GIS for Homeland Security

An ESRI® White Paper • November 2001

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An ESRI White Paper

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Executive Summary

On October 8, 2001, an Executive Order was signed creating the White House Office of Homeland Security. With its formation comes focused attention in setting goals and priorities for homeland security. Analysis, preparation, and implementation of strategies will hinge not only on how information is collected and analyzed, but, more important, on how it is coordinated and shared. At the federal level alone, more than 50 agencies share and coordinate information before, during, or after any emergency.

Thankfully, the urgent need to develop strategies and methodologies for information access on which we can base our preparedness for homeland security comes with some perspective. The GIS community has years of experience and data at its disposal. Many of us have worked in preparing for and responding to national emergencies such as earthquakes, floods, and wildfires. This experience now enables us to redefine planning and preparedness for the incurred risk of malicious attack. However, the ability to mitigate the effects of any emergency is drastically reduced by lack of forward planning.

This paper describes the critical role that geographic data plays in the assessment, preparedness, and response to such threats. Essentially, the capability to build on existing data sets in the public and private sector, along with the knowledge and methodologies developed over decades by the GIS community, allows organizations to move forward with confidence and vision.

The time to do this is now.

We, therefore, call for immediate and courageous action to "think anew" about how we manage and share our information from the local to the national level so that we can best protect that which we hold most dear.

Introduction

All disasters start locally.

The United States and its allies face a number of new and difficult challenges. Traditional threats to security were nation-based and aimed at U.S. forces and allies overseas. But with weapons of mass destruction, extremist group terrorism, attacks on information infrastructures, and other possibilities, threats now involve nonnation-based individuals or groups, with a reach that directly affects our security at home.

This new reality means rethinking policies, planning, allocating resources, and formulating partnership strategies among federal, state, local, and private sectors.

Homeland Security as a National Goal

While the federal government is the first line of defense in managing threat data and deterrence, it is state and local government that is the first line of response in an actual emergency. The capability to quickly and effectively access data that can prevent an attack, minimize damage, and save lives is the key.

A fundamental component of security is information, and for homeland security this means geographic information. An important and powerful characteristic about buildings, schools, churches, day care centers, malls, bridges, tunnels, airports, railroads, and highways is that they exist in identifiable locations that can be displayed on a map. People, too, can be tracked to specific addresses such as homes or businesses or aggregated to areas such as census blocks. And all of this geographic-based data, or "geodata," can be stored and displayed in a computerized geographic information system, or GIS.

GIS Supports the Homeland Security Mission

GIS databases have been used for decades to help organizations collect and analyze data to make better decisions. Public and private sector organizations have built valuable databases of spatial-based information, and they have put in place the hardware, software, procedures, and skilled staff resources necessary to work with geodata.

The federal government has deployed GIS into most agencies and departments. Repositories of geodata are used every day in the U.S. Department of Agriculture, the United States Geological Survey, the Environmental Protection Agency, the Bureau of Land Management, the Department of Justice, and many others. GIS databases also exist in thousands of municipal, county, regional, and state agencies, as well as in nongovernment organizations and private sector organizations. As a result, the United States is the most geodata rich country in the world.

While federal organizations usually maintain the greatest coverage, local data is managed at very detailed scales. In combination, the framework exists for establishing integrated processes for data access and exchange. Many of the organizations that use GIS technology today follow standard data models that facilitate data integration and promote data sharing. The geodatabases that exist today are the foundation on which to build strategies for a national knowledge base that will enable organizations to create, publish, and access geographic and associated data sets for strategic planning or tactical operations.

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The effort should not build a single system, network, or organization but rather create a distributed knowledge base in which geodata is collected, managed, and served by many organizations to create a mosaic of geographic information. This effort will involve the federal government, states, local communities, and everyone who uses geodata.

Building Communities with GIS

Homeland Security will require managers at all levels of government to develop effective methods to collect, analyze, and share location-based data to do effective planning.

Organizations that already use GIS can build on their experience to dramatically improve their capability to plan for and reduce the consequences of terrorist attacks or emergencies. Those who are new to, or are considering GIS, can leverage the extensive geodata resources that currently exist to help their organizations implement Homeland Security strategies.

GIS can be used for consequence assessment and developing an emergency response plan by integrating data on the location of schools, neighborhoods, key infrastructures, and emergency personnel. Analysis can identify transportation choke points near bridges or overpasses. GIS can help city and emergency managers plan for different scenarios and

types of events and create the action plans needed to deploy personnel, vehicles, heavy equipment, fencing, and other important materials or resources.

GIS can also help manage data in real time, allowing emergency managers to make important decisions. Wireless technology allows for dynamic data exchange from field personnel back to the geodatabase. GIS integrates data on the fly, allowing emergency managers to visualize and analyze events as they unfold.

GIS Supports Emergency Planning and Analysis

The analysis milestones that support emergency planning exist today, independent of GIS technology. However, GIS enhances each phase of emergency planning with integrated views of data.

Homeland Security Milestones

Homeland Security activities can be grouped into five traditional milestones that are related by time and function to all types of emergencies or disasters. These milestones also relate to each other, and each involves different types of skills. In addition, in a dynamic and ever-changing world there may be activities that are nontraditional and not easily pigeonholed in traditional phases. Regardless, GIS can help managers make assessments and focus on where mitigation efforts will be necessary, where preparedness efforts must be targeted, where response efforts must be strengthened, and the type of recovery efforts that may be necessary. GIS facilitates all of the requirements of Homeland Security planning by allowing decision makers to view appropriate combinations of spatial data.
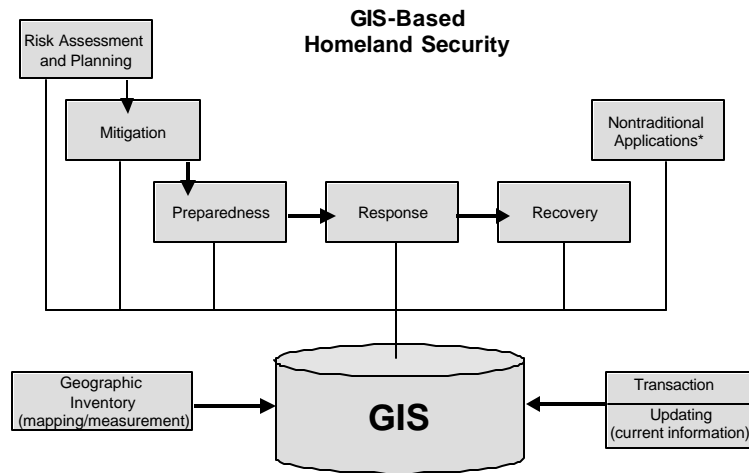
GIS plays a significant role in each milestone of the emergency planning process.

■ **Risk Assessment and Planning**

Activities necessary to analyze and document the possibility of a terrorist event, emergency, or disaster and the potential consequences or impacts on life, property, and the environment. This includes assessing the hazards, risks, and probability as well as a determination of mitigation, preparedness, response, and recovery needs.

■ **Mitigation**

Activities that actually eliminate or reduce the probability of a disaster (for example, improved airline security to thwart a terrorist attack or legislation that requires stringent building codes in earthquake-prone areas). It also includes long-term activities designed to reduce the effects of unavoidable disaster (for example, better counterterrorist intelligence, environmental health surveillance, and detailed cataloging of hazardous material locations and inventory).

■ **Preparedness**

Activities necessary to the extent that mitigation measures have not, or cannot, prevent terrorist events and other disasters. In the preparedness phase, governments, organizations, and individuals develop plans to save lives and minimize disaster damage (for example, compiling federal/state resource inventories, mounting training exercises, installing early warning systems, predetermining emergency response forces). Preparedness measures also seek to enhance response operations (for example, stockpiling vital food and medical supplies, performing training and mobilization exercises).

■ **Response**

Activities following a terrorist event, emergency, or disaster. These activities are designed to provide emergency assistance for victims (for example, search and rescue, emergency shelter, medical care, mass feeding). They also seek to stabilize the situation and reduce the probability of secondary damage (for example, shutting off contaminated water supply sources; cordoning off affected areas to prevent further injury, looting, or other problems) as well as to speed up recovery operations (for example, damage assessment).

■ **Recovery**

Activities necessary to return all systems to normal or better. They include two sets of activities: *short-term recovery* activities return vital life-support systems to minimum operating standards (for example, cleanup, return of power, temporary housing, access to food and water), while *long-term recovery* activities may continue for a number of years after a disaster. Their purpose is to return life to a predisaster state or to an improved level (for example, redevelopment loans, legal assistance, and community planning).

Risk Assessment and Planning

Homeland Security programs begin with locating and identifying potential emergency management problems.

Disaster events such as terrorist attacks, chemical/biological releases, wildfires, floods, epidemic spread, and hazardous material spills can be modeled and displayed in a GIS. This allows agencies to make comprehensive assessments and develop mitigation plans. Homeland Security personnel can use GIS for both strategic planning and for actual tactical deployment during a disaster.

Strategic Planning

Agencies and organizations at the state or regional level are often responsible for supplementing mitigation activities and secondary response support to local governments where disasters and emergencies occur. Providing additional resources, supplies, and emergency personnel to reinforce the local efforts are often the primary roles these levels of government fulfill. GIS can assist by displaying the locations of emergency resources and tracking ongoing incidents throughout a larger geographic region. Selecting and routing emergency resources, equipment, and supplies can be accomplished using GIS. GIS Internet applications can allow emergency managers to view the status of incidents, resources, and the overall situation from remote locations using a browser.

Tactical Planning

Local government agencies are responsible for initial planning and response to emergency incidents, disasters, and terrorist events. It often takes several hours for outside reinforcements to become available. Tactical planning relies on very detailed information concerning potential risks, hazards, and infrastructure protection needs.

Using GIS, officials can pinpoint hazards and begin to evaluate the consequences of potential attacks, emergencies, or disasters. For example, hazard data (fire hazard areas, flood zones, etc.) can be viewed with other map data (population density, strategic interests, streets, pipelines, power lines, etc.) to identify potential disaster hot spots. Such data may come from city/county/state/federal agencies, telecommunication companies, utilities, businesses, and other organizations. Emergency managers can begin to formulate mitigation, preparedness, response, and possible recovery needs. Lives, property, and critical infrastructures at high risk from potential attack or emergency become apparent.

Mitigation

Mitigation may include implementing legislation that encourages the creation of a detailed, enterprise GIS warehouse to improve understanding of the issues and, in the event of a homeland attack, dramatically improve response.

As potential emergency situations are identified, mitigation needs can be prioritized. Mitigation analysis can examine potential human injuries and infrastructure damages within the potentially affected area. GIS analysis can easily determine adjoining structures, utilities, and affected population areas. It can identify facilities that require reinforced construction or relocation. Other mitigation efforts may target hazardous material storage, building security buffers, or high-risk facilities such as electrical transmission lines. Risk assessment can be accomplished quickly and efficiently through GIS. More important, human life and other valuable resources (property, infrastructure, environmental, etc.) at risk from these emergencies can be quickly identified and targeted for protective action. GIS can identify the likely path of a flood based on topographic

features or the spread of a coastal oil spill based on currents and wind. Utilizing existing databases linked to geographic features in a GIS makes this possible.

Preparedness   Preparedness includes those activities that prepare for the consequences of emergencies that you cannot mitigate.

GIS can provide answers to questions such as

- Where are additional Urban Search and Rescue teams necessary to improve response time and capability?

- Where should fire stations be located if a five-minute response time is expected?

- How many paramedic units or ambulances are required, and where should they be located?

- What evacuation routes should be selected if a toxic cloud or plume is accidentally or intentionally released from a known plant, storage facility, or terrorist device based on different wind patterns?

- What are alternative routes?

- How will people be notified?

- Will the road networks handle the traffic?

- What facilities will provide evacuation shelters?

- What quantity of supplies, bed space, and so forth, will be required at each shelter based on the number of expected evacuees?

GIS can display "real-time monitoring" for an emergency early warning. Remote weather stations can provide current weather indexes based on location and surrounding areas. Wind direction, temperature, and relative humidity can be displayed by the reporting weather station. Wind information is vital in a chemical release or anticipating the direction of wildfire spread upon early report. Air quality, airborne pathogens, environmental health issues, radiation, and so forth, can all be monitored and displayed by location in a GIS. It is now possible to deliver this type of information and geographic display over the Internet for public information or the Intranet for organizational information delivery.

Response   During complex emergency events, it is difficult to locate or create vital geodata when power grids are out, buildings are damaged, and key personnel are committed to emergency operations.

GIS can provide one of the primary components for computer-aided dispatch (CAD) systems. Emergency response units based at fixed locations can be selected and routed for emergency response. The closest (quickest) response units can be selected, routed,

and dispatched to an emergency once the location is known. Depending on the emergency, GIS can provide detailed information before the first units arrive. For example, during an attack on a commercial building, it is possible to identify the closest fire hydrants, electrical panels, hazardous materials, and the floor plan of the building while en route to the emergency. For hazardous spills or chemical releases, the direction and speed of movement can be modeled to determine evacuation zones and containment needs. Advanced Vehicle Locating (AVL) can be incorporated to track (in real time) the location of incoming emergency units. AVL can also assist in determining the closest mobile units (law enforcement/fire/ambulance) to be dispatched, based on their mapped position through global positioning system (GPS) transponders.

During multiple emergencies (chemical release, explosions, multiple fires, flooding) in different locations, a GIS can display the current emergency unit locations and assigned responsibilities to all personnel within the Operations Center as well as to other groups needing the information. If these emergencies become a large-scale disaster, emergency response units arriving from outside the local area can be added, displayed, and (in the event that they have AVL) located rapidly within GIS.

Recovery   Recovery efforts begin when the immediate threat to life, property, and critical infrastructures has ceased to exist. Recovery efforts are often implemented in two phases: short term and long term.

Short-Term Recovery   Short-term recovery restores vital services and systems. This may include temporary food, water, and shelter to citizens who have lost their homes or have been displaced by a terrorist event. It means assuring that injured persons have medical care, restoring electrical services through emergency generators, reconnecting lines of communication, and so forth. The effects of the emergency may be continuous, but the immediate threats are halted, and basic services and vital needs are restored. A GIS can play an important role in short-term recovery efforts. One of the most difficult jobs in a disaster response is damage assessment. A GIS can work in concert with GPS to locate each damaged facility, identify the type and amount of damage, and help establish priorities for action (triage).

Laptop or handheld computers can update the primary database from remote locations through a variety of methods. A GIS can display (through the primary database) the damage assessment as it is conducted. Emergency distribution center supplies (medical, food, water, clothing, etc.) can be equitably appropriated to shelters based on population displacement and type of damage in each area. A GIS can also display the number of shelters needed and where they should be located for reasonable access.

A GIS can display areas where services have been restored to quickly reallocate recovery work to priority tasks. Action plans with maps can be printed outlining work for each specific area. Shelters can update inventory databases, allowing the primary command center to consolidate supply orders for all shelters. The immediate recovery efforts can be visually displayed and quickly updated until short-term recovery is complete. This "visual status map" can be accessed and viewed from remote locations by critical decision makers. This is particularly helpful for large emergencies or disasters where multiple efforts are ongoing at several different locations.

Long-Term Recovery   Long-term recovery means restoring all services to a predisaster state or better. Long-term recovery (replacement of homes, water systems, streets, hospitals, bridges, schools, etc.) can take several years. Long-term plans and progress can be displayed and tracked utilizing a GIS. Prioritization for major restoration investments can be made with the assistance of a GIS, and as long-term restoration is completed, it can be identified and visually tracked. Accounting for disaster costs can be complicated. As funds are allocated for repairs, accounting information can be recorded and linked to each location.

As evidenced by recent events, long-term recovery costs can be in the billions of dollars for large disasters. Accounting for how and where funds are allocated is a demanding but necessary task.

Challenges for Data Sharing   Because the most readily available and most useful geodata is in digital form, accessing digital geodata should be the first priority.

Geodata resources, and the expertise that build them, are highly dispersed, so a distributed architecture to facilitate maintenance and sharing is preferable to extensive data replication and the maintenance of massive centralized repositories. Relying on the Internet, or secure Intranets or Extranets, to access data also has the direct advantage of keeping data resources dispersed and therefore potentially less vulnerable to a direct threat. Security can be further enhanced by such devices as mirror sites, remotely stored backup copies, permanent archiving, and sophisticated firewalls. Leaving these data resources in the hands of those who created them also increases the likelihood that data will be current and of high quality.

Managing access to geodata may present a considerably more difficult challenge for Homeland Security. There is a long history of disagreement on the issue of geodata sharing both within the United States and in the rest of the world. No two countries have quite the same policies and procedures for the use of geodata, and there is no settled and accepted law or custom on this matter. Intellectual property rights, ownership, the right to change or modify the geodata, the means of paying for use, the appropriate charges, the control of who can access the data and for what purpose, permission for a user to modify the geodata, permission to resell the geodata, the means of access, the extent of the user community, and many other concerns are resolved in different ways by different organizations that own or maintain digital geodata.

Some of these practices are founded on competitive considerations. The data may represent 90 percent or more of the total cost of a GIS. In the case of governments, the petroleum industry, the mining industry, the forest industry, large municipalities, and others, these costs easily run to billions or tens of billions of dollars. In the minds of some members of the public, geodata is often closely associated with the organizations that created or maintain the geodata, so the organization's reputation or image is wrapped up with its data products.

Some of these practices are founded on security or privacy concerns. Intelligence data, or military or law enforcement data, typically is shared under severely restricted conditions and usually is maintained within an organization or community of organizations at a

given level of government. Homeland Security may well require the sharing—and protection—of information among and by nontraditional partners.

Fostering new sharing arrangements may require some combination of an executive order, new federal legislation (and perhaps resulting court decision), creation of a special class of restricted or classified data, and funds for expanding controlled access to geodata.
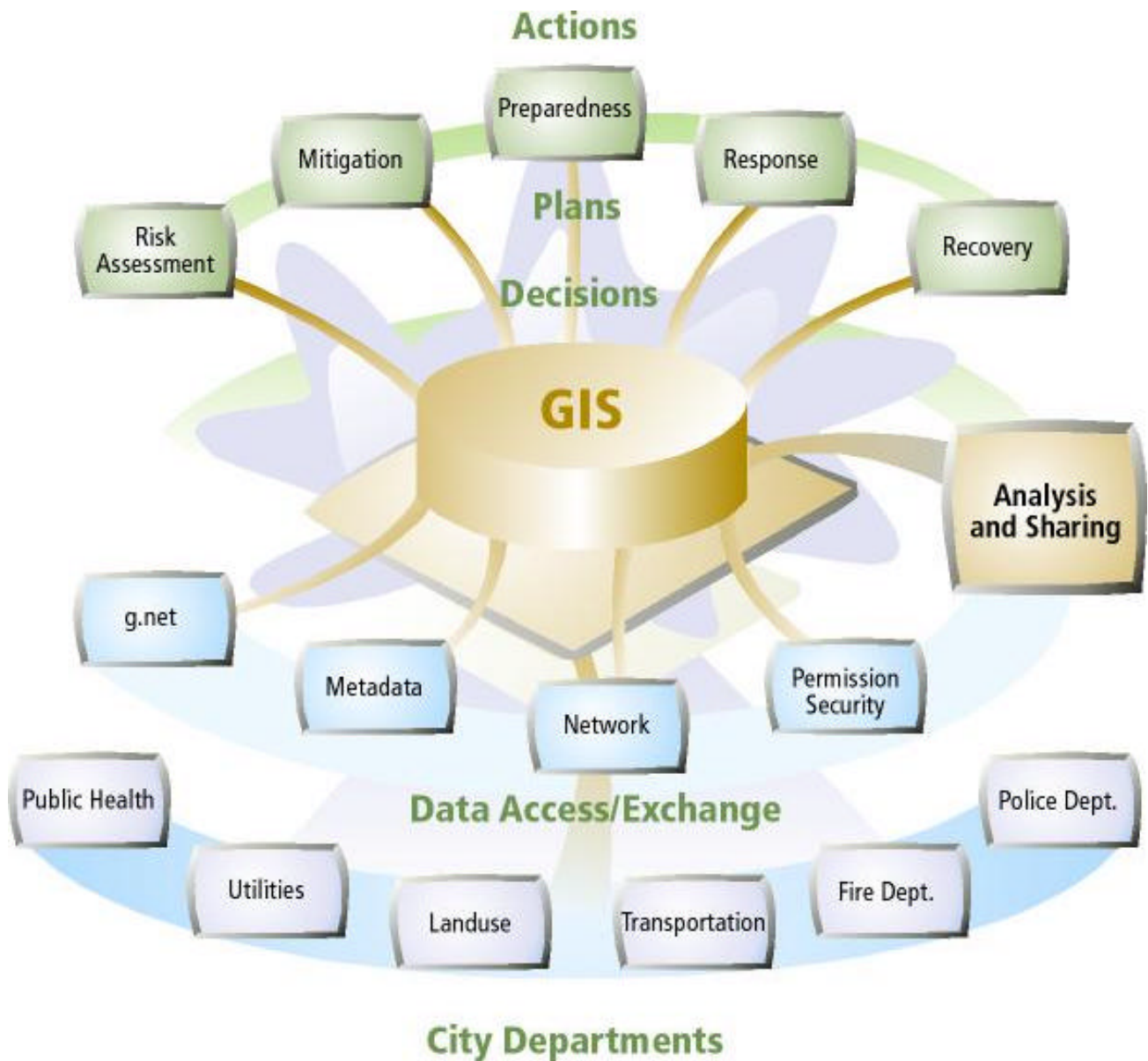
Nevertheless, there are many examples of geodata sharing agreements that suggest that geodata sharing for Homeland Security can be worked out, with patience and goodwill on all sides. For example,

■ Because of the recognized high cost of creating or updating land use data for large municipalities or large urban areas, cities, counties, and utilities have formed alliances that, over time, collect and maintain land use geodata with cost sharing, division of labor, and the data sharing of the resulting resources.

■ Federal agencies have entered into agreements with other levels of government to create digital geodata and shared this data once it was created.

■ The federal government has in place a policy on data sharing. Many other organizations also have such policies, though their terms may be so onerous that they will discourage or prevent the use of their data in so vast and dispersed an activity as Homeland Security.

Data Sharing Strategies

Geography Network

The technology exists today to support remote access to data sets in a secure, sharable, distributed, Homeland Security Geography Network℠.

The value of building data warehouses for each community as well as obtaining permissions and access to invaluable proprietary data sets cannot be stressed enough. Gathering data to create a GIS to meet potential emergencies requires an immediate and concentrated effort. It is far easier to accomplish this task *before* an attack or emergency than in its aftermath.

Imagine any community trying to put together the necessary data for response and recovery during a terrorist event or in the immediate aftermath of that event. Even within local government entities it is not unusual to find many departments that do not share any, or only parts, of their data. Extend this to the county, regional, state, and federal governments, and it becomes evident that there are thousands, if not hundreds of thousands, of information silos—all containing valuable information to Homeland Security. Adding to this problem is the proprietary information contained in databases controlled by utilities, water companies, pipeline companies, telecommunications, and other entities.

The critical effort should be the creation of a centralized spatial database for each community, county, state and, ultimately, the federal government. For those databases that are proprietary or controlled for security reasons, the effort should be to obtain advance permissions and/or access codes to secure the information when a disaster occurs. That access could be in the form of a secure link with coded access. This type of approach allows us to create a secure, sharable, distributed database for spatial information that can make communities more resistant to attacks/disasters as well as more responsive to an actual event. This network can be based on g.net architecture, creating a Geography Network for Homeland Security.

Metadata   Another major issue is that of metadata, or data about data. When was the data created? What is contained in the data set? Who created it? What are the conditions for its use? The better the metadata, the more effective and useful the mapping and analysis efforts generated from it.

The data issues are challenging but manageable. GIS data sharing among agencies is completely feasible with existing nonproprietary formats for geodata, established federal standards for metadata, and Internet access to shared databases. While a national data set needs to be accumulated, Homeland Security begins at home—in communities, towns, and cities throughout the country.

ESRI Solutions   ESRI's range of products and integrated technologies is the proven standard for public safety departments within federal, local, and state government. We also work with a strong group of business partners specializing in developing GIS-based solutions for the public safety industry.

ESRI's GIS software products, professional services, and business partners can play a vital role in Homeland Security. GIS is already used in disaster response and can be readily adapted to new Homeland Security initiatives. And because ESRI® software is standards-based and integrated, it provides an open enterprise solution for GIS needs in organizations of all sizes, from local to national. See www.esri.com/software/ for more information on ESRI software.

ArcGIS   ArcGIS™ is a scalable system of software for geographic data creation, management, integration, analysis, and dissemination.

The ESRI ArcGIS software suite is the first industry-strength GIS that provides vital scalability and performance for deployment throughout a government enterprise.

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ArcGIS Solutions for Homeland Security

The ArcGIS software suite offers industry-strength GIS tools that provide the vital scalability and performance for deployment throughout the homeland security enterprise.

Enterprise Solutions   ArcGIS meets the challenge of providing the data and services to support Homeland Security. Sophisticated functionality, such as editing, analysis, and modeling, along with cutting-edge data models and management, continue to distinguish the ArcGIS software family as the leading GIS software. Users can deploy multiple ArcGIS clients.

ArcInfo   ArcInfo™ is the professional GIS system with capabilities for automation, modification, management, analysis, and display of geodata.

ArcView   ArcView®, the world's most popular desktop mapping and GIS software, is a powerful tool for management, display, and analysis of spatial information.

ArcEditor   ArcEditor™ software includes all the functionality of ArcView and adds the power to edit features in a multiuser geodatabase. Additional functionality includes support for multiuser editing, versioning, custom feature classes, feature-linked annotation, dimensioning, and rasters in a multiuser geodatabase.

ArcGIS servers meet their needs for scalable GIS solutions.

ArcSDE   ESRI's ArcSDE™ is client/server software that allows storage, management, and quick retrieval of spatial data from leading commercial database management systems.

ArcIMS   ArcIMS® software is the foundation for distributing geodata and applications on the Internet.

Field Data Collection

ArcPad   ArcPad™ is an easy-to-use, lightweight, low-cost solution for mobile mapping and field-capable GIS. ArcPad enhances portable touch screen computers with intuitive mapping, GIS, and GPS functionality. ArcPad makes field data collection fast and easy, improves data accuracy, and provides immediate data availability and validation.

Services   ESRI offers professional services to help users move through the GIS implementation process quickly and efficiently through technology transfer.

The ESRI Professional Services Division has ongoing projects with local, state, and federal agencies. Through these projects, ESRI has developed a working knowledge of data and application needs for these organizations. ESRI's Professional Services Division has the skills needed to build large-scale databases, develop agencywide applications, and rapidly deploy GIS experts to crisis locations.

See www.esri.com/consulting/ for more information on ESRI's Professional Services Division.

Business Partners   ESRI works with a strong group of business partners who specialize in GIS-based solutions for use in public safety analysis including crime analysis/pin mapping, E-911/CAD/RMS systems, mapping interfaces, vehicle tracking, vehicle routing, beat/reporting district allocation, law enforcement aviation maps, and many other uses.

ESRI business partners have available today commercial off-the-shelf software built on ESRI core products that are immediately deployable in emergency situations. See www.esri.com/partners/ for more information on specific software products from ESRI partners.

Summary   Homeland Security programs will be developed and implemented through analysis of information. The vast majority of this information is spatial and can be brought into a

GIS and mapped. Once this occurs, Homeland Security analysis and planning can begin. When information on life, property, and critical infrastructures is combined with risk and probability, managers can formulate mitigation, preparedness, response, and recovery program needs.

Appendix

Definitions

Homeland

Our homeland is the geography where we live. To understand our homeland is to understand our geographic diversity. These are different ways to think about geography. As we strive to secure our homeland, geography and geographic information play a role in how we go about defense.

- **Physical geography:** What is physical geography? It is the mountains, the lakes, the valleys, the plains, the forests…it is everything that makes up our homeland. However, think about the differences that these geographic areas instill on our national defense. For example, we need different responses for different terrains. We need helicopters or boats or all-terrain vehicles depending on where we are.

- **Natural resource geography:** This country contains many valuable natural resources: the water in our lakes, oil and gas, timber, and our food supply. How do you protect these? Each of these natural resources varies in their characteristics based on geography.

- **Cultural geography:** Our nation has both natural and man-made features (i.e., our built environment), all of which could be subject to terrorism. The cities where we live, the religious institutions where we worship, and the medical facilities that help ensure our well-being require security. We have symbolic man-made features such as the Statue of Liberty and other pristine natural treasures such as Yellowstone National Park.

- **Social geography:** Where do people live? What are their demographics? As we strive to protect our citizens and their values and differences, we must understand their geographic characteristics.

- **Economic geography:** Our business, transportation, telecommunication, energy, and other industries that are critical to our national economy.

Security

One of the primary responsibilities of any government is to provide for the safety of the nation, communities, and individual citizens. In today's environment the same responsibilities apply to businesses, institutions, and other organizations. An organization or country cannot achieve security without good information (intelligence), and although the old axiom that "knowledge is power" may have some merit, it is in the *sharing and distributing* of this information that *real* power is found.

Terrorism

Terrorism is the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.

Emergency

An emergency is a deviation from planned or expected behavior or course of events that endangers or adversely affects people, property, or the environment.

Disaster

Disasters are characterized by the scope of an emergency. An emergency becomes a disaster when it exceeds the capability of local resources to manage. Disasters often result in great damage, loss, or destruction.

General Types of Emergencies

Attack

This includes acts of large-scale terrorism or war using nuclear, conventional means, chemical agents, biological agents as well as other nonconventional means as recently demonstrated by the horrific events in New York; Washington, D.C.; and Pennsylvania.

Human-Caused Emergencies

Human-caused emergencies include those unplanned events or accidents that result from human activity or human developments. Examples include chemical spills, nuclear radiation escapes, utility failures, epidemics, crashes, explosions, and urban fires.

Natural Disasters

Natural disasters include those unplanned events that occur as a result of natural processes such as earthquakes, tornadoes, tsunamis, freezes, blizzards, extreme heat or cold, droughts, and insect infestations.

Internal Disturbances

Internal disturbances are those events or activities planned by a group or individual to intentionally cause disruption. These include riots, demonstrations, large-scale prison breaks, violent strikes, and so forth.

Energy and Material Shortages

Emergencies, as a result of shortages and/or sabotage, include resource scarcity, strikes, price wars, and so forth.