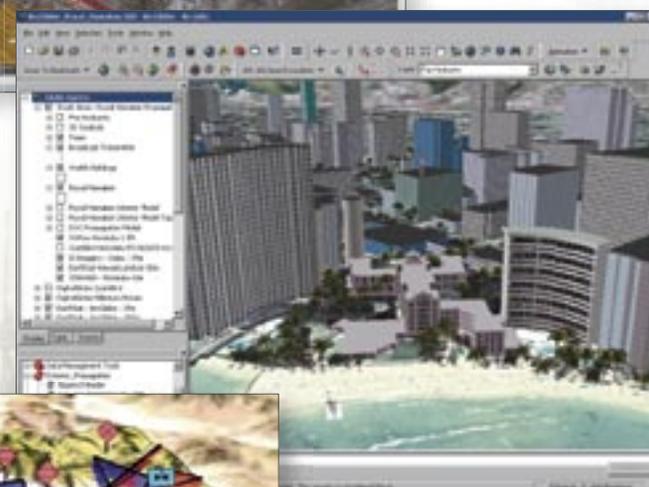
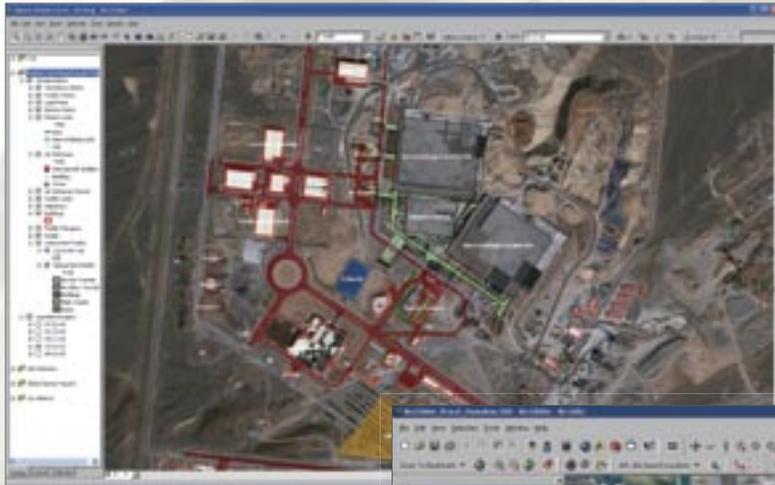


# GIS for Defense and Intelligence



# Introduction

*Since 1969, ESRI has been helping people solve real-world geographic problems in a wide range of domains. For the last 15 years, ESRI's software has been used in the most demanding of domains—the defense and intelligence community. Today, the ArcGIS platform is helping users in every service, throughout most defense domains, and in many nations around the world.*

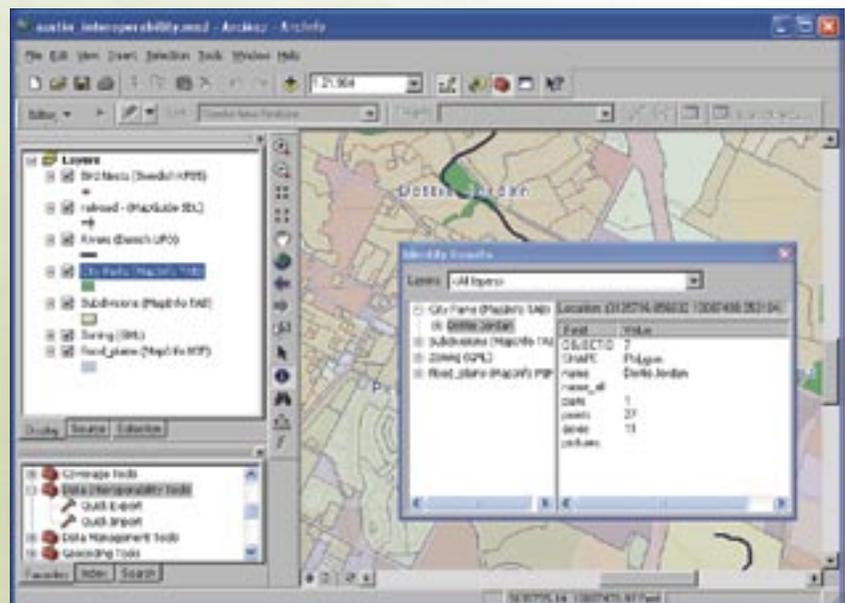
ESRI is the largest supplier of geographic information system (GIS) technology to the defense and intelligence communities worldwide. GIS technology is rapidly moving from its historic niche usage within defense to becoming a critical defensewide infrastructure. The assessment is based on the fact that defense operations of all kinds depend on a sound understanding of terrain or geography. This involves more than an understanding of location—geography is a science that creates a framework for understanding the relationships between all entities in an area of interest. This, in turn, fosters the development of spatial knowledge from the flood of data.

Defensewide spatial infrastructures break down the stovepipes that divided systems in the past to provide a common framework for handling spatial information across all defense systems. This is important because the government avoids having to pay repeatedly for developing the same core functions for each system. It also ensures that the defense user receives the latest capabilities from the commercial off-the-shelf software community where IT innovation occurs. The creation of a spatial infrastructure also leads to the sharing of data and applications throughout the networked environment.

GIS is now widely used throughout the warfighter, business, and strategic intelligence domains. It is important to understand that the ArcGIS® platform ensures that each domain is served from a common, open, and interoperable technology platform. This common infrastructure is critical in today's security climate where war fighting, national security, and force protection must interlock seamlessly.

## Capabilities that use GIS

- Command and control
- Defense mapping organizations
- Base operations and facility management
- Force protection and security
- Environmental security and resource management
- Health and hygiene
- Intelligence, surveillance, and reconnaissance systems
- Logistics
- Military engineering
- Mine clearance and mapping
- Mission planning
- Peacekeeping operations
- Modeling, simulation, and training
- Terrain analysis
- Visualization



Directly use data in many formats within the ArcGIS Desktop environment.

# Enterprise GIS Concepts for Defense and Intelligence Organizations

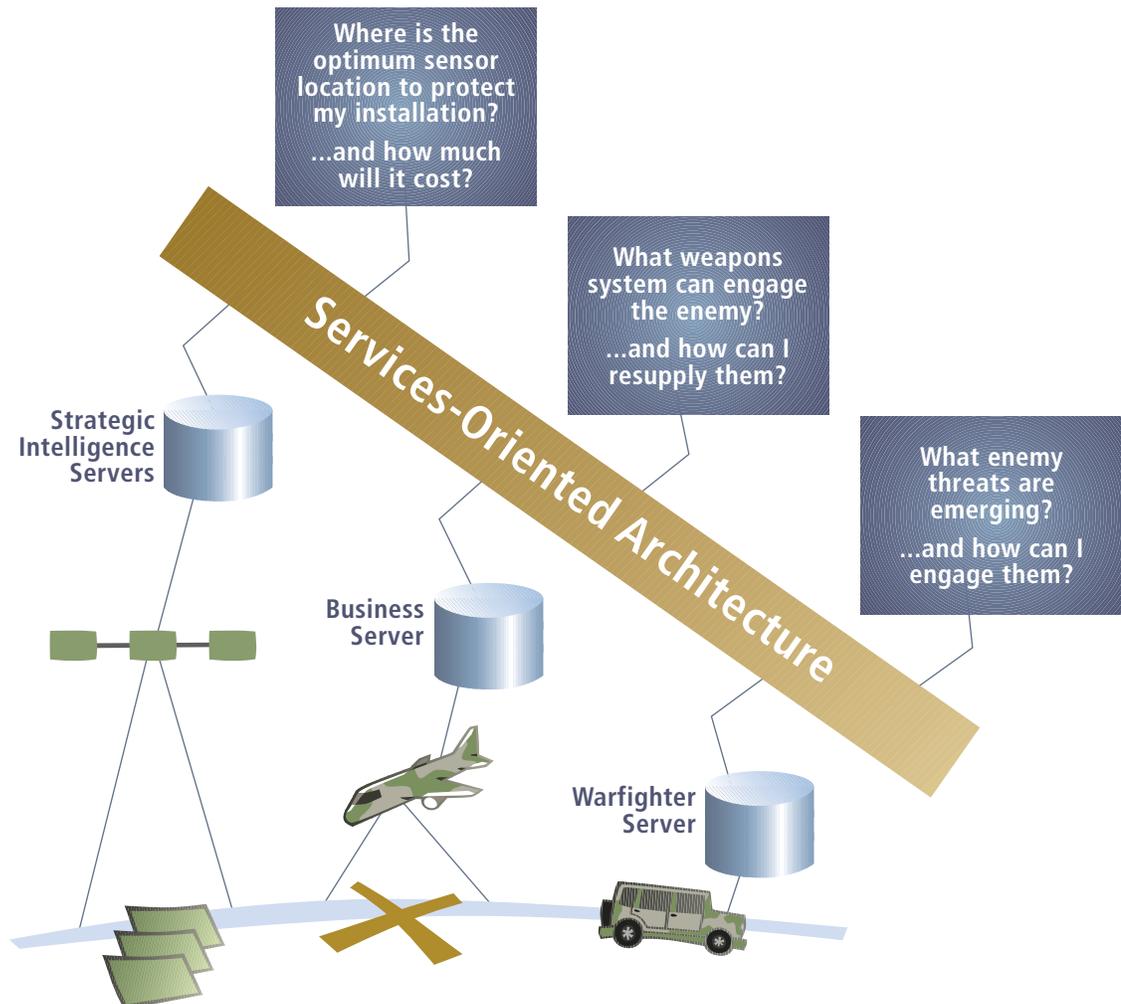
The ArcGIS platform is an enterprise information technology infrastructure. As such, it provides a horizontal, crosscutting technology that is very different from GIS technology's past niche usage.

This aligns well with the concepts of Network-Centric Operations (NCO)—the use of the network to connect decision making across multiple defense domains and beyond. Therefore, NCO is about far more than war fighting; it connects war fighting to strategic intelligence to installation management. It also goes beyond traditional defense and intelligence domains since it seamlessly integrates homeland defense and other internal security activities.

The horizontal nature of NCO demands a move to a modern, services-oriented architecture that provides transparent interoperability between domains. This blurring of domains is powerful but can also be confusing—discrete capabilities are still needed, but each capability is supported by a common information and tool infrastructure.

A key part of a defensewide infrastructure is the spatial information and spatial tools—the enterprise GIS. As a defensewide infrastructure, ArcGIS is simultaneously able to support war fighting missions such as command and control, business missions such as installation management, and strategic intelligence missions such as spatial data production. Given the enormous expense of spatial data production, this re-use across a common spatial information infrastructure offers immediate cost savings in addition to important new capabilities.

An enterprise infrastructure for NCO cannot be built on old technology platforms with interoperability and openness added on as afterthoughts. Interoperability has to be engineered into the core of an enterprise IT platform and from the fundamentally open perspective of a cross-platform, multi-DBMS, multiarchitecture information system.



# Domains

*This brochure will examine GIS usage in the defense and intelligence communities in three sections: Military Operations, Geospatial Intelligence, and Installations and Environment. This is not an all-encompassing definition, since other domains using GIS are often discussed outside this taxonomy such as defense health care, modeling and simulation, and logistics, to name a few. The three sections best represent the warfighter's, base operation's, and intelligence community's use of GIS.*

## Military Operations

ESRI's distributed architecture allows for multi-intelligence fusion. ESRI solutions are for thick clients, Web browsers, and mobile computing devices, together serving NCO solutions. GIS technology is critical to netcentricity for sharing, processing, modeling, analyzing, and visualizing geospatial information and metadata across defense networks and subnetworks. ESRI software is used to perform many tasks, such as intelligence preparation of the battlefield, terrain analysis, mission planning, and other defense-related analyses, using the same geospatial data stored in a network-accessible geodatabase.

## Geospatial Intelligence

Geospatial intelligence (GEOINT) represents the complete integration of a nation's imagery and geospatial capabilities in support of defense and intelligence needs. As such, it marks the latest phase of a long process of drawing together previously separated domains such as map production and imagery intelligence, where GIS has long been a critical infrastructure.

ArcGIS plays a prominent role in the emerging discipline of GEOINT. By enabling efficient management of geospatial data, the fusion of geospatial and intelligence data, and sophisticated analysis and visualization, ArcGIS supports better and faster decision making in a wide variety of national security mission applications.

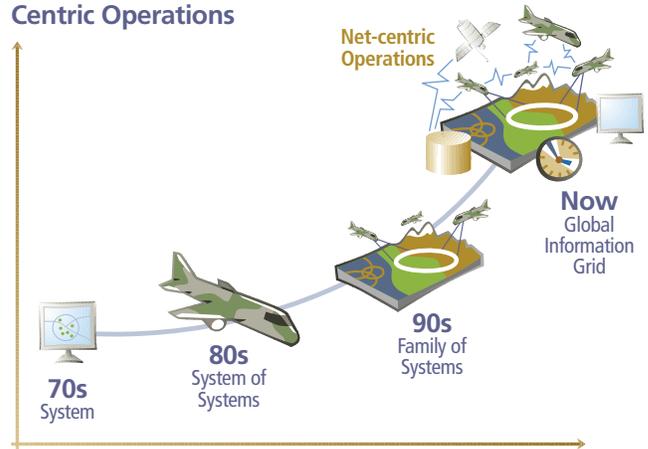
## Installations and Environment

Defense is a major business operation that manages a broad range of activities. As in any other business, GIS plays a role in such diverse activities as logistics, resource planning, and utility management.

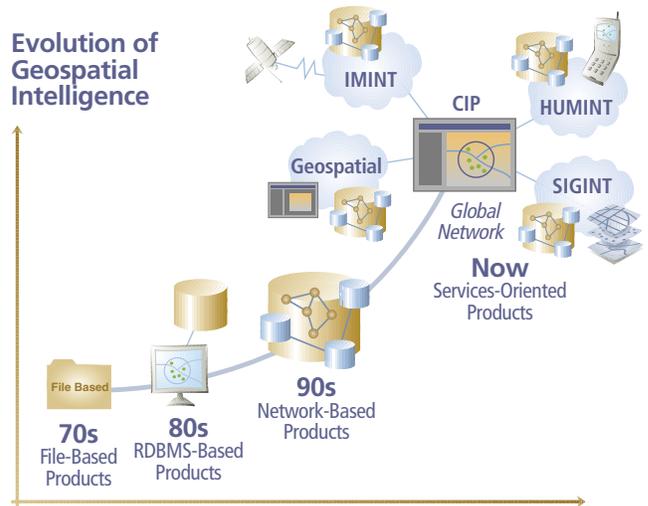
GIS plays a significant role in defense infrastructure and environment management. With decreasing budgets and increasing responsibilities, GIS affords the stewards of military facilities with the ability to forge a new strategy of cooperation. GIS cuts across many disciplines and permits interdepartmental analysis at the work group, installation, regional, and national levels.

The ArcGIS platform is engineered to integrate with other enterprise IT capabilities. This ensures that decision support tools integrate all relevant information resulting in timely and effective decisions.

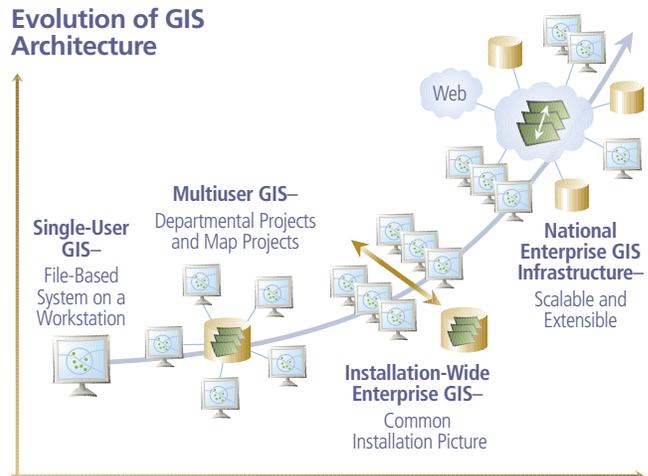
## Evolution of Network Centric Operations



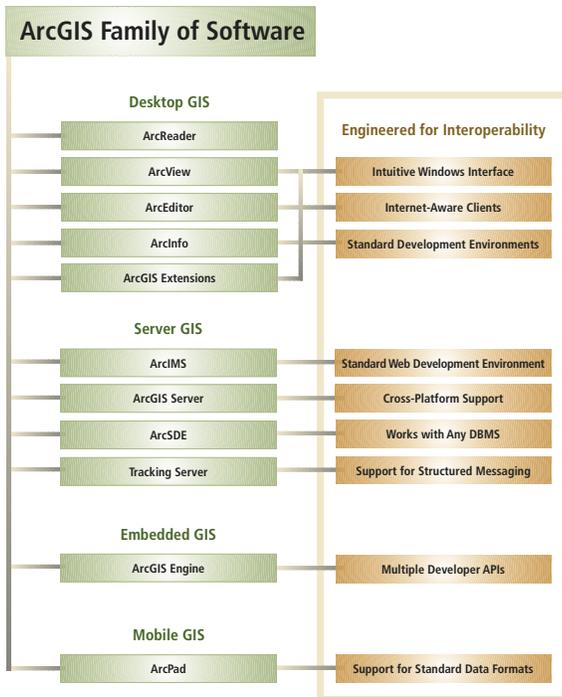
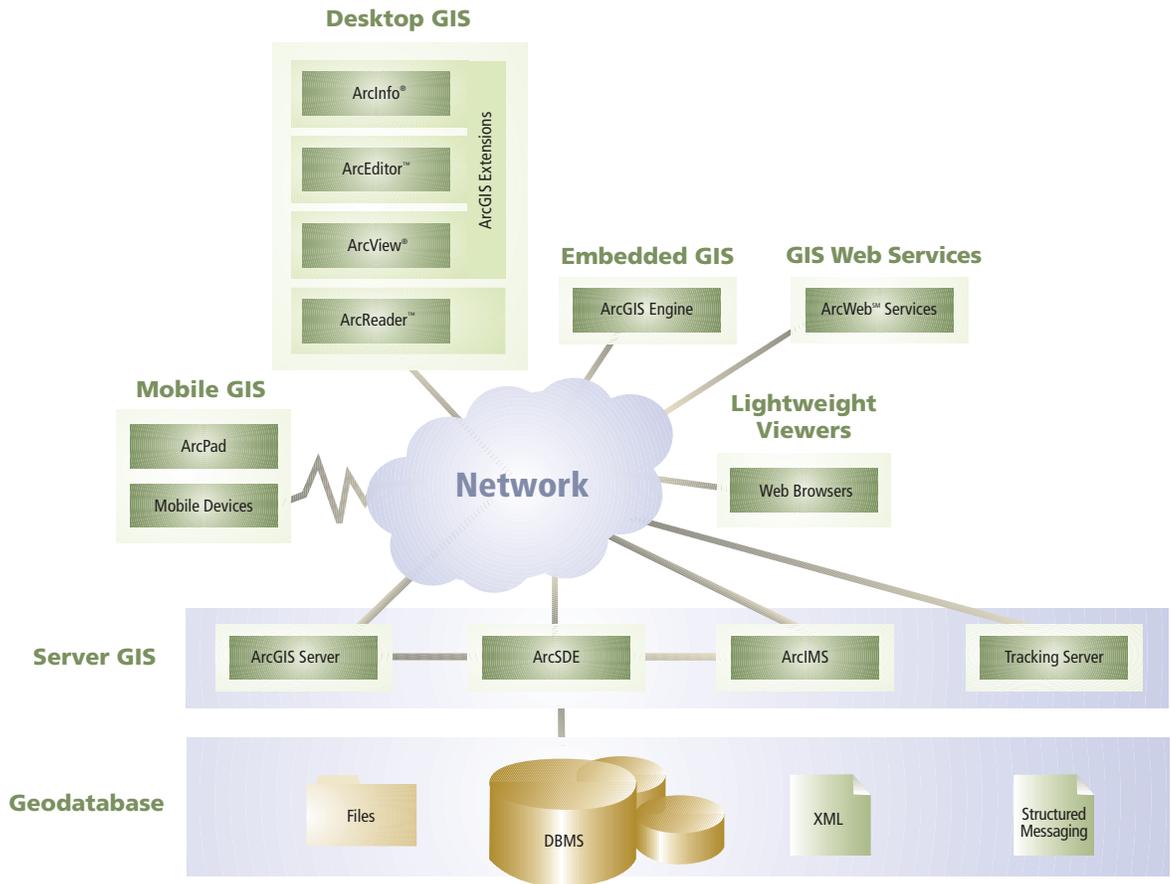
## Evolution of Geospatial Intelligence



## Evolution of GIS Architecture



# Technology



## ArcGIS—A Single, Scalable Enterprise Architecture

ArcGIS provides an open, interoperable platform that underpins capabilities in each defense domain. By doing this, ArcGIS is also capable of connecting the domains—critically important in today’s defense and intelligence environment where boundaries between facilities, war fighting, and strategic intelligence are increasingly blurred. Consider, for example, the intelligence analyst trying to assess terrorist intentions against a forward-deployed air force base.

# GIS for Military Operations

NCO represents a revolution in military affairs. This revolution is about the reorganization and emergence of a new doctrine in defense that takes advantage of modern information technology to transform the military into a smaller, smarter, more agile force. ArcGIS has a critical role to play in each of the three concepts of NCO: intelligence, surveillance, reconnaissance (ISR); command, control, communications, computers, and intelligence (C4I); and precision engagement (PE).

## Intelligence, Surveillance, and Reconnaissance—Battlespace Awareness

ISR involves merging all sensors in the battlespace into spatially aware databases (geodatabases) across networks to help decision makers and warfighters understand the current situation (common operational picture/common tactical picture). ArcGIS provides a critical infrastructure for ISR because it retains the spatial context of the sensors and maintains the relationships between sensors and other battlespace entities and actions within the geodatabases. GIS is a naturally integrating technology, and fusion will occur naturally because the spatial context is maintained.

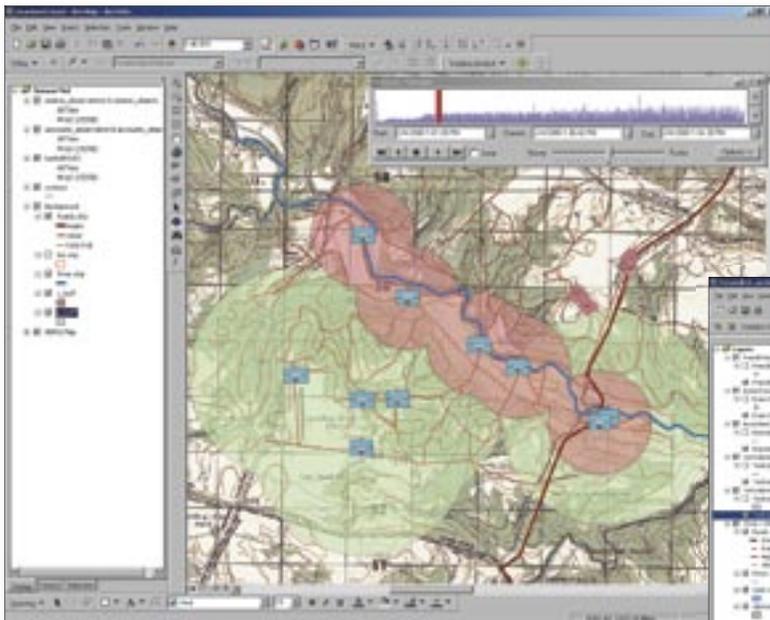
## Command, Control, Communications, Computers, and Intelligence Assessment—To Tell

The C4I domain supports timelier and better decisions by using a variety of tools to analyze, assess, and plan actions. ArcGIS bolsters C4I capabilities by providing a common spatial context and the tools to provide decision makers, commanders, and warfighters with a distributed, scalable, decision support environment.

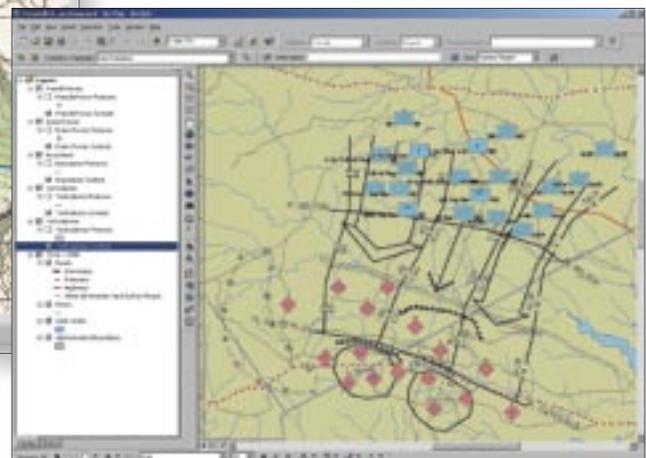
## Precision Engagement—To Strike

PE includes the coordination of strike assets in time and space to achieve the commander's desired effect. ArcGIS provides the information framework and tools to understand time and space activities and constraints, then assists in passing precise information to the engagement systems.

ArcGIS also provides a critical information structure that connects the concepts of NCO. This common foundation permits the spatial context of data to flow as information for ISR to C4I and as actions from C4I to PE. ArcGIS provides the framework for storage, dissemination, and exploitation of battlespace knowledge throughout the defense and intelligence infrastructure.



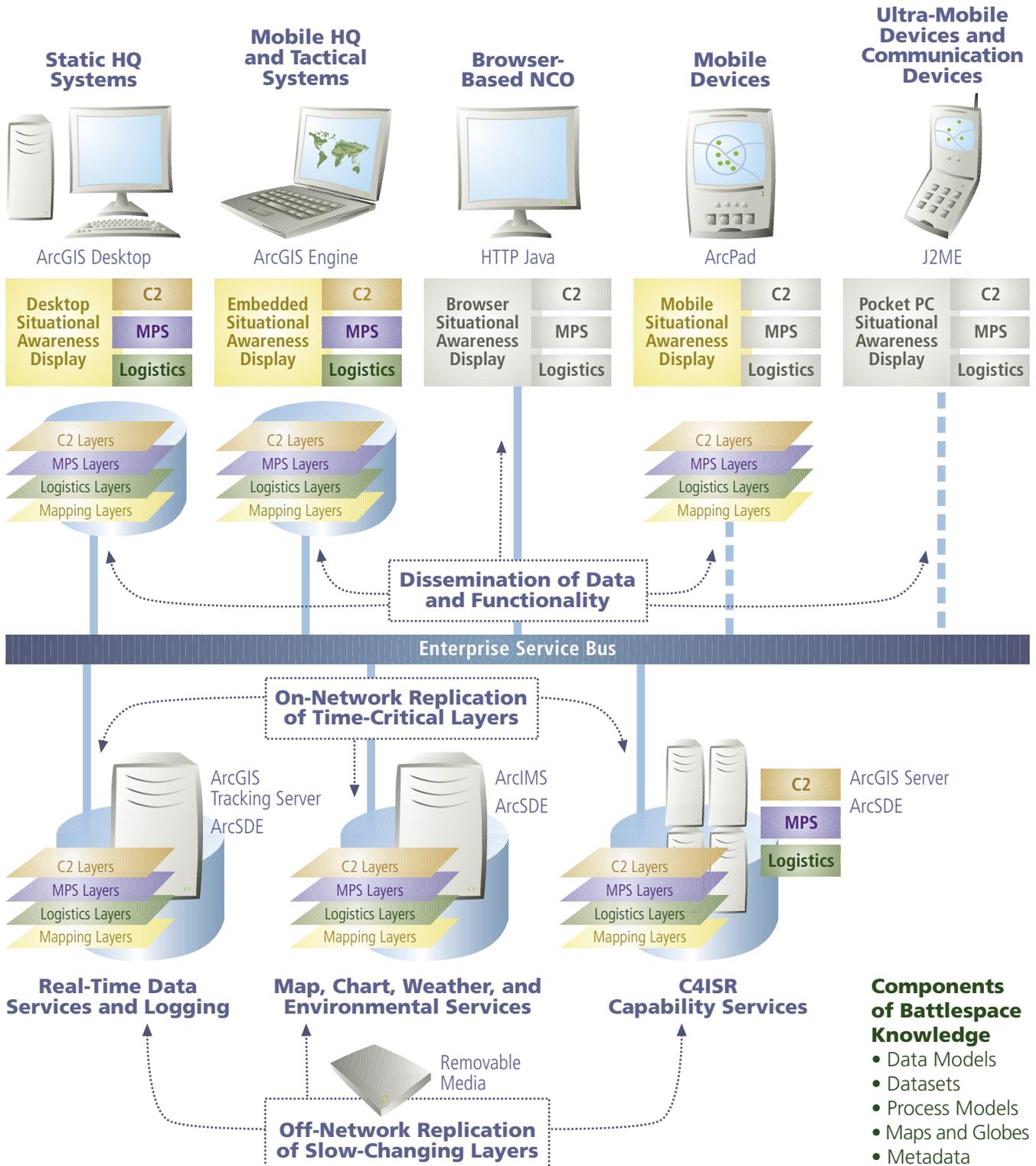
*ArcGIS Tracking Analyst—Connecting the Sensor to the Database to the Shooter*



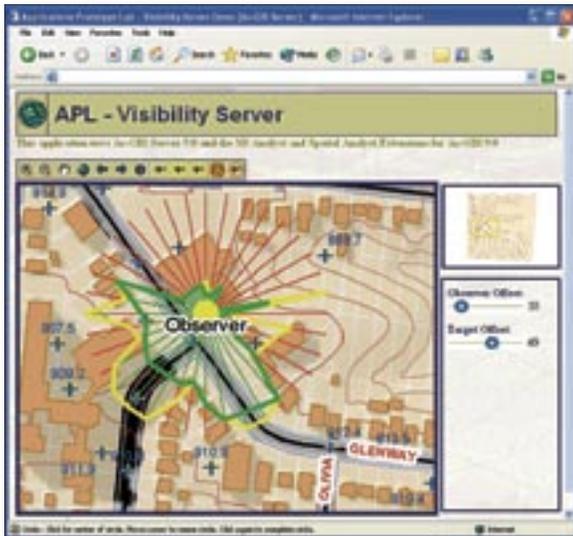
*ArcGIS Military Analyst, Military Overlay Editor (MOLE) for Full MIL-STD 2525B Symbology*

# Military Operations—GIS Infrastructure

## ArcGIS C4ISR Reference Implementation—Overview



# Military Operations—Developer Tools



*Conduct Line of Sight Analysis*

## ArcGIS Engine

ArcGIS Engine is a developer and system integration product for creating custom ISR, C4I, and PE desktop applications that require the integration of geospatial information and analysis. ArcGIS Engine is based on ArcObjects™, the core set of components from which ArcGIS products are built. ArcGIS Engine provides customized, focused spatial solutions for defense users who require geospatial information integration and application.

### ArcGIS Engine offers you

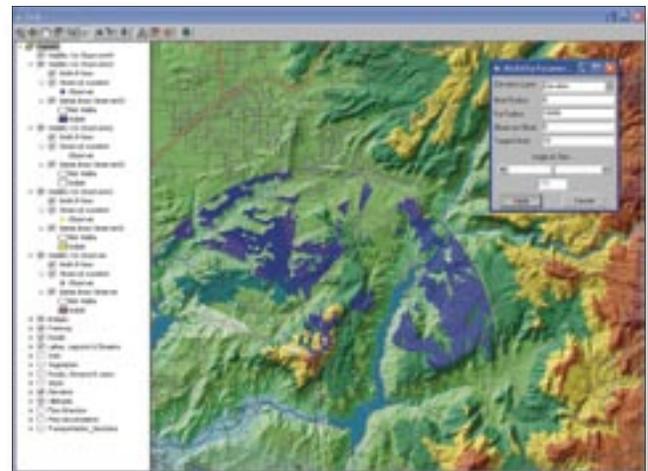
- Rich spatial functionality
- Cost-effective deployment requiring only an ArcGIS Engine Runtime or ArcGIS Desktop license per computer
- Developer controls available in ActiveX, .NET, and Java that simplify application development
- A choice of standard developer languages including COM, .NET, Java, and C++
- Extensive developer resources including object models, utilities, samples, and documentation
- The standard ArcGIS Engine Runtime provides the core functionality of all ArcGIS products and can be enhanced with
  - Geodatabase Update extension for full read-write access to a multiuser geodatabase.
  - ArcGIS 3D Analyst™ extension for advanced 3D visualization.
  - ArcGIS Spatial Analyst extension for complex spatial analysis.
  - MIL-STD 2525B symbols that can be incorporated into GIS applications with the Military Overlay Editor (MOLE™) developers toolkit. See next page for details concerning MOLE.

## ArcGIS Server

ArcGIS Server is a comprehensive platform for delivering enterprise GIS applications that are centrally managed and support multiple users for applications such as a physical or virtual joint intelligence/analysis center (JIC/JAC). ArcGIS Server provides the framework to build and deploy centralized ISR-, C4I- and PE-based GIS applications and services for the defense and intelligence communities.

### With ArcGIS Server, you can

- Provide browser-based access to GIS, utilizing geospatial information from multiple defense nodes.
- Deliver advanced GIS Web services throughout the global defense network.
- Develop custom applications using .NET or Java to meet specific defense and intelligence needs.
- Integrate GIS and other IT technologies using industry-standard software.
- Provide centrally managed, multiuser editing capabilities.
- Perform focused spatial analysis operations on a server.



*Cross Country Mobility Analysis*

## Tracking Server

Tracking Server provides a solution for collecting and sending real-time data from many data sources and formats to Web and desktop clients. As real-time data is received by Tracking Server, you can log it to a file or distribute it to Web and desktop clients including the ArcGIS Tracking Analyst. Tracking Server enables the integration of real-time data to facilitate geospatial analysis.

# Military Operations—GIS Products

## ArcGIS Military Analyst

### Features of ArcGIS Military Analyst

With ArcGIS Military Analyst, you can easily use standard defense data and generate MIL-STD 2525B symbology.

The ESRI ArcGIS Military Analyst extension incorporates a suite of tools tailored to meet the special needs of the defense user that significantly enhances the effectiveness of core ArcGIS for the military planner and intelligence analyst. ArcGIS Military Analyst maximizes the use of the standard suite of defense data products by directly reading and rendering vector and raster products, line-of-sight assessments, Military Grid Reference System (MGRS) conversion, and Digital Terrain Elevation Data (DTED) analysis.

ArcGIS Military Analyst offers full customization using COM interfaces, on-the-fly projection of raster and vector data, and a suite of tools that includes

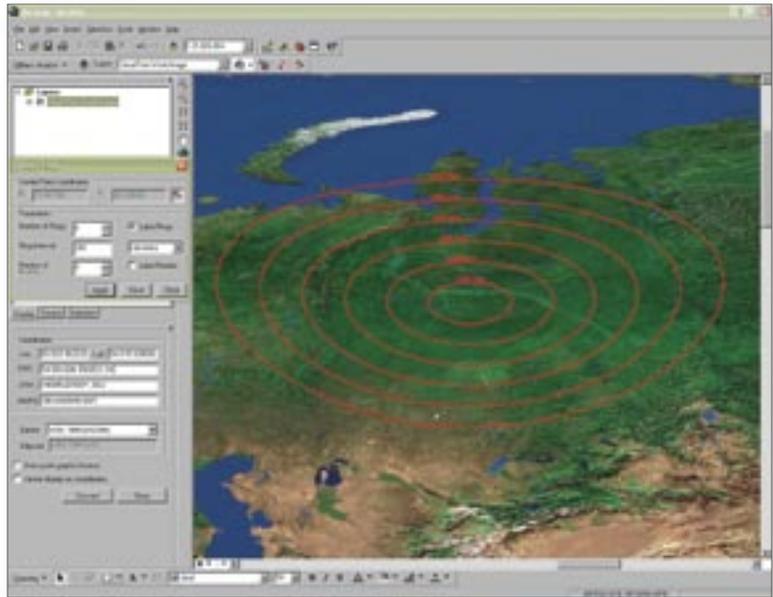
- Data management tools—Manage the display of Raster Product Format (RPF), Vector Product Format (VPF), and DTED data through the use of catalogs; load bulk RPF and DTED data into ArcSDE®.
- A coordinate tool—Supports MGRS and coordinate conversion.
- Terrain analysis tools—Mosaic/Extract RPF and DTED files from catalogs, perform linear and radial visibility analysis across DTED tiles, view data in 3D, and create threat domes.
- Geodesy tools—Calculate and display geodesic, great circle, projected ellipses, and rhumb line distances.
- Conversion tools—Batch coordinate conversion of coordinates in files; convert VPF features to shapefiles and geodatabase feature classes.
- Range Ring tool—Creates a series of spatially accurate and projected ellipses for weapons system and aircraft ranges.

ArcGIS Military Analyst also includes Military Overlay Editor (MOLE), which supports MIL-STD 2525B and custom war-fighting symbologies.

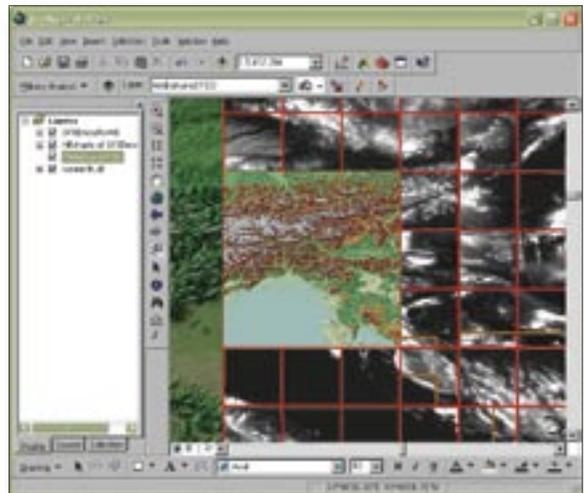
### With MOLE, you can

- Add geographic data in vector, raster, or other supported formats for reference while composing and positioning unit symbols.
- Manually or automatically add leader lines to multiple symbols that occur at the same location.
- Stack symbols of identical units that occur at the same location.
- Print draft copies of your map to any standard Windows output device.
- Use graphics generated by MOLE in Windows-based ArcGIS.

MOLE is also a toolkit for developers who want to embed MIL-STD 2525B symbology into their applications using ArcGIS Engine and ArcGIS Server.



*Create Rang Rings for Target Analysis*



*Manage Multiple Raster Libraries*

# GIS for Installations and Environment

*GIS provides a critical infrastructure for installation management. The ArcGIS platform provides a framework to support business decisions at every level of command, and GIS software integrates seamlessly into the flow of daily business activities. The open, interoperable ArcGIS platform allows you to capture, manage, disseminate, analyze, and visualize geospatial information, all the key factors in efficient installation management and operations.*



*Rehabilitating Utilities Infrastructure in Iraq  
by Mr. Thomas O'Hara (Photo Courtesy of U.S. Army)*

## The ArcGIS platform supports

- Base and facilities management—ArcGIS provides flexible technology to balance the management of real property, assets, and facilities with resources and mission requirements.
- Training area and range management—GIS provides range managers with decision support technology to manage increasingly complex weapons systems and environmental and safety concerns.
- Environmental security—GIS enables environmental managers to overlay many types of geographic and environmental data to create models and strategies that assist in complying with environmental and cultural resource management regulations.
- Force protection and security—Security managers must optimize the use of force protection resources against mission requirements. GIS provides the security management team with a common installation picture and the geospatial tools for effective decision support.
- UXO—Unexploded ordnance poses a unique, spatially distributed environmental management and remediation issue for many defense sites. The suite of tools available in ArcGIS supports the UXO mission to identify, track, analyze, manage, and remediate UXOs.

## Base Operations and Facility Management

- Asset management/tracking
- Utilities
- Communications
- Base operations
- Housing
- Base engineering

## Force Protection and Security

- Police, first responders, and security operations
- Monitoring alarm systems
- Vehicle tracking
- Safety and security
- Monitoring critical infrastructure and high-risk targets
- Emergency operation center operations
- Emergency and disaster response teams
- Vulnerability assessments
- Crime analysis
- Integration of intelligence and surveillance data

## Environmental Security and Resource Management

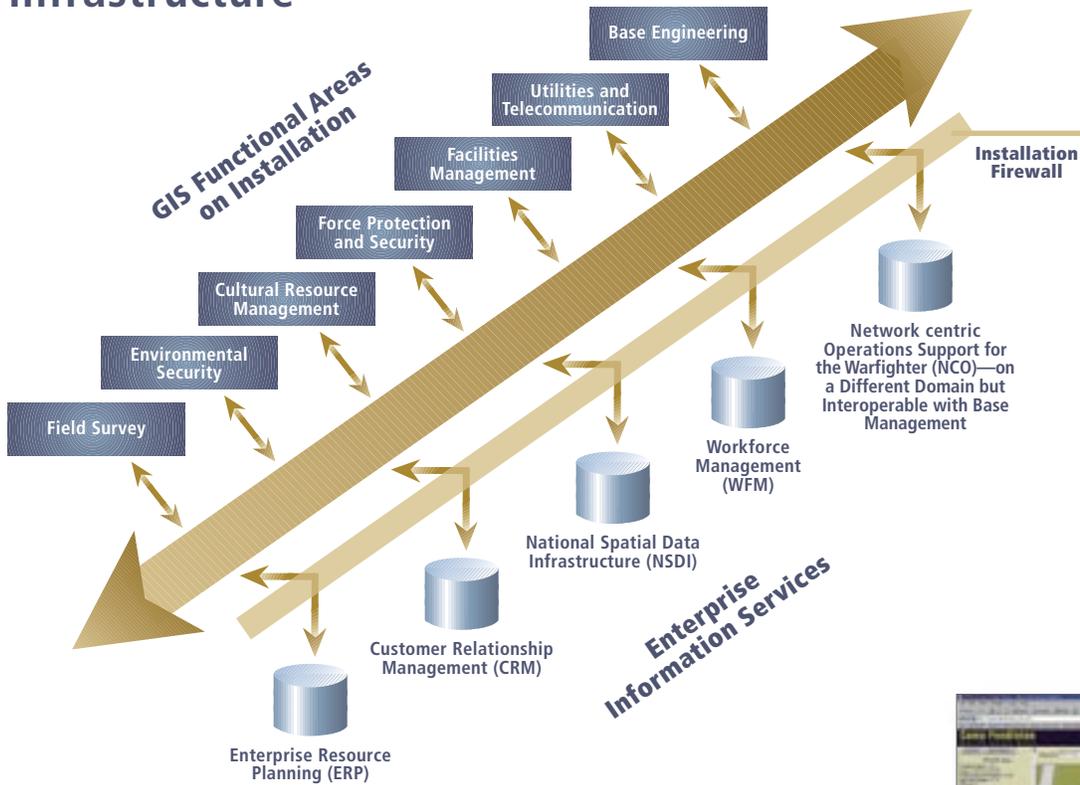
- Regulatory compliance
- Pollution prevention
- Cultural and natural resource management
- Hazmat team response
- Air and water quality
- Environmental remediation
- Hazardous material management



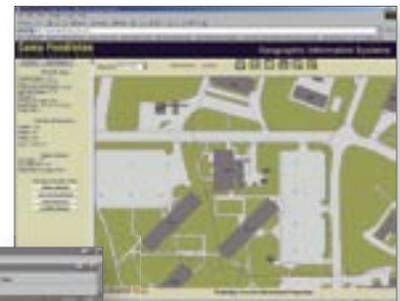
*GIS for Base Closure and UXO Cleanup*

# Installations and Environment—GIS Infrastructure

## GIS Critical Information Infrastructure



*Integration of CAD, GIS, Photography, and Work Order Management System*



The ArcGIS platform underpins base operations with a common information infrastructure. ArcGIS integrates all sources of spatial information including GIS data layers, imagery, CAD drawings, GPS field data, survey information, addresses, and even nonspatially referenced data sources such as work orders, photographs, and documents. The ArcGIS platform supports IT architectures and spatial standards and, therefore, guarantees interoperability with a wide range of defense and national systems.

The interoperable, services-oriented architecture integrates other enterprise applications, such as netcentric operations in support of the warfighter (ISR, C4I, and PE), in addition to back-office productivity solutions such as customer relationship management (CRM), enterprise resource planning (ERP), and workforce management (WFM) applications.

*Camp Pendleton Integration of GIS with MRO Software's Maximo, an Enterprise Asset Management System*



*Water System Utilities Management GIS*



# Installations and Environment—Enterprise GIS Capabilities

## CAD/GIS Integration

Computer-aided design (CAD) applications and data will continue to play critical roles in base operations. CAD systems will continue to be used to design complex base infrastructure, and CAD data is best able to represent those entities in the design/build context. After construction and as you enter the maintenance phase, GIS and its ability to integrate with maintenance management packages provide the planner with the tools to efficiently plan and maintain facilities for years to come.

The integration of CAD data into a GIS-based common installation picture is a key aspect of the GIS support for managing the installation. The ArcGIS platform supports CAD integration at several levels. ArcGIS provides several CAD-specific geoprocessing tools. Native CAD files can be directly read into the ArcGIS environment; additionally, CAD files can be imported into the geodatabase and distributed to the user through a browser or a thick client.



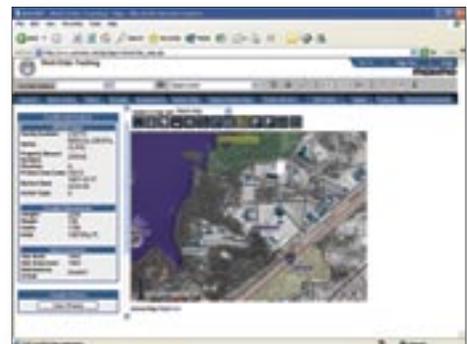
Common Installation Picture, MacDill AFB

## Enterprise Technology Integration

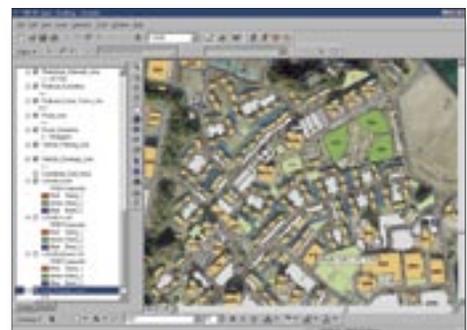
The effective management of an installation involves the application of several enterprise information systems such as CRM, ERP, WFM, and GIS. ArcGIS is an enterprise platform that integrates with these other enterprise capabilities to provide spatial context and geoprocessing capabilities to any application that may require it. ArcGIS is fully integrated with DBMS technology that offers

- A distributed, extensible DBMS to manage the organization's spatial and other data holdings
- An open GIS gateway that works directly with data management solutions provided by different DBMS vendors
- A standards-based approach for managing GIS data in a DBMS that is consistent throughout the IT community
- A way to efficiently serve GIS datasets to a large number of distributed users on the desktop, network, and Internet
- GIS spatial infrastructure built on an existing DBMS, adding spatially enabled storage, processing, and visualization

There are three views of enterprise IT architecture—the presentation, algorithm, and database. The GIS architecture mirrors this structure with—geovisualization, geoprocessing, and geodatabase. Both architectures conform to industry IT standards and provide the links required to build an enterprise information system infrastructure.



Work Order Tracking



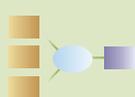
Facility and Utilities Management GIS

## Three Views of GIS

**Geovisualization**  
Maps



**Geoprocessing**  
Models



**Geodatabase**  
Databases



# Installations and Environment—GIS Products

*The ArcGIS platform provides a complete range of mobile and field data collection technology solutions for facilities, environment, and infrastructure data.*



*Mapping in the Field under Combat Conditions  
by Spc. Chris Stephens (Photo Courtesy of U.S. Army)*

## ArcPad

ArcPad® software supports mobile GIS on a Pocket PC or handheld computer. It makes data collection in the field easy and efficient. Users can create a copy of their GIS data from their desktop or server, and it is ready to use on a handheld mobile device. Additionally, data can be loaded in a mobile device via wireless technology.

ArcPad integrates with a GPS receiver, allowing the mobile GIS user to collect, edit, query, locate, and navigate using the facilities, infrastructure, and environmental data extracted from the master GIS geodatabase. Data in ArcPad is immediately available in the mobile GIS and can be validated in the context of an actual map.

The data on the Pocket PC in ArcPad is managed by the enterprise GIS as a long, disconnected editing transaction. That is, the enterprise GIS remembers what data was checked out, and once the field operation is complete, the enterprise GIS will check back the edits and additions from the mobile device into the master enterprise database.

## Tablet PC

ArcGIS supports the design specifications of Microsoft Windows XP Tablet PC Edition. The user can take advantage of the Tablet PC's innovative features such as pen-based computing, digital ink technology, and enhanced mobility functions. Facilities and environmental teams benefit from the ability to check out a portion of the GIS data, work in the field with a full-featured GIS as a disconnected editing transaction, and subsequently check back the edits and modifications in to the geodatabase. Both ArcPad and the Tablet PC constitute a well-integrated and disconnected mobile extension of the enterprise GIS environment.

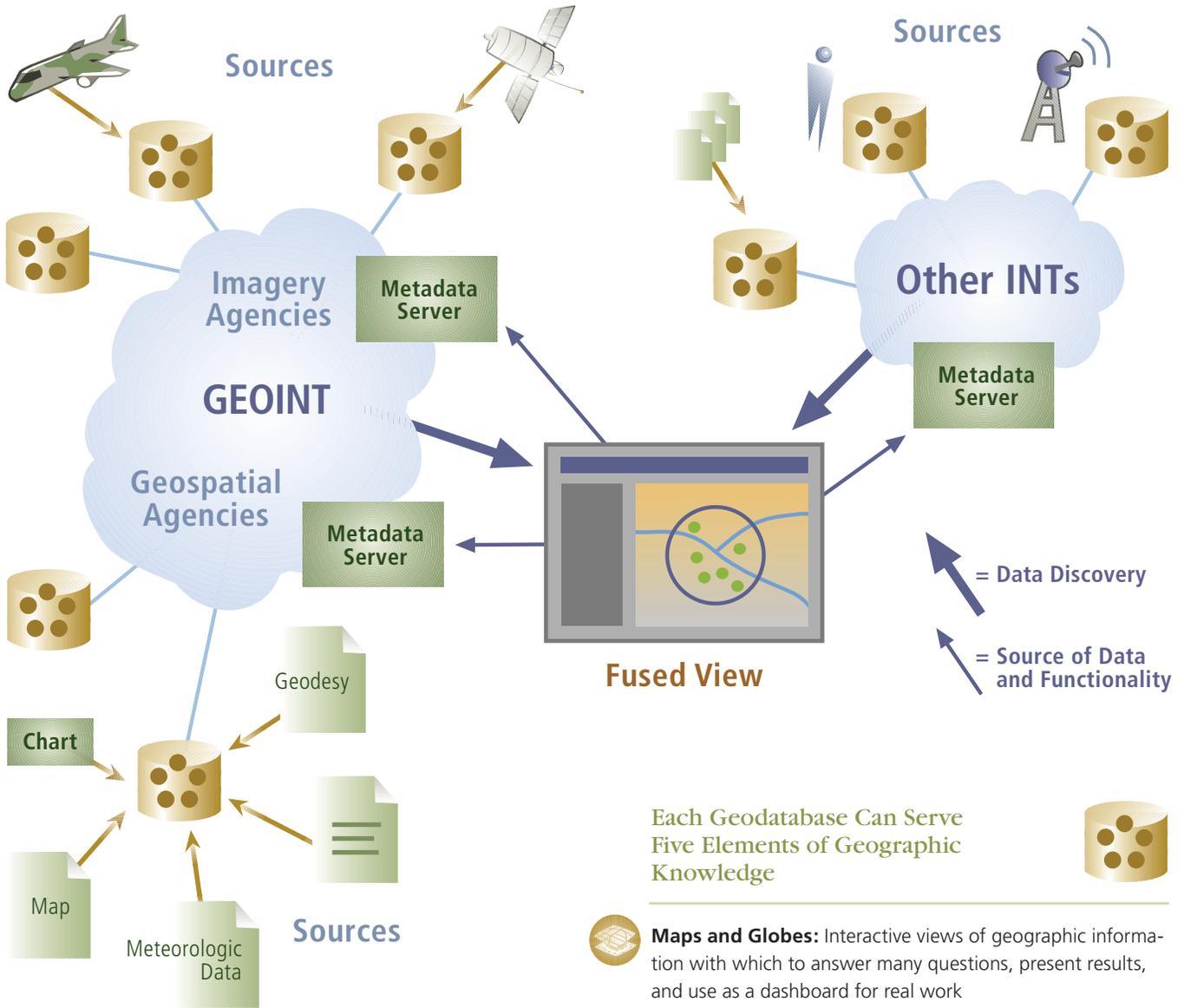


*Mobile GIS Field  
Mapping and Data  
Capture Technology*



# Geospatial Intelligence Infrastructure

## GIS—Enabling Fusion in the Intelligence Community



### Geospatial Intelligence

GEOINT is the exploitation and analysis of imagery and geospatial information to describe, access, and visually depict physical features and geographically referenced activities on the earth. ESRI ArcGIS architecture enables GEOINT exploitation and analysis with a scalable family of products for desktop, server, Internet, and mobile platforms.

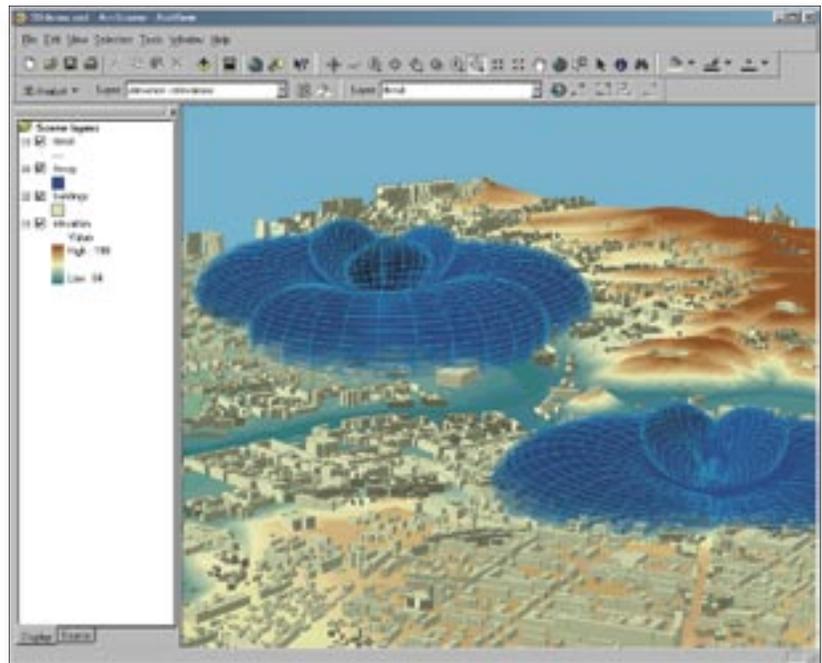
### Each Geodatabase Can Serve Five Elements of Geographic Knowledge

-  **Maps and Globes:** Interactive views of geographic information with which to answer many questions, present results, and use as a dashboard for real work
-  **Geographic Datasets:** File bases and databases of geographic information—features, networks, topologies, terrains, surveys, and attributes
-  **Processing and Workflow Models:** Collections of geoprocessing procedures for automating and repeating numerous tasks
-  **Data Models:** The schema, behavior, and integrity rules of geographic datasets
-  **Metadata:** Document catalog enabling users to organize, discover, and gain access to shared geographic knowledge

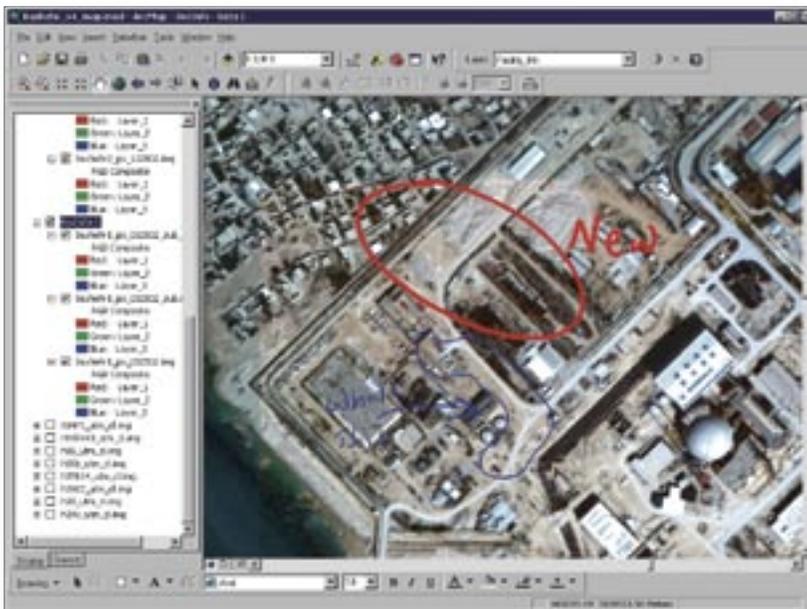
# Geospatial Intelligence

GIS is a critical infrastructure for the geospatial intelligence community and their handling of spatial knowledge in an information system. ArcGIS abstracts knowledge of the real world into datasets, maps and globes, metadata, data models, and workflow models within the geodatabase. The geodatabase is hosted on industry-standard DBMS technology that can be directly disseminated across any network. The geodatabase is operated by a powerful, open, and component-based toolset on both the client side or server side. This enables a common spatial capability to underpin all defense and intelligence domains.

The two main constituent agencies that form the GEOINT domain—the map and chart production agency and the imagery intelligence agency—use GIS as a bridge between their specialty areas and to reach out to the national and warfighter domains they serve. ArcGIS provides a framework for map and data production on the same geodatabase that serves the warfighter. Other data sources, including imagery, can be handled as another layer of information within the geodatabase and readily fused with any other intelligence information source.



*3D Analysis and Visualization*



*Geospatial Intelligence Collaboration*

## GIS Roles in GEOINT

- Data and map production
- Data dissemination, discovery, and fusion
- Analysis and exploitation
- Workflow management
- SIGINT, IMINT, and other sensor analysis
- Multi-INT fusion
- Collaborative planning
- Suitability analysis
- Temporal analysis

## Data Production and Dissemination

GEOINT agencies create and serve standard data and map-based products and build on these to develop their mission-specific datasets. These agencies can share common databases, data models, and services by conducting data discovery through metadata catalogs and dissemination through Web portals and browsers.

# Geospatial Intelligence—GIS Solutions

## Dissemination and Discovery

### Overview

The Distributed Geospatial Intelligence Network (DGInet) technology employed by defense and intelligence organizations provides an enterprise solution for publishing, disseminating, and exploiting geospatial intelligence data. DGInet was designed as a Web-based enterprise GIS for non-GIS savvy intelligence analysts, military planners, and warfighters. It uses thin clients to search massive amounts of geospatial and intelligence data using low-bandwidth Web services for data discovery, dissemination, and horizontal fusion of data and products.

The DGInet core technology is deployed at several defense and intelligence community sites.

### Features

- Web map services across multiple organizations/nodes
- XML-based metadata search
- Selective data display/data fusion
- Thin-client/Server-side applications
- Portal/Portlets
- Download capability
- Geoprocessing Web services
- Data management/Data-loading services

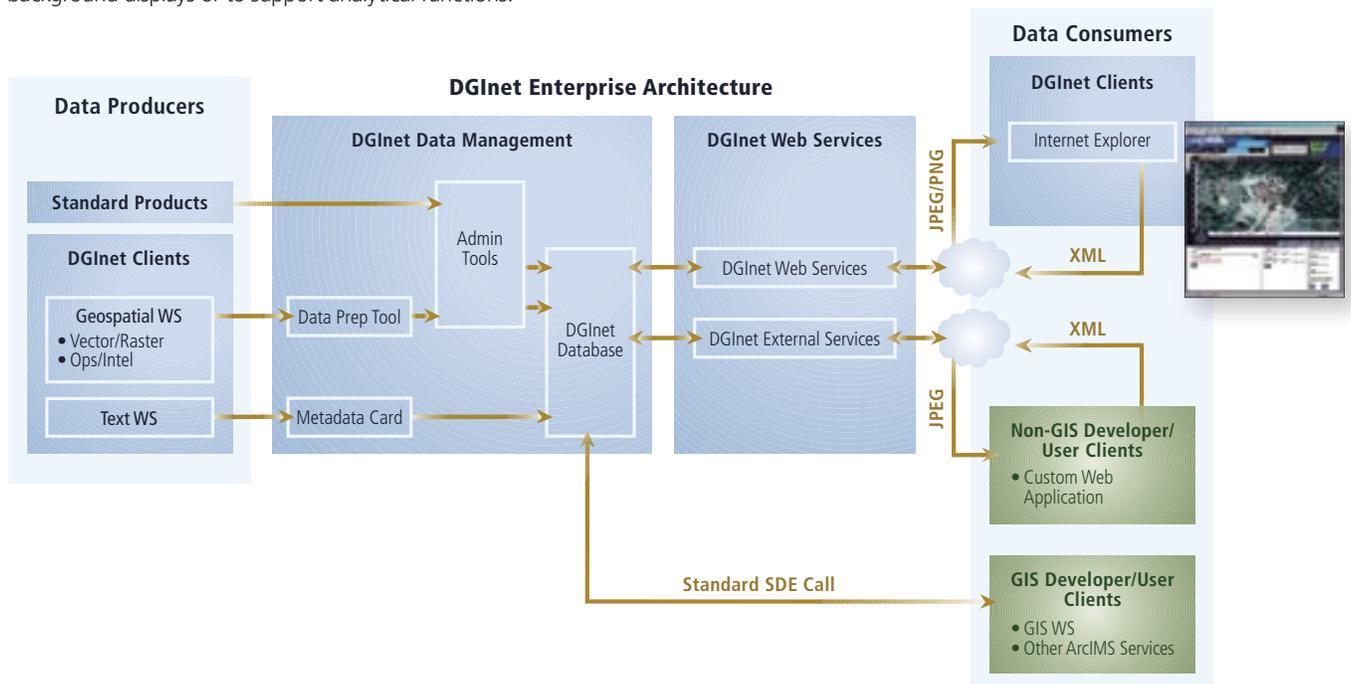
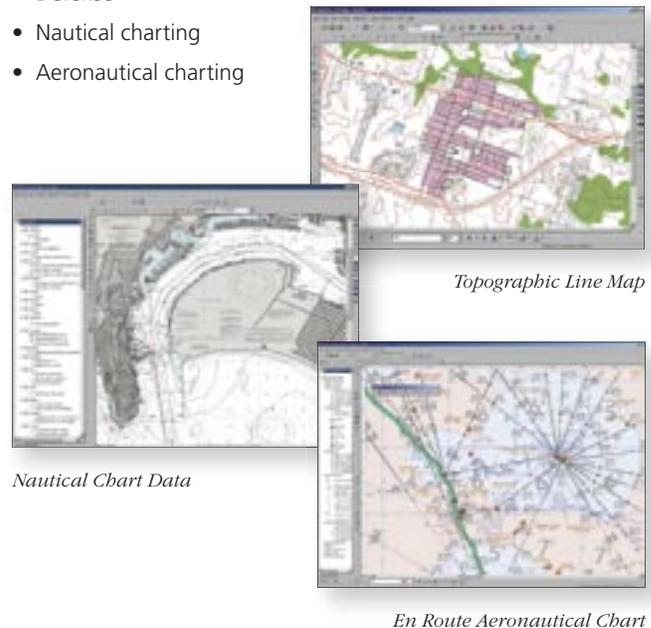
### Benefits

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

## Database-Driven Production

PLTS™ for ArcGIS is a collection of software applications that extend ArcGIS for high-volume database production, maintenance, quality control, cartographic product generation, and workflow management. These production tools are driven by product standards encapsulated in data models and knowledge bases and applied in data editing, attribution, validation, and output processes. PLTS for ArcGIS includes tools and workflow solutions for

- Defense
- Nautical charting
- Aeronautical charting



# Geospatial Intelligence—Enterprise GIS Capabilities

## Geoprocessing

Geoprocessing is what differentiates a GIS from a map display. The geoprocessing tools can be used to add powerful capabilities to a core map display.

- Using analysis techniques to compress large volumes of data into meaningful information
- Cuing in an operator to events occurring in areas of interest
- Providing domain-specific analysis plug-ins to the display such as
  - Radio Frequency Analysis
  - Terrain Analysis
  - Network Analysis

## ModelBuilder

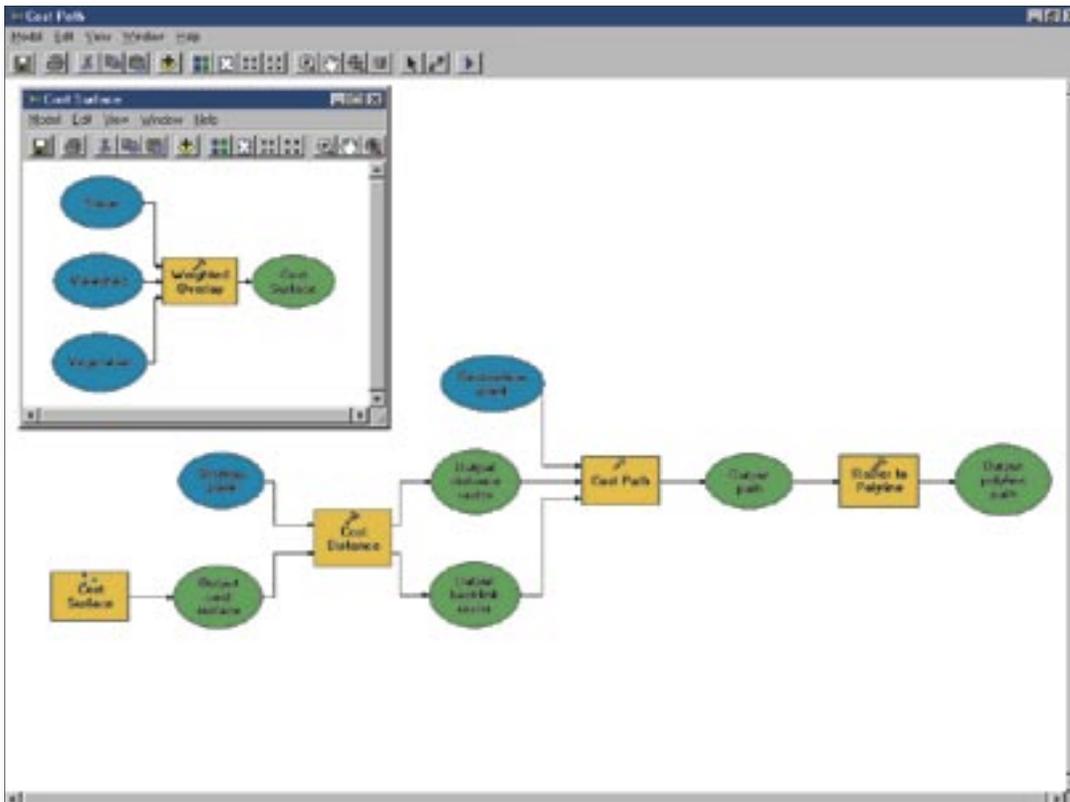
The ModelBuilder™ interface provides a graphical modeling framework for designing and implementing geoprocessing models that can include tools, scripts, and data. These models form a critical component of battlespace knowledge that can be stored in the geodatabase, disseminated across the network, then utilized throughout the enterprise.

ModelBuilder can be used to generate models that can be run in a variety of architectural scenarios.

- Run on a desktop GIS
- Embedded within a defense or intelligence application
- Deployed on ArcGIS Server as a service, accessible using a browser or mobile client

## Geoprocessing—the business logic of GIS

The ArcGIS platform provides an unrivaled range of geoprocessing tools. These provide defense and intelligence organizations with a rich palette of capabilities to support a wide range of decision support processes. The tools are exposed to developers, allowing the embedding of geoprocessing into defense systems. Geoprocessing tools are also exposed through the ModelBuilder interface, a graphic modeling environment that allows multiple datasets and geoprocessing operators to be connected into comprehensive work flows. This permits organizations to capture, disseminate, and enhance tradecraft.



ModelBuilder Cost Path

# Standards and Interoperability

ArcGIS is an infrastructure for defense because it provides an open, interoperable platform. Interoperability is engineered into the ArcGIS platform based on the premise that system designers should be free to define the enterprise IT architecture and implement GIS capabilities as part of it.

This approach to interoperability demands embracing open industry standards that define all modern computing platforms—XML, SOAP, SQL, and others—in an inclusive manner. ESRI's support for services-oriented architecture (SOA) does not preclude the adoption of stand-alone, peer-to-peer, and client/server architectures and permits interoperability with legacy systems. This critical strength enables one platform to support

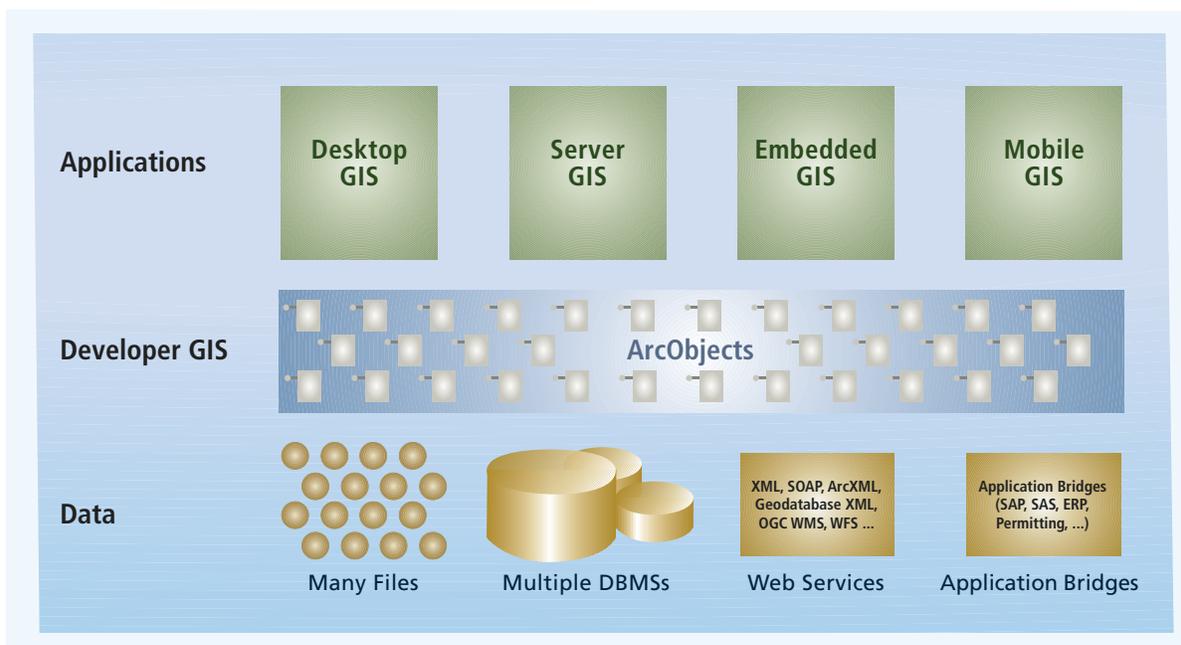
- Web service capabilities while connected to the network and fall back to stand-alone capability with cached data when the network fails—the same concepts, tools, and applications support both needs.
- The migration of an application from file-based data during prototyping to peer-to-peer in initial deployment to full services-oriented network architecture—the same application can support all phases of new architecture development.

The ArcGIS platform also supports the geospatial standards that are critical to exchange information between defense capability areas. This support for Open Geospatial Consortium (OGC) Inc., International Organization for Standardization (ISO), Digital Geographic Information Working Group (DGIWG), Multinational Geospatial Co-production Program (MGCP), and other standards is engineered into the ArcGIS platform again, in an inclusive manner, embracing all standards definitions in a program.

**ArcGIS was designed and engineered with interoperability in mind. The following are a few examples.**

- ArcGIS supports the storage and management of geospatial data within multiple and heterogeneous DBMSs. This offers considerable cost savings through supporting multiple DBMS vendors across the entire defense enterprise.
- ArcGIS operates in a heterogeneous computing environment that includes Windows, Linux, Sun Solaris, and various types of mobile devices and Web browsers. It can connect to and work with information on many central DBMS servers across a range of platforms. This enables a common spatial framework to straddle capability areas independent of their platform choice.
- Defense developers can deploy GIS logic such as mapping, editing, and geoprocessing anywhere—the traditional workstation desktop environment, embedded in custom mission applications, running on mobile devices, or managed in a server environment. This use of a common toolkit on different platforms saves considerable money through the reuse of code.
- System integrators can deploy GIS in a services-oriented architecture that uses open and interoperable standards such as WMS, WFS, ArcXML, and SOAP. ArcGIS provides a netcentric spatial capability as a critical foundation for NCO.
- ArcGIS supports open and documented APIs for C++, .NET, Java, and COM, through which developers can access, update, and use all GIS functions.

## ArcGIS



# Standards and Interoperability Products

## Interoperability Products

The defense and intelligence communities demand comprehensive solutions to interoperability challenges. The plethora of legacy systems and data formats demands the ability to work with a wide range of standards while, at the same time, embracing emerging services-oriented architectures. The ArcGIS platform has always offered unrivaled support for defense data formats and now adds exhaustive client and server support for a wide range of vendor proprietary formats. ESRI has collaborated with ESRI business partner Safe Software, a leading provider of spatial data transformation solutions, to fully integrate its powerful tools within the ArcGIS platform.

## ArcGIS Data Interoperability

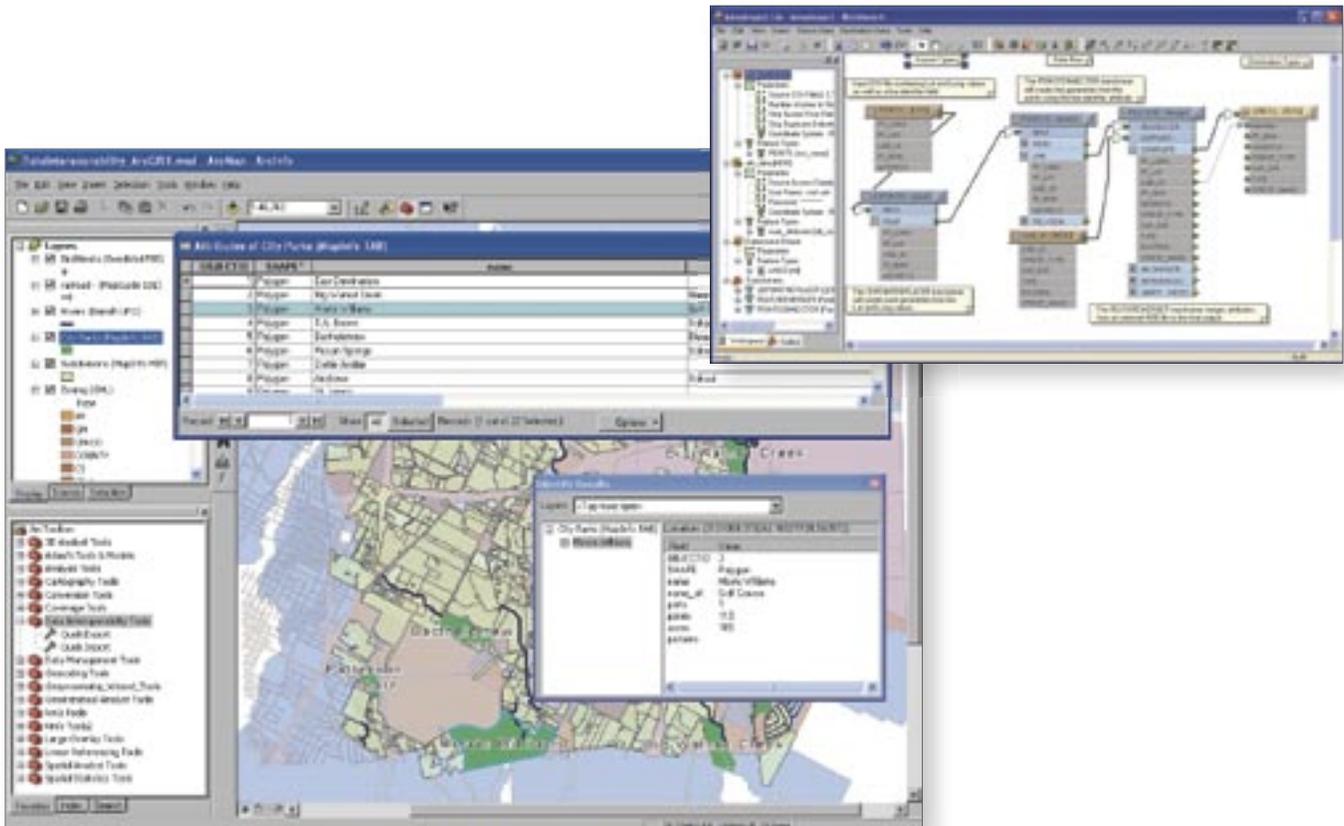
The ArcGIS Data Interoperability extension enhances the data access capabilities of the ArcGIS Desktop products by providing access to many more data formats through direct read, translation, and transformation. The extension enables users to directly read and import more than 70 spatial data formats and export to more than 50. Users also have the flexibility to define custom data formats within an interactive, visual diagramming environment. ArcGIS Data Interoperability is built on Safe Software's industry-standard Feature Manipulation Engine product.

This is a significant capability for desktop product users in all defense domains. It dramatically enhances the ability to fuse spatial information from a wide range of proprietary and legacy data structures without incurring the significant cost of bulk conversion.

## ArcIMS Data Delivery

The ArcIMS® Data Delivery extension enables ArcIMS to serve data in a variety of formats and projections that best meet the needs of the client application. This introduces an entirely new notion of openness, since data can be delivered to the client in that client's native format rather than in a compromised format that impacts performance, functionality, or both. Many popular CAD, GIS, and standards-based formats, such as GML, can be served directly into a client application—whether they are a different vendor's CAD, GIS package, or a thin client browser.

This capability is critical for defense and intelligence users who want to avoid vendor lock-in and exclusionary standards. It permits different capability areas to maintain interoperability despite conflicting procurement life cycles—a critical factor in the journey to networkcentric operations.



ArcGIS Data Interoperability Extension



For more than 35 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprise-wide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

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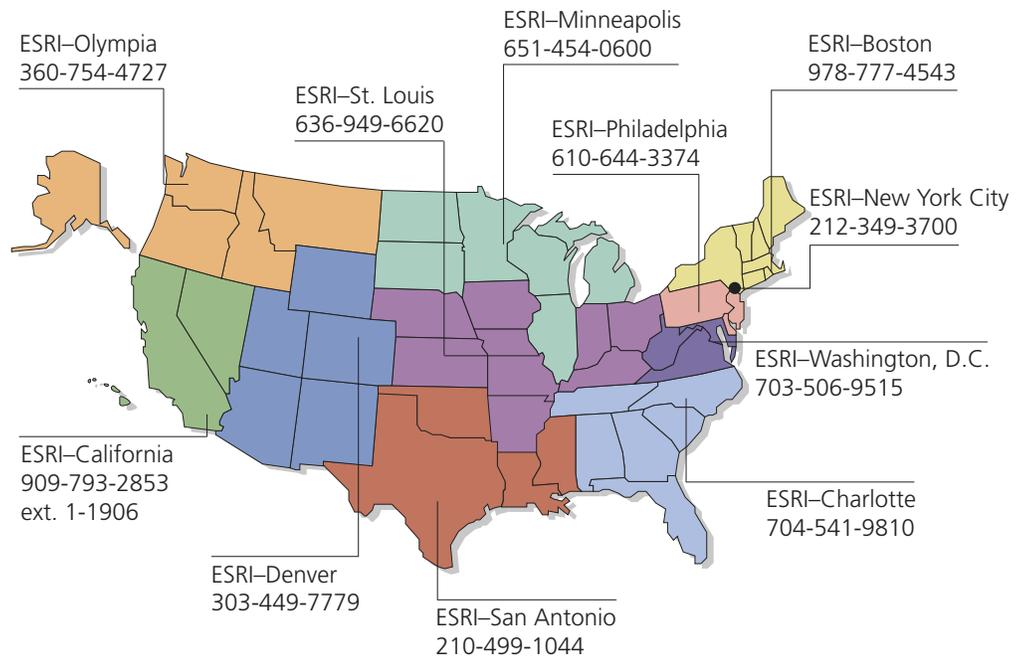
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