

GIS Platform for National Security

An Esri® White Paper
July 2014



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GIS Platform for National Security

Executive Summary

The business of securing a nation is complex, dynamic, and unique to the individual nation. Each nation has its own interests such as protecting against hostile intent, domestic or foreign; mitigating areas prone to disasters; securing natural resources and critical infrastructure; and preserving a way of life and cultural identity. Every nation faces challenges threatening its security including economic instability, domestic unrest, foreign threats, and exposure to disasters (natural, technological, or deliberate attack).

Nearly every nation provides governmental services to its citizens, guest workers, and immigrants, such as civil defense (law enforcement, fire protection, and emergency medical services), health and human services, and national defense. Commonly referred to as *national security*, governments also have a vested interest in protecting critical infrastructure, citizens, national resources, and other assets owned or managed by the government. National security is the protection of the nation from threats within, at, and beyond its borders.

Providing an effective national security program requires identifying and assessing vulnerabilities from all types of hazards and threats. It includes developing capabilities to prevent, protect from, respond to, and recover from catastrophic incidents. Maintaining continuous situational awareness is now generally accepted as the foundation for successfully maintaining national security. Acquiring the ability to collaborate with diverse stakeholders; assess vulnerabilities; and determine priorities for the resource allocation is challenging.

Esri's ArcGIS® platform supports national security mission requirements. Esri's geographic information system (GIS) platform enables government agencies to

- Assess threats and vulnerabilities to critical infrastructure and the population.
- Develop mitigation and protection options for protecting critical infrastructure.
- Maintain shared situational awareness across multiple groups for daily operations.
- Support response and incident management workflows.
- Support damage assessment using all types of mobile devices.

A Platform for Understanding

GIS technology has long been used by government agencies including those supporting national security missions. Traditionally, GIS has been a technology used by a small group of highly trained analysts and GIS professionals to identify threats, plan resource

deployments, and map potential action and contingency plans. Desktop applications were used to create information products and print paper maps. Today, the ArcGIS platform enables personnel to access easy-to-use maps and applications that support the mission, on any device, anywhere, at any time, on any network.

GIS technology is far more pervasive and accessible online, in the cloud, just about anywhere one would want.

Esri® ArcGIS is a complete geospatial software platform for geographic understanding, supporting user workflows, collaboration, dynamic situational awareness, and monitoring and measuring. The technology provides access to information for planning, response, apprehension, mitigation, and recovery. Applications are easily configured and can be quickly accessed, understood, and shared to support coordinated actions.

The ArcGIS platform also integrates geographic information with business intelligence systems. Tabular data comes to life on a dynamic map so the information is easy to understand, resulting in quicker and better decisions for national security. Agency enterprise business intelligence can now be geoenriched with geospatial data and maps.

The ArcGIS platform is designed to deliver relevant content through simple applications and web maps that are aligned to the needs of each person in an organization. The platform allows users to create, manage, and access data from other systems both within the organization and from outside systems. The platform supports desktop, browser-based, and mobile environments. It works across any environment, from the office to the field. Mobile applications can immediately synchronize with office systems and continue to operate when disconnected from the network.

The ArcGIS platform can be easily configured to enable secure data sharing with specific users or communities.



The ArcGIS platform enables multiagency collaboration and shared situational awareness through web maps.

Interagency collaboration and the sharing of intelligence are critical for national security. For example, collaboration occurs when planning security for a special event such as a major sporting competition. Special events attract a large volume of people including dignitaries and celebrities.

Many agencies and stakeholders use their own systems during the planning and operational phases of a special event. Those systems are often disconnected, which makes exchanging and sharing information virtually impossible. The ArcGIS platform is designed to access data from existing systems and integrate it into a common geographic context—a web map. The platform enables data interoperability and provides greater understanding by adding location.

Configuring the Platform to Support National Security

National security and public safety organizations have similar organizational mission requirements and responsibilities:

- Planning and analysis
- Logistics
- Command
- Operations
- Outreach
- A GIS foundation

The ArcGIS platform can be configured with applications and viewers and permits organizing by groups that align with organizational workflows. The appropriate

applications, dashboards, and tools can be configured to support the flow of information and data to efficiently support the diverse and complex mission requirements for national security.



The ArcGIS platform can be configured to support typical organizational divisions and critical workflows and organize content to provide easy-to-use maps and applications for addressing specific mission requirements.

Planning and Analysis

Raw data might not be useful, but analyzed information is. ArcGIS provides the analytical engine to turn the raw data stream into actionable information. Planning and analysis are most commonly performed through the use of ArcGIS for Desktop, but the ArcGIS platform allows access to the analyzed actionable information by operations personnel via their mobile devices. Comprehensive and effective analysis makes the development of plans much easier and more logical. Once the risks to critical infrastructure—the hazards, threats, vulnerabilities, and consequences—are understood, plans can be prioritized for mitigation based on the greatest risk. The platform provides modeling tools that can be used to understand the potential impact and consequences of incidents, helping to define specific mitigation, protection, and training needs.

GIS support for analyzing national security vulnerabilities includes the following:

- Identification and Mapping of Values and Assets
 - Critical Infrastructure
 - ◆ Government facilities
 - ◆ Commercial utilities
 - ◆ Hospitals

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- ◆ Schools
- ◆ Public assemblies
- ◆ Transportation networks and hubs
- ◆ Economic values
- ◆ Cultural values
- ◆ Cybersecurity network
- Special Needs of Vulnerable Populations
 - ◆ Elderly
 - ◆ Low income
- Identification and Mapping of Threats and Hazards
 - Natural Hazards
 - ◆ Seismic zones
 - ◆ Coastal zones
 - ◆ Landslide-prone areas
 - ◆ Areas prone to wildfire
 - ◆ Rivers
 - ◆ Areas prone to hurricanes and similar weather events
 - Technological Hazards
 - ◆ Nuclear power plants
 - ◆ Facilities with hazardous materials
 - ◆ Transportation routes (rail, other)
 - ◆ Transporting hazardous materials
 - Deliberate Attacks and Hazards
 - ◆ Border enforcement and protection
 - ◆ Crime
 - ◆ Gang areas or areas of historic civil unrest
 - ◆ Cyber attacks
 - Historical Risks
 - ◆ Previous events and frequency and the likelihood of an occurrence
 - ◆ Projections of risk based on trends, developments, or population shifts

- Intelligence Gathering and Analysis
 - ◆ Threats and warnings
 - ◆ Interagency collaboration
 - ◆ Mobile data

When these types of data are combined and modeled, vulnerabilities become apparent. Priorities for training and adequate response can be quickly determined.

The analysis drives the development of plans. Staffing requirements, budget needs, and preincident planning can be developed more accurately. The ArcGIS platform makes it easy to conduct the analysis, collaborate with stakeholders, and develop appropriate actions and capabilities.

Logistics

All organizations within the national security community have logistical requirements and constraints. The ArcGIS platform allows national security agencies to balance and make best use of their own resources acquired under capital expenditure (CAPEX) with those they can acquire during operations (OPEX). During emergencies, command and operations personnel need visibility into the status, availability, and location of resources to successfully meet incident objectives. This workflow includes the ability to query and task relevant commercial or emergency rental resources potentially needed for events (dump trucks, potable water, portable toilets, lumber, etc.) based on proximity to an incident location. The ArcGIS platform provides updated information on the transportation network for appropriate routing and movement of resources. This same type of information is important for business operations, supply chain management, and product and services delivery. Configured applications to support all forms of logistic requirements are enabled by the ArcGIS platform:

- Selection of best transportation delivery method—air, land, and sea
- Routing based on shortest path
- Site selection for the distribution of supplies during an emergency
- Optimal locations for staging areas and shelters
- Closest locations of business to provide equipment and supplies
- Dynamic monitoring and surveillance of the transportation network
- Tracking and security of vehicles carrying supplies

Logistical support is critical for all types of operations in business functions, emergencies, and planned events. Without effective logistics, operations are difficult to execute.

Command

Once a plan is executed, the ArcGIS platform provides a dashboard for situational awareness and performance indicators (graphs, charts, and reports). The dashboard provides a high-level overview and the current status of a jurisdiction or operation. It includes information feeds (weather, incidents, disruptions, trends, etc.) but can also be connected to other information management or business systems. The dashboard is easy to use, with an interface designed for command, department managers, elected officials, or business executives.

Operations

From decision makers to first responders, the ArcGIS platform can serve the appropriate data to all users within operations, providing unity of action through shared situational awareness. Beyond that, the configurable viewer contains tools supporting analytics. Whether these tools are configured for emergency incident management or business continuity, they support specific operational missions:

- Incident management and reporting
- Staff deployment and workflow
- Search and rescue
- Damage assessment
- Debris removal
- Law enforcement field interviews
- Cyber supply line monitoring and adjustment

The GIS platform provides mission-specific maps and applications that tailor situational awareness to different roles.

The platform supports the ability to perform briefings to command and executive staff through applications focused on telling the story of each event. The platform is also integrated with common productivity applications such as Microsoft SharePoint, PowerPoint and Excel, and it provides briefings on multiple types of devices such as tablets and smartphones or over the web when possible. The platform begins to transform the briefing process from the rigid 12-hour cycle found in traditional public safety organizations into an ongoing, dynamic process, removing the downtime and data synchronization problems found during events.

Outreach

All national security stakeholders must provide information to their mission partners and constituents. They can benefit from acquiring timely information and feedback from the public. The ArcGIS platform provides configurable applications to support these requirements and easily allows an organization to publish relevant information in a number of formats—as embedded maps within the organization's web page, in mobile applications, or as static maps and graphics supporting briefings.

Many national security stakeholders are responsible to provide public information. Whether a business, a traditional government agency, or a first-responder organization, keeping customers, constituents, and the public informed is important. In return, the public can provide valuable information to the organization through evolving social media and crowdsourcing technologies. The ArcGIS platform provides awareness to citizens for all types of national security needs. From an emergency management perspective, these might include the following:

- Road closures because of an emergency
- Shelter locations
- Alerts such as evacuation notifications and routing instructions
- Law enforcement alerts such as crime activity in an area
- Amber alerts
- Overall incident status and progress

The public information applications are configured for non-GIS users and are intended to be lightweight and with limited tools and data for the public to access. The data provided can easily be a subset of the operational data that has been approved for public release. Likewise, the viewer can be used to collect information from the public through controlled entry forms for volunteered geographic information (VGI) or to harvest public information from social media sites (Twitter, YouTube, Flickr).

For nonemergency use, protective or preventive information or instructions on self-help can be provided to mitigate potentially dangerous situations:

- Removing hazardous vegetation around structures
- Maintaining adequate security measures around the home
- Disaster and first aid supplies everyone should have on hand
- Businesses that provide supplies

Many national security organizations have intelligence gathering and analysis missions that involve sensitive information and/or intelligence sharing. The ArcGIS platform supports secured information outreach among staff.

GIS Foundation

Timely, relevant, and accurate geospatial foundation data is essential to provide a consistent framework for all other geospatial map production, analysis, and shared situational awareness. Foundation data is used to create basemaps that provide geographic context for operational data layers. Foundation data (basemaps) can include the following:

- Topography
- Hydrography
- Aviation
- Elevation and bathymetry
- Imagery
- Place-names
- Cadastre

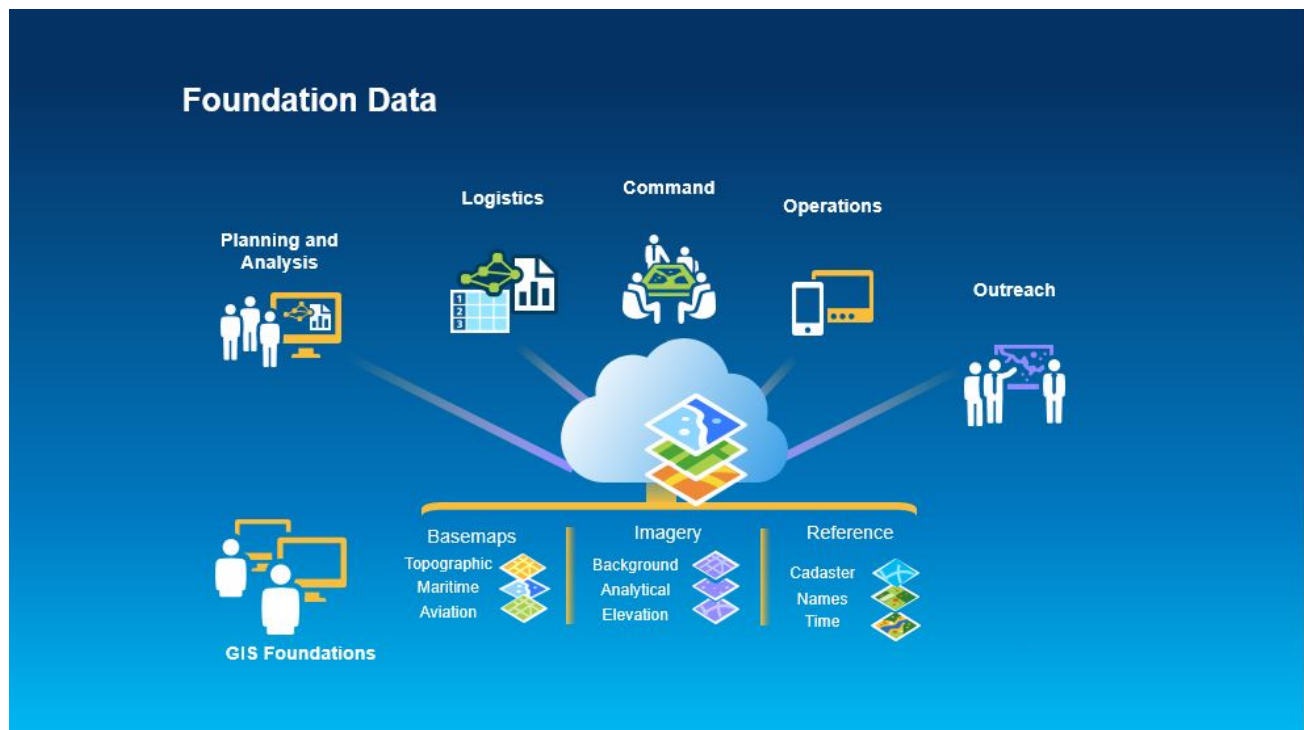
The ArcGIS platform provides tools and enhanced capability for maintaining foundation data. GIS professionals can create and maintain the authoritative geospatial content and achieve economies of scale by directly managing and publishing data and cartographic products. Through a shared work environment, teams of any size can improve the quality and value of geospatial data and cartographic products.

ArcGIS provides the following capabilities for foundation data management:

- Ensure that your geospatial content adheres to industry- and organization-specific standards by defining and distributing data and map specifications
- Generate specification-driven output through reliable, consistent processes
- Centralize GIS workflow creation and management to ensure consistency across operations

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- Streamline data creation with additional templates, construction tools, and on-the-fly validation of features while editing
- Implement an efficient review process by automating spatial data quality control tasks
- Standardize and centralize detailed cartographic production with tools for creating and maintaining derived data, symbology, page elements, and maps



The ArcGIS platform provides tools to organize and manage foundation data for the enterprise, making authoritative mapping content available to everyone.

Delivering National Security Applications

Supporting the national security mission is made easy through the use of geospatial applications that run on any device and on any network. These applications are intuitive and combine consumer-level simplicity with the science and analytics of geospatial technology.

GIS apps are preconfigured solutions for a specific workflow. GIS apps are easily downloaded from an app store like iTunes, from a website, or via a URL using a GIS template. An app typically leverages a GIS template or data model and, with little to no instruction, allows users to begin operating and collecting information. These simple-to-use apps connect directly to an online geodatabase to which other viewers and dashboards connect, providing real-time situational awareness.

Geospatial apps are designed to leverage maps and content in ArcGISSM Online or on premises. Apps let users access online data from any mobile device in the field. Apps

provide simple-to-use geospatial tools for any business process, such as collecting data remotely. Apps not only operate on high-performance networks but also in situations where users are disadvantaged by network conditions that are disconnected or intermittent or have low bandwidth.

Templates provide a quick start for building GIS solutions that support specific national security mission objectives.

For example, a national security template for special event planning has the following configurable components, allowing a quicker solution implementation:

- Data models supporting data requirements for the following:
 - Resource staging area identification
 - Security posturing assessments
 - Traffic routing and road closure assessments
 - VIP routing and security
- Connected content from other map/web services supporting these workflows
- A configurable viewer/app to visualize and interact with the map
- Source code to implement the template in any operating environment including desktop and mobile technologies

Many templates supporting national security missions and GIS practices are available at resources.arcgis.com/en/home. An example is the Pre-Site Survey Template and how to apply it to a special event planning use case.

Special Event Planning Use Case Example

Large events such as the Olympic Games, the soccer World Cup, the National Football League (NFL) Super Bowl, and political summits require specialized security.

All stakeholders who are responsible for the smooth outcome of a special event need to understand and work from the same plan. Aside from a rare catastrophic threat, special events pose a unique challenge in responding to health emergencies or disorderly conduct as well as maintaining normal security around ingress and egress.

GIS technology supports special event planning by providing better planning and decision making for the following:

- Resource staging and deployments—While emergencies are unpredictable, the need for response during a special event is almost certain. Understanding the best location to stage resources such as fire/rescue personnel and equipment, law enforcement assets, security teams, and support personnel is essential. GIS can be used to analyze variables such as traffic patterns, road closures, venue access points, criminal activity, and protest areas. Personnel can perform hot-spot analysis to ascertain where the best locations are to stage resources.

- **Security posturing**—Security analysts can use GIS to determine the best locations to set up barricades, place security checkpoints, and establish restricted areas; predict locations crimes most likely will occur; and track where threats are coming from and how to best protect against them. GIS can be used to analyze where hazardous materials pose a threat to the venue if accidentally or intentionally released. Social media feeds can provide insight into where people are beginning to congregate to protest or where trouble is occurring. Command staff in an operations center can also observe incidents in real time and adjust the security posture on the fly to meet new threats or security breaches.
- **VIP routing and security**—Political figures, celebrities, and high-profile individuals present special security needs. In addition to providing on-site security, staff must protect such individuals while getting to and from a location. Security analysts can use GIS to determine the best route to escort VIPs to and from the special event venue; where roadblocks would be required; and, through line-of-sight analysis, identify where potential dangers such as a shooter could be located. Security personnel can then use this information on a web map to increase vigilance as the caravan makes its way along the designated routes.
- **Traffic logistics**—GIS can effectively provide information on traffic conditions surrounding the special event. An analysis can be done on expected volumes of automobile and foot traffic and whether or not the infrastructure can support the added volume of traffic. GIS can also be used to determine the impact road closures will have on traffic patterns and what intermodal transportation (rail, bus, and shuttles) will be needed to support the flow of people and vehicles. The results of the analysis can be published on a map and given to the media to inform event attendees and the surrounding population of what to expect during the event.
- **Incident response planning**—Once a plan is created, it needs to be operationalized and distributed to all stakeholders. They need to understand their role within the plan as well as the expectations and prescribed procedures to respond to incidents. GIS operates in a mobile environment. All stakeholders can access digital maps to operate from the same plan. Real-time data feeds provide each stakeholder with situational awareness as incidents unfold. Command staff and decision makers can adjust the plan and communicate it to field teams using the same map. This is the power of web maps—real-time data access and situational awareness.

ArcGIS Platform Deployment Options

The ArcGIS platform can be deployed in a variety of ways. It can be deployed by a national security agency either on-premises, through the cloud, or in a combination deployment.

The cloud architecture enables the platform to be more pervasive, making it easy to get access on any device at any time and from any place that networks permit. Collaboration among organizations becomes easy. National security stakeholders can go to a common organization site and access maps and apps that are open and shareable or ones that are secured for specific missions or personnel.

The cloud is often considered to be too unsecured an environment for sensitive information. Cloud GIS has evolved to become configurable to secure sensitive

information yet have the flexibility to share open information as needed. It enables authorized personnel to access and integrate authoritative data with other data to make a more comprehensive and actionable map.

Conclusion

National security is protecting a nation's critical infrastructure, its population's health and welfare, and sustainability of its economy.

The requirements to achieve that protection include the following:

- The identification of hazards, threats, and vulnerabilities
- Analysis and development of actionable intelligence to inform decision making and operations by mitigating threats and raising preparedness
- Interagency/Multidepartmental collaboration through shared situational awareness
- The capability to disseminate actionable intelligence through easy-to-use applications on multiple devices to operators for coordinated action
- Outreach to not only national security mission partners but also the public

The ArcGIS platform enables organizations to rapidly build capability for national security and unified action across organizations.

Traditional desktop applications and server-based systems come alive with web maps and applications. Stakeholders gain access to information they need to fulfill their mission objectives.

Easy-to-use templates and apps make it simple for national security stakeholders to operate from any device, anytime, anywhere.

The web map concept means that GIS is secured throughout any workflow. One authoritative map is accessible to anyone with the right credentials or permissions.

To learn more of how GIS supports national security, visit esri.com/nationalsecurity.



Esri inspires and enables people to positively impact their future through a deeper, geographic understanding of the changing world around them.

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