first CRTC to have a completed GeoBase CIP. Rice stated, "This exceeded the projected Gulfport CIP delivery date by more than one year." This is the first CIP ever created entirely by Air Force personnel for a stateside installation; all others have been provided through contract support. The savings to the Air Force are estimated to be $143,000.

Through the efforts of all involved, Pope AFB leadership gained the ability to effectively plan and execute all contingency events through one site picture. Along with CIP development, Mission Data Sets (MDS) were created specific to the contingency environment. A set of related spatial features, such as utility systems, aircraft parking plans, and force protection zones, displayed on top of the CIP is called an MDS. All base units were able to access the ArcIMS site prior to deployment and use one mapping service to plan all bed-down operations. The 43rd Maintenance group commander stated, "This is by far the best heads-up mapping effort I have ever seen for any deployment." Once deployed, GeoBase was used to provide accurate, real-time awareness to the battle staff leadership and other control centers, enabling split-second decision-making capabilities.

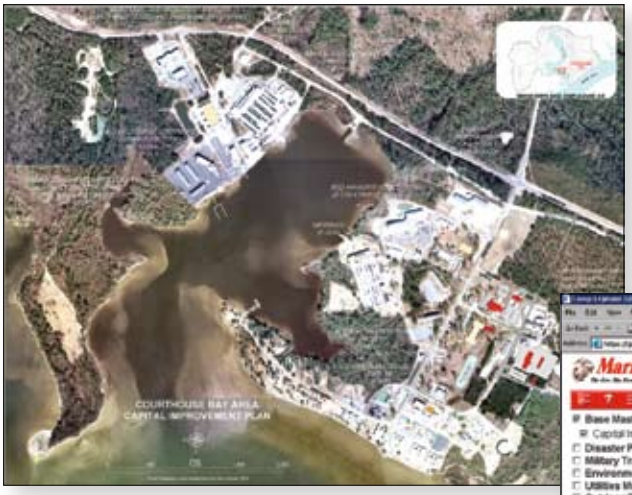
The GeoBase partnering success between Pope and the ANG Southeast Regional GeoBase office goes far beyond just the CIP deliverable and an excellent ORI rating. It turned out to be a win-win situation for all involved, already paying huge dividends in many other ways. The Pope AFB engineering career field gained invaluable contingency mapping experience. Through lessons learned during this experience, a number of recommended changes to the Air Force Expeditionary Site Mapping Concept of Operations (CONOPS) have been made. A consortium of training resources between the Southeast ANG Regional GeoBase Office and Pope AFB engineering personnel is being actively pursued. Guard engineering personnel now have points of contact with their active duty counterparts to aid in the problem-solving process. Moreover, other bases within AMC and other commands are now modeling the Pope Gulfport GeoBase experience to train active duty engineering personnel while providing the ANG with an end product.

This was all accomplished simply because the 43rd Civil Engineering GeoBase shop took a contingency exercise opportunity and treated it like a real-world event—once again proving that the best way to succeed is through good partnerships.



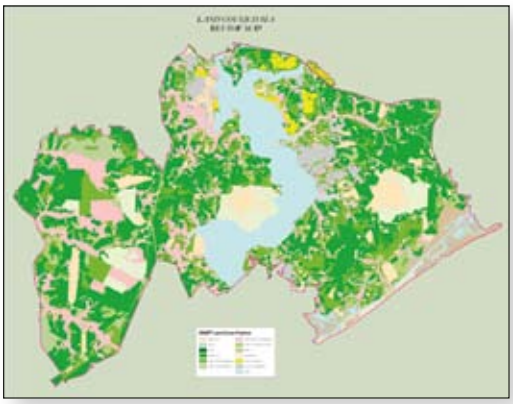
Facilities Management and Planning

GIS is used extensively in support of facilities management and planning activities at Camp Lejeune Marine Corps Base. By combining data and imagery from the GIS database with other databases such as the Naval Facilities Assets Database (NFADB), several maps and derived data can be produced to visualize information leading to better decisions and a more dynamic master planning process.



Site Planning Using GIS Data Layers and Aerial Imagery

GIS data layers represent future project areas in a Web-based mapping session.

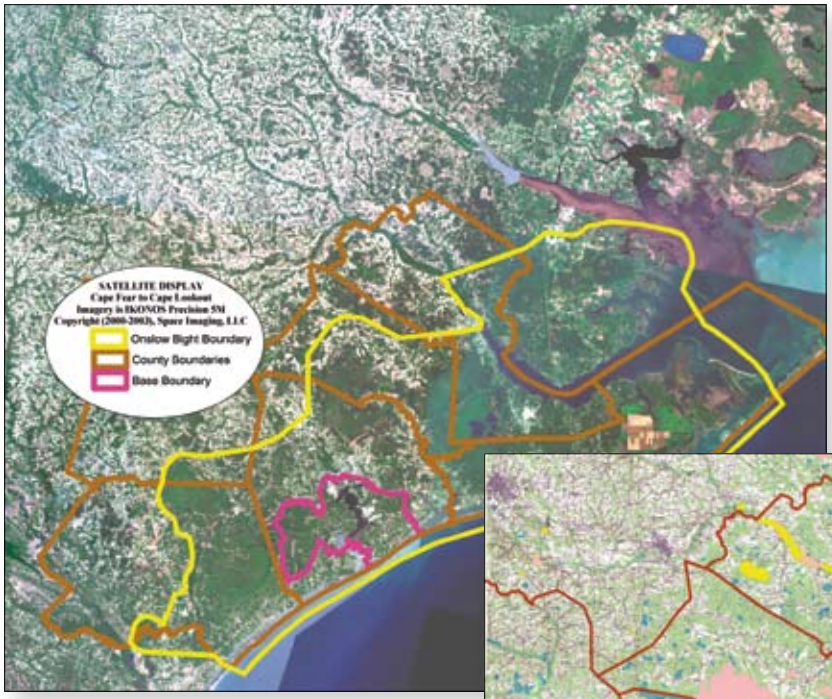


GIS structure data, rendered with NFADB color codes, allows the user to update land-use data.

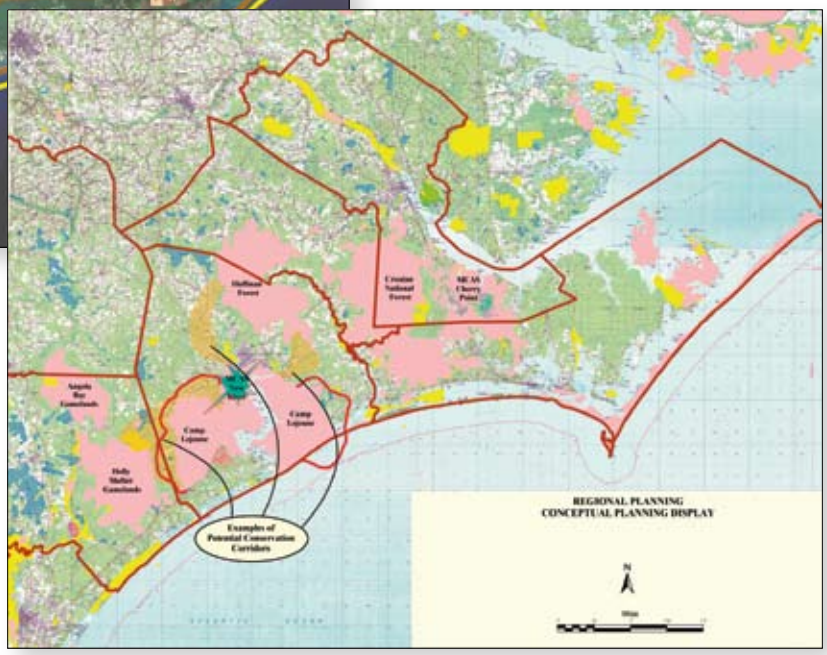
Updated Land Cover Theme Created from Timber Stands, Wetlands, Streams, Soils, and Imagery Data Layers

GIS data is color coded by major command occupant to display the geographic spread of facilities utilization.

Regional Planning



Satellite Display of the MCB Camp Lejeune Region (figure 1)

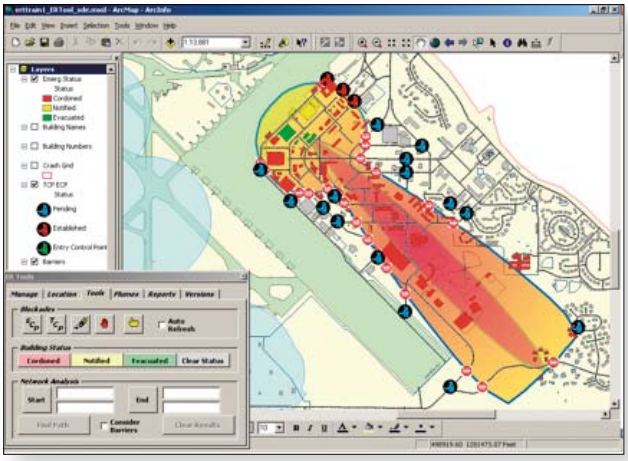


Regional Planning Analysis (figure 2)

To ensure the continued success of Camp Lejeune's training mission, it is necessary to look beyond the Installation boundary and recognize the challenges posed by its surroundings. GIS has proven to be an ideal platform to view and analyze data from many different sources to visualize the surrounding area and subsequently generate meaningful information. In these examples (figure 1 and figure 2), data was combined from state, county, and nongovernmental databases along with Camp Lejeune's extensive GIS database to provide a visual information display in support of regional planning initiatives.

MacDill Builds on the Initial Efforts by PACAF and ESRI with Emergency Response Tools

MacDill Air Force Base GeoBase and Readiness Team Up to Save Lives and Property



Overview

At MacDill Air Force Base, the incident management process is one of the most critical responsibilities for the base Civil Engineering Squadron's (CES) Readiness Flight. Before 2005, most incident management procedures at MacDill were accomplished using outdated wall maps with transparent grease pencil overlays. The business process was prone to miscommunication and spatial location errors and was a slow manual process.

In 2003, the installation GeoBase Program began implementing the Air Force's standards-based CIP, creating the foundational architecture and data required to implement the GeoBase standard of "One Base, One Map." This provided the foundation to build the incident response Mission Data Set (MDS) and the Emergency Response Tool (ERT) application. These milestones allowed the incident management process to benefit from geospatial technology.

MacDill built on previous joint efforts to create ERT-style capabilities. The initial ERT efforts by PACAF and ESRI, along with subsequent efforts by ESRI under contract to the Air Force Center for Environmental Excellence and Air Education and Training Command, resulted in an ArcGIS extension that is simple, powerful, yet easy to use with minimal training. That extension is now known in the Air Force community as the Emergency Response Tool.

By early 2004, a strong partnership had been formed between the Geo Integration Office (GIO) and CE Readiness functions at MacDill AFB. Readiness personnel were quick to recognize the value of the GeoBase architecture and the CIP. The Geo Integration Office quickly recognized the value of sharing information with Readiness. A key element of the GeoBase program in the Air Force is support by contractors that are experts in the GIS industry. An early benefit of the contractor support was a regularly scheduled Science Applications International Corporation (SAIC) teleconference in which MacDill learned about the preexisting ERT. A call to ESRI rapidly got the ball rolling with locating a copy of the tool and additional pertinent information.

Within three weeks, the MacDill GeoBase office and Readiness teamed up to field a demonstration of a solution that met most of the requirements for an incident management tool for the Readiness Flight. The return on investment (ROI) was actualized by reusing existing code the Air Force already owned. The early results showed that a rapid prototype, low-cost solution was attainable. The resulting excitement energized the Readiness community. Working together, Civil Engineering Squadron/ GIO and CES Readiness defined additional requirements and addressed enhancements to the prototype that would be required. Readiness Flight personnel pursued support from the base commanders to find the resources to migrate the existing manual process to a digital process using the ERT.

The Readiness and GIO partnership along with strong support from wing leadership was the key to success. The shared vision was to improve communication, enhance the emergency response capability, and bring GIS technology and incident management together to automate key portions of the process. The guiding principle was to achieve these capabilities by capitalizing on the Air Force's investment in GIS technologies.

Key Roles

The Readiness function clearly identified the incident management business process and served as the facilitator between the technology implementers (GeoBase) and the end users (Fire and Security Forces).

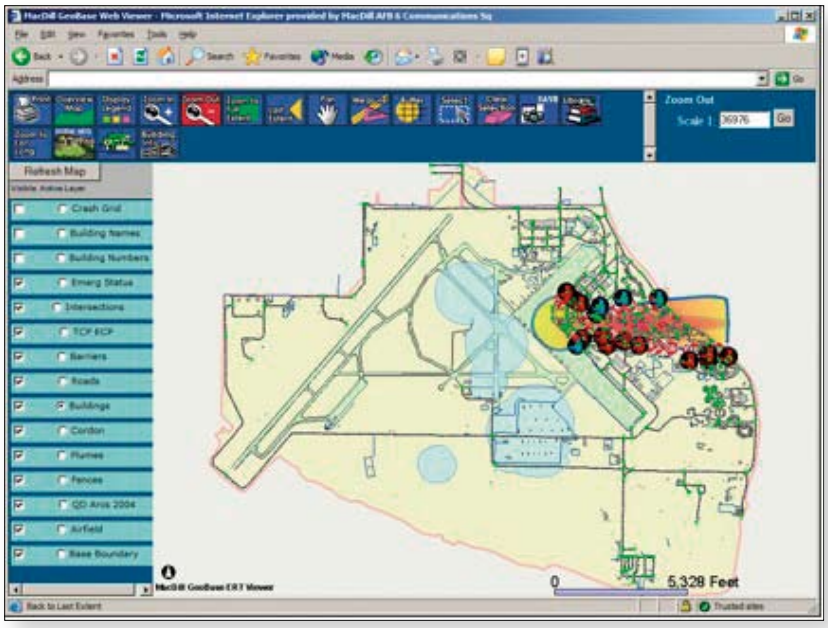
The GeoBase function created and demonstrated GIS capabilities and shared technical knowledge with Security Forces, Fire, and Readiness, resulting in a good understanding of what is possible.

Results

MacDill emergency responders are now using the ERT that is revolutionizing the way information is managed and accessed during an incident. The incident location, cordon, plume models, and entry control point are created and managed by the Fire troops, while the traffic control points and the building evacuation status are managed by Security Forces. Management by both functional areas is simultaneous and capitalizes on the multiuser incident management editing capabilities of a centralized ESRI ArcSDE database.

Situational awareness has reached an unprecedented level by utilizing ESRI's ArcIMS Web mapping services to project the incident and related emergency information on the MacDill local area network via a Web browser live to the command and control (C2) and emergency services personnel. Future plans allow some of the incident information to be made available to general base populace, facilitating rapid notification and response, resulting in a smarter and more timely response to potentially dangerous situations. C2 staff are now able to see incident information in a regional mapping environment faster than ever.

The Web browser allows personnel to overlay or link to other databases, providing an improved situational awareness and access to related information at the click of a button. For example, the installation commander can easily access the facility manager contact information when he or she clicks on a building that is affected by the incident. C2 realizes that the Web-based C2 viewer is powerful because it brings essential information into a unified picture. This allows decision makers to see more options and possible solutions when managing a crisis. The ERT and associated Web-based mapping viewers help focus limited resources to the areas of highest priority and still help personnel not lose the big picture as to how to best use resources to maximize impact during a response.



Conclusion

The improved response time, communication, and state-of-the-art mapping display are helping MacDill prepare for and respond to emergency-related incidents. Improved response is allowing MacDill to protect responders and property and save lives while preserving its ability to carry out its mission.

Langley AFB Deploys Flood-Mapping Tool to Prepare for Ophelia

LAFB Flooded from Hurricane Isabel, September 18, 2003

Staff Members Jennifer Anderson and Jermaine Smith in Map Production Using ArcGIS

Patricia McSherry

On September 14–15, 2005, tropical storm Ophelia buffeted Langley Air Force Base with heavy winds and rain and the threat of flooding that comes with each hurricane season. Prior to the storm, some were reminded of Hurricane Isabel, which came ashore almost two years prior to the day, but this time, Langley had a new weapon in its emergency response and preparedness arsenal.

Isabel was a major hurricane of the 2003 Atlantic hurricane season that made landfall on September 18, 2003, just south of Cape Hatteras. While still over the Atlantic, Isabel's winds peaked at 160 miles per hour, classifying it as a deadly category 5 storm. Clouds associated with Isabel covered an area of 275,000 square miles, roughly the size of Texas.

Hurricane Isabel cut a devastating path across the North Carolina Outer Banks islands, Virginia, and Maryland, leaving behind a wake of destruction. Langley Air Force Base also experienced significant damage from the wind and storm surge.

Armed with lessons learned from the planning for and response to Hurricane Isabel, Langley Geo Integration Office (GIO) chief Patricia McSherry set out to develop a tool that would allow the base to better predict the effects of flooding from storm surges and other occurrences so that emergency preparations could be focused on those areas most vulnerable in any given flooding event. McSherry also recognized that with so many Air Combat Command (ACC) bases located in hurricane-prone areas, Langley AFB would not be the only ACC base that could potentially benefit from this kind of planning and response flood-mapping tool.

To build this FloodTool and provide other support to the GIO, McSherry contracted with Penobscot Bay Media, a Maine-based, service-disabled, veteran-owned small business that specializes in GIS technology and applications, geospatial information security, support services, and training. Penobscot Bay Media worked closely with GIO staff to build and deploy the FloodTool in time for the 2005 flood season, and Ophelia was the first to put it to the test.

The FloodTool is a Web-deployed geospatial application that enables users to dynamically create flood modeling scenarios and provide real-time access to distributed emergency response teams, facilities managers, and command personnel. These scenarios provide accurate, detailed maps of flooded or potentially flooded areas and identify facilities that are affected and/or vulnerable within each event model.

On September 13, Ophelia changed course again and was upgraded to hurricane strength. Within minutes of the hurricane condition declaration, there were the usual requests for maps from base personnel trying to assess the predicted effects of the storm and determine where to deploy various protective barriers. In the past, the best the GIO could provide was a printed flood contour map, which could do little more than show rough approximations of predicted flooding using two-foot intervals in ground elevation. While useful, these maps could not provide enough detail to support accurate flood modeling or reliable event planning for the deployment of barriers or evacuation.

With the FloodTool up and running, the GIO had a new type of map, delivered over the LAFB intranet, that emergency personnel and others could use for visualizing the flood conditions in real time and even predicting within inches the extent to which flood waters might go as the storm progressed. Additionally, these personnel could see at a glance the current or predicted threat condition of each and every facility on base in real time from any computer on the network.

As the day progressed, the requests for maps became more numerous and specific. The Hurricane Operation Center called with a request for a set of large maps depicting 10 different flooding scenarios. Battle Staff meeting attendees needed up-to-date prediction maps and reports for their critical decision processes. Various base management personnel requested more than 100 large-format maps of flood scenarios. Traffic at the GIO was extreme with people constantly rushing in and out through the front door to the office where a large chart was posted to keep track of the many incoming map requests. The GIO staff members were operating at their workstations, coordinating scenario map production and updating the flood event views via the Web application. The printer queues were getting longer and longer, and maps now covered every available space. The laminating machine was abandoned except for essential all-weather requests. This was typical of other hurricane events as the crush of map requests resulted in waits of two to three hours or more between request and delivery. But this day would be different from others in the past: The FloodTool was introduced to attendees of the Battle Staff meeting, and the impact was felt immediately.

As building managers moved to secure their buildings, they were able to get real-time information on the event and how it affected their building. The FloodTool interface allowed these personnel to scan a map of Langley AFB for their area of concern or search for a specific building number and magnify the view to see a map image of their building and surrounding area in relation to the flood waters. They could also print out a report of affected buildings with a map image. In record time, sandbags appeared in front of vulnerable building doors, equipment and personnel were prepared for evacuation, and base managers and commanders had a common information picture of the entire installation.

During the Ophelia preparedness event, the FloodTool

- Addressed ever-changing storm predictions by modeling 10 different scenarios
- Displayed a separate real-time event for most current condition predictions
- Interoperated with GIO's GeoBase GIS to allow for automated, up-to-the-minute map production of varying sizes
- Created an environment for real-time flood modeling, cutting out the usual lag time associated with the map request > map creation > map printing > map delivery process
- Provided a color-coded, graphic threat-assessment view of all facilities along with a call-list-status function indicating the building contact information, contact status, and contact confirmation status

By Wednesday morning, the FloodTool was already having a positive impact by reducing the number of emergency printed map requests coming in to GIO. GIO staff instead focused on creating new flood scenarios they shared instantly with everyone using the FloodTool. Within a few hours of a basewide BSD containing the intranet address for the FloodTool, nearly 3,500 base personnel had accessed the service online.

In the end, Ophelia did not deliver on her threat of flooding at Langley AFB, but she did provide a great test for Langley AFB hurricane preparedness including the GIO staff, personnel from Penobscot Bay Media, and the FloodTool itself. It was a test they all passed with flying colors.

Sr. Airman Valter Goncalvez Updating Map Symbology with FloodTool Event Views

Air National Guard: England Air Park and Hurricane Katrina

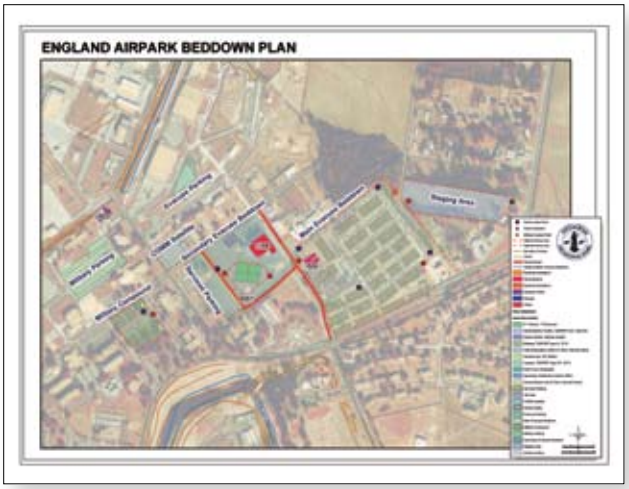


Figure 1

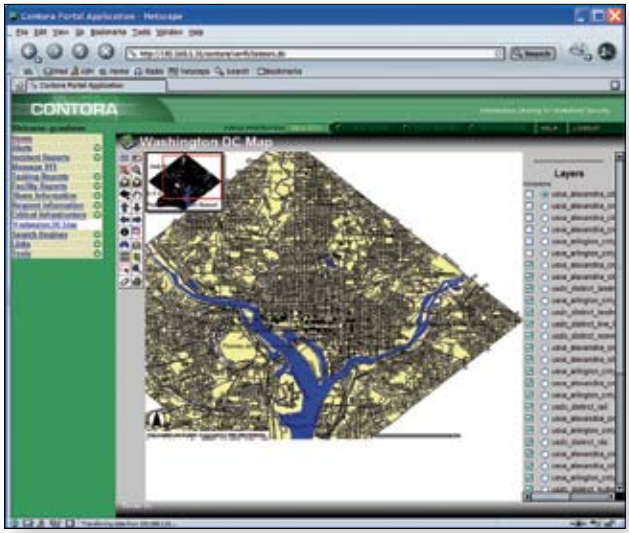
In response to the Hurricane Katrina aftermath, the Air National Guard Readiness Center's (ANGRC) Crisis Action Team (CAT) and the Air National Guard GeoBase program office were tasked to support disaster assessment and relief operations along the U.S. Gulf Coast. One specific task that relied heavily on GIS technology was the bed-down planning for 4,500 evacuees and a military contingent of 500 at England Air Park in Alexandria, Louisiana. The GeoBase application GeoBEST (Base Engineering Survey Toolkit) was utilized to help automate the planning process. This tool provides users with the ability to view the spatial extent of the selected location and match the required deployable resources in a spatial configuration conforming to established siting standards.

Bed-down planning officers from the 179th Civil Engineering Squadron, Mansfield, Ohio, had physically conducted the initial site survey, so they had concise awareness of existing infrastructure including the availability of sanitary sewer, wastewater, commercial power, gas, fuel, abundant parking, staging area availability, and existing hard facilities as well as proximity to essential community services such as fire departments, medical facilities, and schools. The locations of existing utilities were confirmed through the use of georeferenced CAD maps obtained from the England Air Park Authority that were included in the planning process. The planning team's next step involved using GeoBEST to identify and visualize these existing resources within the extent of the airfield site image. Additionally, the planning officers identified critical features such as entry control points as well as existing and planned fences.

Planning for an evacuee bed-down camp rather than a military force proved to be atypical for multiple reasons. Services such as HAZMAT, portable sanitation, and solid waste would be contracted rather than serviced by USAF assets. Additionally, essential materials for bed-down operations would be required beyond standard USAF assets. Based on existing constraints, the bed-down team finalized the tent city layout plan as shown in figure 1.

Although the bed-down plan did not conclude in the actual ANG development of a tent city for Hurricane Katrina evacuees, the bed-down planning process would have been significantly delayed without the use of GeoBEST and GeoBase-provided imagery. GeoBEST enabled bed-down planners to quickly lay out required asset quantities that conform to USAF siting standards and rapidly make changes to the layout based on area constraints. Additionally, ANG GeoBase personnel learned valuable lessons regarding disaster preparedness and response operations. This will help users execute expeditionary site mapping sequenced actions (locate, collect, assess/map, and enable) and address CONUS natural disasters in the future.

U.S. Army: Prepare, Respond, Inform, Secure, Monitor Program (PRISM)



Overview of PRISM Program and GIS Use

Prepare, Respond, Inform, Secure, Monitor (PRISM) is an information sharing and command and control backbone that can tie together the emergency response actions of federal (DHS and DoD), state, and local governments. PRISM provides command and control capabilities needed to visualize the situation via an ArcIMS software-enabled mapping interface, direct the response, and collaborate among affected/responding parties. The PRISM application provides access to alerting, incident report tracking, tasking and facilities reporting, and request for information tools. It also enables collaboration through information sharing and provides the ability to search for and locate relevant information while responding to an event. Integration with sensor systems, reverse 911 messaging, and vehicle tracking systems has been completed and is optionally available.

The PRISM software serves as a front-end user interface for the emergency response/crisis management community. Integration with GIS products from ESRI has enabled PRISM to provide a single display in which the user is able to quickly visualize the situation at hand and drill down into the map to learn more about the events that have taken place. The power behind the system that distinguishes PRISM from other command and control capabilities in this market space is its integration with Solers' Transsend™ Enterprise Messaging Service product. Using Transsend, PRISM is able to share information gathered and displayed at one PRISM server with other servers on the network that share responsibility for the same geographic area of interest. Thus, information that is gathered at one PRISM server is automatically and immediately sent to other PRISM servers and displayed on their mapping interface.

Agency: U.S. Army Ft. Gordon Battle Command Battle Lab (BCBL(G))

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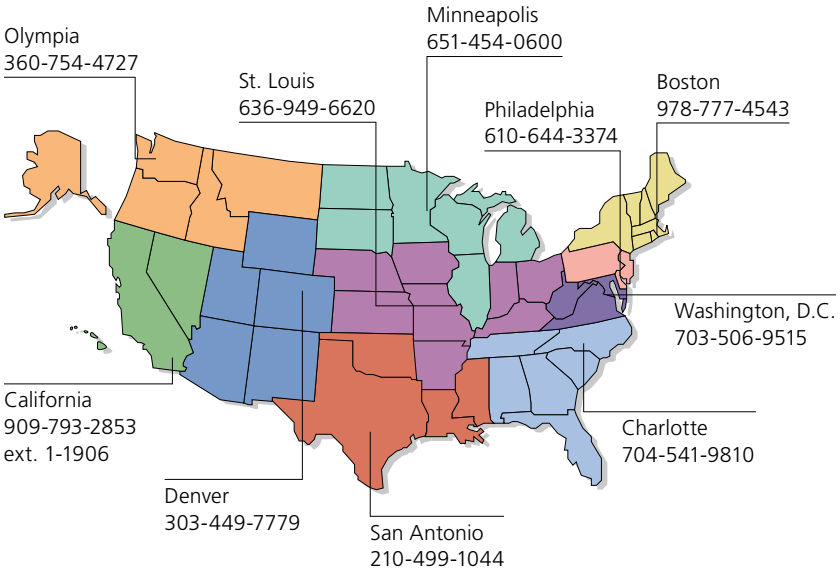

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