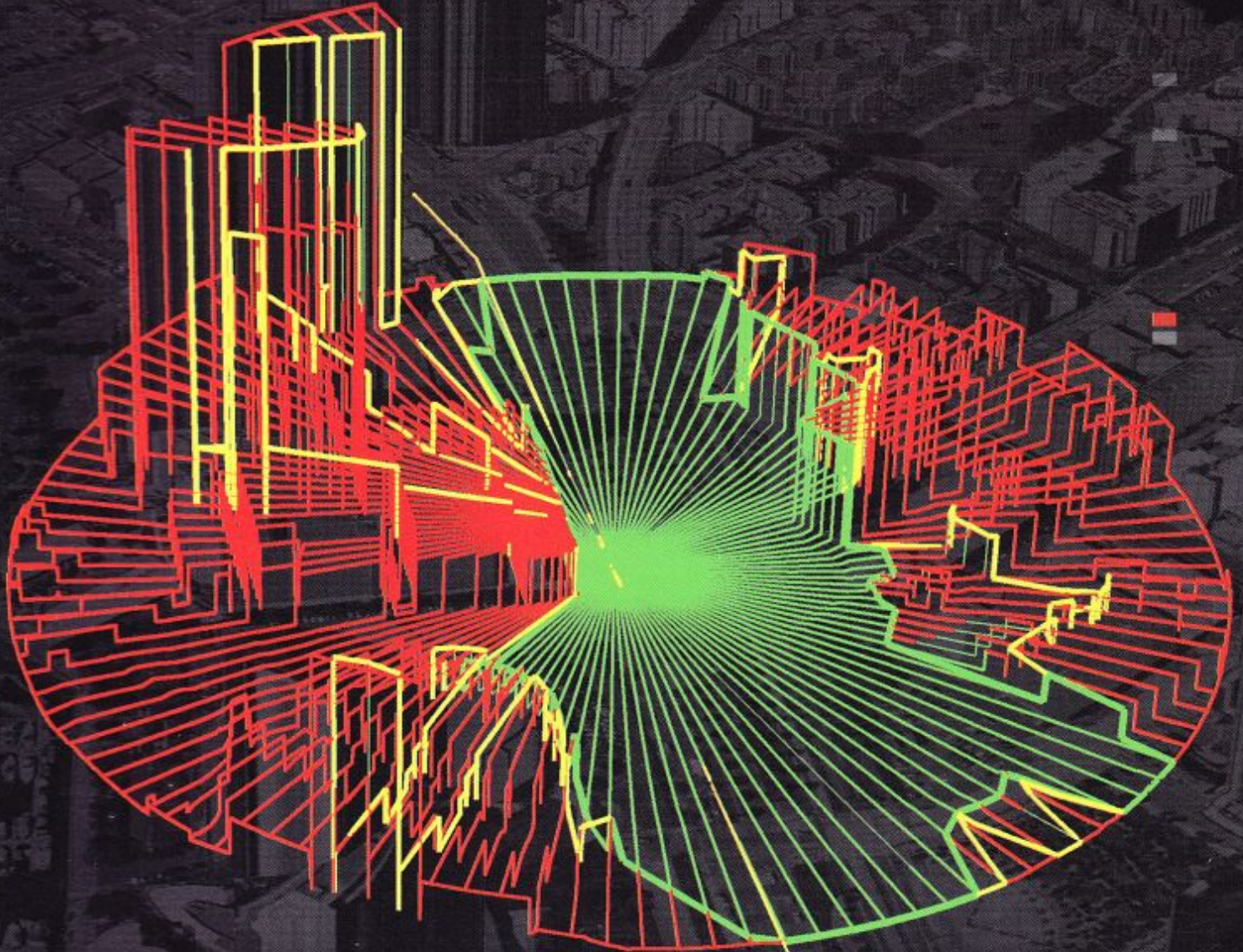


NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

PATHFINDER

The Geospatial Intelligence Magazine

JULY / AUGUST 2005



Protecting Our Homeland with GEOINT

>>Agency Helps Build DHS While Supporting Fast-Paced Operations

>>Border Security Gets a Fresh Look

>>New Command Reflects Military Resolve



ON THE COVER

NGA is empowering homeland-defense experts to perform dynamic line-of-sight analyses based on virtual environments like this one of San Diego, created from airborne commercial imagery. Laura Garber designed the cover, based on a concept by Leon Samuels.

GETTING PUBLISHED

All members of the geospatial intelligence community are welcome to submit articles of community-wide interest. Articles are edited for style, content and length. The copy deadline is the last Friday of the third month before publication. For details on submitting articles, e-mail the Pathfinder. Our address is pathfinder@nga.mil.

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Contents

About the Authors 4

Letter to Our Readers 5

On My Mind 6

FEATURES

NGA Plays Central Role in Homeland Defense 8

Agency Helps Build DHS While Supporting
 Fast-Paced Operations 11

New Command Reflects Military Resolve 14

Border Security Gets a Fresh Look 17

Connectivity Is Key at Special-Security Events 19

GEOINT Enhances Stateside Force Protection 21

DEPARTMENTS

Our Heritage: Above the Earth to Know the Earth 24

21st Century: NGA Pioneers Homeland
 Security Database 25

Industry: Collaboration Improves Homeland
 Security Data 27

Partnerships: NGA and USGS Focus on
 Homeland Security 29

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Protecting Our Homeland— with GEOINT

Letter to our Readers

NGA has taken on a new mission and geospatial intelligence (GEOINT) has found a new end use with homeland security. In this Pathfinder, we look at GEOINT from the vantage point of all those who protect our homeland.

In past issues we focused on the power of GEOINT to help American forces achieve dominance in any situation. We also highlighted GEOINT's unsurpassed navigational capability to show the way to people on the move everywhere. Now we want you to look at the protection provided by GEOINT as the first line of defense against threats to our homeland.

Our lead article describes the sheer scope of the Agency's efforts, in our post-9/11 world, as developer, broker and integrator of GEOINT created to protect our homeland. Beyond providing the nation's first comprehensive homeland-security infrastructure database, NGA is providing systems that give customers Web access and people to assist with analysis—on site and online.

While participating in a rapid succession of security events, disasters and exercises, NGA's Department of Homeland Security Support Team has also been involved in developmental efforts, the next article shows. The goal is to establish GEOINT capabilities at all levels of the department and across its many components.

Of course homeland security has a military dimension. NGA has initiated several efforts, among them the proactive embedding of GEOINT into the front end of U.S. Northern Command's key processes.

In other articles, NGA's border experts are using the latest visualization technology and leading an interagency issues group to give border security a fresh look. And to support special security events, NGA has re-engineered the mobile support capability we used in Iraq and Afghanistan for use in settings as small as a hotel room. Still another team is taking the initiative to help military installations analyze their security issues and develop solutions.

Three departments look at homeland security: "21st Century" discusses the challenges NGA faces in building the nation's first comprehensive homeland-security infrastructure database. "Industry" describes the remarkable cooperation among disparate companies and NGA to populate the database with the most accurate data possible. And our "Partnerships" department spotlights a new cooperative effort of NGA and the U.S. Geological Survey to provide a unified approach and comprehensive information.

In the next Pathfinder, we'll look at technology from the vantage point of the many contributors helping NGA keep the promise of GEOINT. Thanks to Congress, industry, end-users, NGA people and many other contributors, GEOINT continues to make a revolutionary difference.



Mark Schultz
Director, Office of Corporate Relations



On My Mind

Supporting Homeland Security

NGA Is Helping to Dissolve Old Barriers and Build New Partnerships

By Lt. Gen. James R. Clapper, Jr., USAF (Ret.), Director, National Geospatial-Intelligence Agency

On June 29 President Bush endorsed 70 of the 74 recommendations of the Weapons of Mass Destruction (WMD) Commission from its March 30 report on our nation's intelligence capabilities. From the establishment of an Assistant Attorney General, who will centralize the Department of Justice's national security matters into a single office, to the implementation of programs that will facilitate information sharing within the government, with the private sector and with our foreign allies, many of the endorsed recommendations will undoubtedly enhance our nation's homeland security capabilities. For NGA and our Intelligence Community partners, many of these recommendations will also help us dissolve old barriers between foreign and domestic intelligence activities to enhance homeland security/homeland defense efforts.

As many of you already know, NGA has been doing its part—morphing our foreign-intelligence capabilities into a domestic context that can support homeland-defense efforts. Prior to the tragic attacks of Sept. 11, 2001, our predecessor organizations

largely applied their intelligence capabilities to military tactical missions in an overseas context. Although they had a disaster-relief mission to assist in the after-

math of U.S. natural disasters, they were generally not as involved in large-scale homeland-security efforts.

“...our nation no longer has the luxury of maintaining divisions between its foreign and domestic intelligence structures...”

Providing a Common Operational Picture

After 9/11 and with onset of the global war on terrorism, we quickly began to apply the tactics, techniques, procedures, products, services and solutions that we have long used in an overseas context to a domestic context. We began to translate and transform our mission to meet this

new demand. From the 2002 Olympics in Salt Lake City to the 2005 Presidential Inauguration and Super Bowl, our Agency and its deployable teams have provided a common operational picture and geospatial depictions for other federal, state and local agencies to use in homeland security operations.

We will continue to see homeland security/homeland defense support as a part of our overall mission. In response to the President's endorsement of one of the WMD Commission's recommendations, Air Force Lt. Gen. Michael V. Hayden, Deputy Director of National Intelligence, stated that our nation no longer has the luxury of maintaining divisions between its foreign and domestic intelligence structures because “our enemy does not recognize that distinction.”

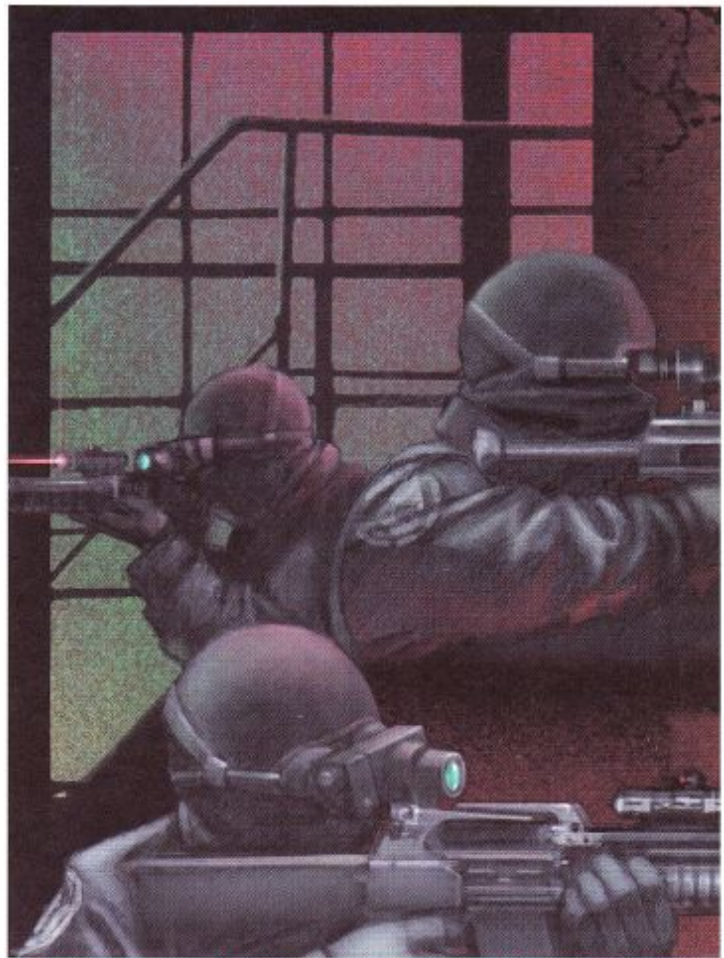
Building New Partnerships

NGA will continue to work with all levels of government to ensure that these barriers do not hinder national security efforts. Our recently established NGA Support Team (NST) at the Federal Bureau of Investigations is one such example. A small team

“We are proud to play a role in supporting the FBI’s new National Security Service...”

of NGA analysts is being placed at the FBI to support the Counterterrorism and Foreign CounterIntelligence Divisions. Our FBI NST will provide reach-back into NGA for our products and services. The team will also define and build mission-specific data sets to support FBI operations in the areas of counterterrorism and counterintelligence. We are proud to play a role in supporting the FBI’s new National Security Service, which the President endorsed on June 29.

As the need for our products expands to support national intelligence users as well as U.S. tactical forces, NGA will continue to sustain a culture of excellence to satisfy our increasing array of customers. As our mission has grown and expanded to include a central role in homeland defense, we have formed enduring partnerships



NGA’s support team at the FBI is defining and building data sets to support specific missions.

with both our colleagues and customers that will help everyone involved achieve national security goals.

James R. Clapper, Jr.
Lieutenant General, USAF (Ret.)
Director

NGA Plays Central Role in Homeland Defense

By Monica Gaughan

NGA's North America and Homeland Security Division stood up the day after Sept. 11, 2001. A small number of analysts, carved out of the Office of Americas, immediately began to focus skills and tradecraft they had applied to areas beyond our borders to protecting our homeland. The new staff joined with an analytic staff that had long supported the Agency's disaster readiness, response and recovery mission.

Since its standup, the division has dedicated itself to providing the best available geospatial intelligence (GEOINT) to protect the homeland. The scope of these efforts has made NGA, in our post-9/11 world, the developer, broker and integrator of GEOINT created to protect our homeland. At the same time, NGA is providing systems that give customers Web access and people to assist with analysis—on site and online.

Using the U.S. Geological Survey's National Map as the foundation, the division has provided the nation its first comprehensive homeland-security infrastructure database. Called the Homeland Security Infrastructure Program, it combines

imagery, geospatial data and intelligence pertaining to critical infrastructure into a single, integrated database. With this database, federal decision makers and operational planners have a common frame of reference for:

- daily threat assessments,
- critical infrastructure vulnerability analysis, and
- domestic crisis response and consequence management.

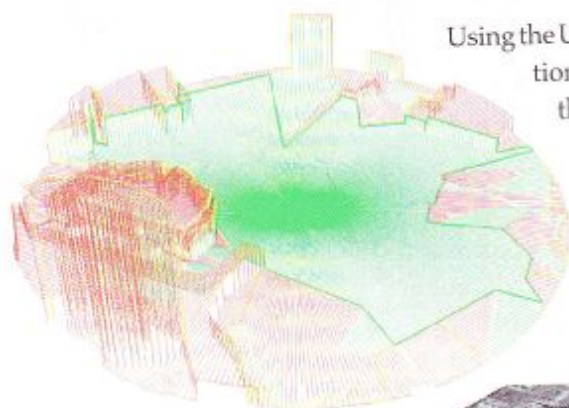
NGA Brokers the Data

Through its development of the infrastructure database, NGA has moved to the forefront of the homeland-security community as a broker of imagery, elevation data and vector data sets (graphics-based geographical features).

In 2004, NGA contracted for the acquisition and integration of airborne imagery over 83 high-priority urban areas. For many of these areas, analysts used the imagery to create high-resolution three-dimensional models and visualizations.

The Agency also obtained local imagery and vector data from cities hosting special-security events. For example, NGA partnered with the City of New York in the collection of six-inch resolution, color airborne imagery over all five boroughs—critical to the support NGA and the Department of Homeland Security provided to the Republican National Convention.

Besides imagery, NGA acquired and integrated a variety of data sets on 11 critical infrastructure sectors identified by the Department of Homeland Security.



NGA analysts are using newly collected airborne imagery to create high-resolution three dimensional models and visualizations of urban areas.





Photo courtesy of the White House Media Center

On short notice, NGA provided on-scene support to the funeral of former President Ronald Reagan in Washington, D.C., above, and Simi Valley, Calif. Since the standup of the North American and Homeland Security Division, the Agency has supported many national special-security events through pre-event planning and the deployment of imagery and geospatial analysts.

From across the country, including the Canadian and Mexican borders, more than 1,500 data layers were added to the infrastructure database.

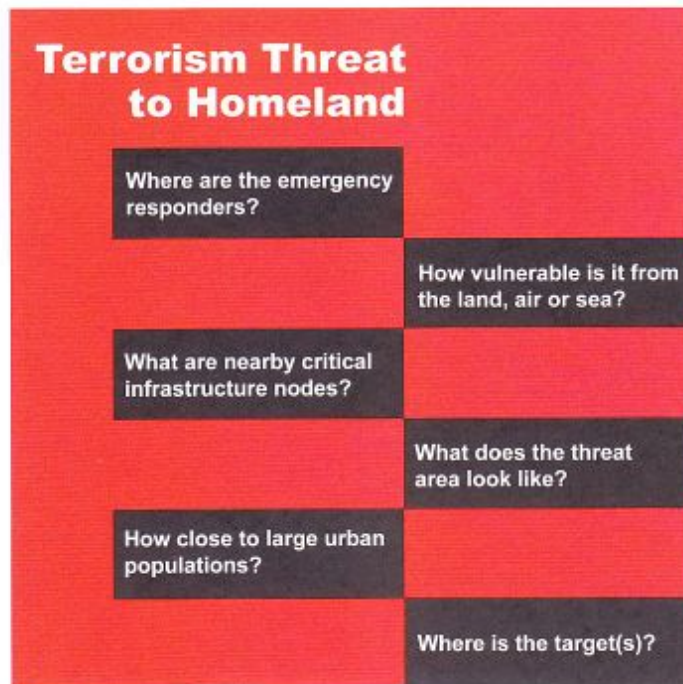
Access to the infrastructure database is through a Web-based system developed by ESRI, the Environmental Systems Research Institute, Inc. Inaugurated in 2004, Palanterra™ provides users a common operational picture on multiple networks that empowers them to visualize, analyze and act upon the latest GEOINT in real time. Users include the Department of Homeland Security's Homeland Security Operations Center, White House Situation Room, U.S. Northern and Joint Forces Commands, FBI, National Counterterrorism Center and the Transportation Security Administration's Transportation Security Operations Center.

Analysts Sit with Customers

NGA has supported numerous national special-security events through pre-event planning and the deployment of imagery and geospatial analysts. These events have included everything from the Super Bowl to the Presidential Inauguration. NGA has also continued and expanded its support to disaster readiness and recovery operations with the development of new types of products. It has expanded its support to the national interagency firefighting community, and it was fully engaged in numerous civil and military homeland-security exercises.

Deployed analysts sat in the customer's footprint, equipped with a complete suite of analytic tools and the best GEOINT available to solve any problem. Sometimes they deployed with only a few hours' notice.

The Geospatial Intelligence Readiness Challenge



NGA's Homeland Security Infrastructure Program gives decision makers and operational planners a single, integrated database that combines imagery, geospatial data and intelligence pertaining to critical infrastructure nationwide.

During the G-8 Summit in Sea Island, Ga., NGA received word that former President Reagan was close to death and that his funeral would be a special-security event. The funeral would be conducted both in Washington, D.C. and Simi Valley, Calif. Fortunately NGA already maintained significant data over the Washington Capital Region. Simi Valley, however, was a different case. NGA contacted the U.S. Geological Survey partners for assistance and by the time the deployed geospatial analysts arrived in California, they had the local data they needed.

NGA also responded to four hurricanes that hit Florida in 2004 in what became the largest relief effort in the history of the Federal Emergency Management Agency (FEMA). Analysts gathered, integrated and assessed geospatial and imagery information and conducted strike probability and vulnerability analyses that were critical to pre-positioning supplies in the hardest-hit areas. After impact, NGA analysts provided damage-assessment information to FEMA and first-responders that helped direct disaster managers to the hardest-hit areas.

After the first hurricane, Charley, NGA analysts deployed within 24 hours to provide tailored GEOINT to the FEMA Disaster Field Office. As an example, the analysts produced geospatial products that helped local officials select safe temporary housing sites for some 15,000 victims.

NGA supported efforts of the National Interagency Fire Center to fight wildfires in Alaska throughout the summer fire season. Analysts assessed more than 2.5 million acres of forest and provided critical infrastructure information for daily operational meetings.

The division also supported the U.S. Northern Command in two exercises. Members of the NGA Support Team assigned to NORTHCOM received "reach-back" support from division elements in St. Louis and Washington, D.C. Meanwhile, the division supported the FBI in an exercise aimed at safeguarding oil reserves in Oklahoma.

Depending on the event, NGA has demonstrated the capability to develop products tailored to specific requirements. Although Palantir™ has become the system of choice, NGA has developed a series of hardcopy event books and multimedia products to give customers alternate formats to suit their individual business models.

New Products, New Customers

NGA continues to develop the Homeland Security Infrastructure Program and expand the available data layers. The Agency is working with the Department of Homeland Security to make the data available to state and local process holders.

NGA's role in homeland security has led to a widely expanded customer base. It is NGA's goal to be the information provider of choice for all customers involved in homeland security, as the Agency strives to find new and different applications of GEOINT to varied homeland-security issues.

Agency Helps DHS Build Capabilities While Supporting Fast-Paced Operations

By Sue Hall

In less than a year, the Department of Homeland Security (DHS) NGA Support Team has supported a rapid succession of activities. The list includes: the Democratic and Republican Conventions, presidential election, inauguration, State of the Union address, Super Bowl, a Congressionally mandated homeland-security exercise, three orange-level threat periods and several disasters, not to mention two Asia-Pacific Economic Cooperation (APEC) summits and the G8 and NATO summits.

A 25-foot Defender-class security boat keeps an eye on passenger vessels and high-profile landmarks as it patrols New York Harbor. NGA supports Coast Guard intelligence centers with actionable intelligence for operational commanders.

On-site teams with the capability to reach back to NGA for more support provided all of the Agency's geospatial-intelligence (GEOINT) for these events.

Despite the intense operational pace, the NGA Support Team is actively involved in many developmental initiatives of the Department as it focuses the nation's attention, as never before, on homeland security.

The scope of NGA's activities is referenced in a certificate of appreciation presented to NGA Director retired Air Force Lt. Gen. James R. Clapper Jr., signed by retired Army Lt. Gen. Patrick Hughes, Acting Under Secretary for Information Analysis and Infrastructure Protection, on behalf of the Department.



Department of Defense photo by Petty Officer 3rd Class Kelly Newlin, U.S. Coast Guard

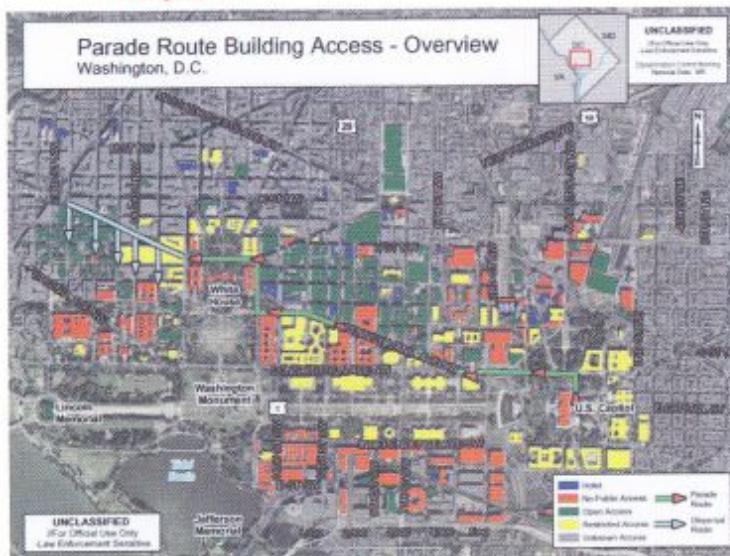
“NGA’s visionary dedication to the mission of DHS and to the protection of the homeland has manifested itself in myriad pursuits,” the citation says. “From the presence of superb NGA professionals in DHS to the wide range of high-quality support products for every DHS mission requirement, NGA has been a foundation upon which DHS success has been built.”

Foremost among NGA’s support activities is a plan to establish GEOINT capabilities throughout the Department of Homeland Security operating environment. The plan’s key component is an Infrastructure Critical Asset Viewer (iCAV), comprised of NGA’s database of homeland-security infrastructure and Palantira™ software, an application that enables users to share homeland-security information online. With the iCAV, NGA aims to provide the Department its first real-time common operational picture of the nation’s critical infrastructure and key resources. (An article about Palantira™ appeared in the January-February 2005 *Pathfinder*.)

Supporting All Levels

As indicated by the citation’s reference to “myriad pursuits,” NGA Support Team members work throughout the Department of Homeland Security, from senior staff offices to the homeland security operations center.

NGA provides custom graphics for national-security special events like this “Parade Route Access” graphic for the Presidential Inauguration.



In the operations center, NGA analysts are supporting efforts to coordinate the homeland-security operations of federal intelligence agencies and state and local law enforcement. The center operates 24 hours a day, seven days a week, 365 days a year.

At the same time, Support Team members are helping to develop the GEOINT component of the operations center’s counterterrorism communications system. The center’s director has designated the GEOINT component as the primary platform for real-time threat analysis and collaboration.

Meanwhile, NGA analysts supporting the infrastructure-protection program at the Department of Homeland Security are using GEOINT to assess the vulnerabilities of critical infrastructure. The project continues to evolve in the context of a changing threat environment.

For border and transportation security, NGA is providing GEOINT for daily reports various DHS elements submit to senior staff. The role involves coordinating geospatial requirements of the U.S. Border Patrol, U.S. Customs Service, Transportation Security Agency and several other organizations. The NGA Support Team for the U.S. Northern Command and the Office of the Americas assist in this effort, along with NGA’s Center for Advanced Geospatial Intelligence and the Office of Transnational Issues.

New Maritime Support

NGA analysts are providing direct support at the Coast Guard’s Intelligence Coordination Center, which analyzes threats to maritime, port and critical infrastructure. Besides providing customized products on site, the analysts are supporting the development of a Port Geographic Information System for the Coast Guard, with NGA data and both commercial and national imagery.



Photo courtesy of the White House Media Center

NGA has provided on-site support to a rapid succession of national-security events like the Presidential Inauguration.

NGA is also supporting the Coast Guard's new Maritime Intelligence Fusion Centers with enhanced GEOINT for their maritime domain awareness mission. Located in the Atlantic and Pacific areas, the centers provide actionable all-source intelligence to operational commanders.

An NGA staff officer at Coast Guard headquarters is assisting with several initiatives. These include expanding the Coast Guard's imagery intelligence program, fielding an enterprise geographic information system that incorporates both national data sets and Coast Guard-unique features, and developing a common operational picture to replace an existing command-and-control system. NGA recently helped the Coast Guard incorporate two NGA applications (HarborView and the Digital Reconnaissance Mapping Tool) for use in port security and critical infrastructure protection.

Traveling with the Secret Service

Geospatial intelligence has become an integral part of several facets of Secret Service operations. When the President travels in the United States, NGA's representative provides products and services tailored to the specific itinerary, including scene visualizations and geospatial vulnerability assessments, which integrate threat information into a geospatial context. This

geospatial analyst also regularly travels with the protective detail overseas.

NGA also supports the Secret Service on site during national-security special events with GEOINT for situational awareness and a common operational picture. This support is shared with other entities, including the CIA, Department of Defense, National Security Agency and White House military office.

At home, NGA supports efforts of the Secret Service to assess physical-security measures at the White House and presidential ranch in Crawford, Texas, Camp David, Md. and Andrews Air Force Base, Md. Secret Service intelligence relies on NGA for GEOINT to study terrorism trends and tactics.

Expanded Role in Disasters

NGA has helped the Federal Emergency Management Agency (FEMA) prepare for and respond to disasters for more than 12 years. Agency support continues to include both geospatial data and imagery-derived products. As an indication of the usefulness of these products, NGA now plays an expanded role, participating in disaster teleconferences at the Department of Homeland Security to ensure that the Agency is collecting and analyzing imagery of the highest-priority areas.

NGA assessments were instrumental in deciding where to send critical assets and resources following the four hurricanes that struck Florida last year. As part of Homeland Security, FEMA continues to receive an expanding array of tailored products and services through NGA's dedicated Disaster Response Branch.

In short, the NGA Support Team provides crucial support to the DHS mission of leading the unified national effort to secure America, prevent and deter terrorist attacks, and protect against and respond to threats and hazards to the nation.

New Command Reflects Military Resolve

By Steve Davila

The horrific events of Sept. 11, 2001 had a strangely dichotomous effect on the psyche of most Americans, an effect not experienced since the attack on Pearl Harbor: We were painfully made aware of our national vulnerabilities while simultaneously being filled with a powerful resolve to prevent similar events from happening in the future.

The result has been the continuous implementation of the most dramatic series of procedural and organizational changes in the federal government since the end of the Cold War. One of the most significant changes has been the standup of the U.S. Northern Command (NORTHCOM), the first military organization assigned the primary mission of homeland defense since George Washington's Continental Army.

NORTHCOM has a twofold responsibility: prevent, deter and defeat aggression against the United States, and provide military assistance to civil authorities. The geospatial-intelligence (GEOINT) needs encompassed within this mission space are enormous: from situational understanding of foreign strategic and terrorist threats to assessments of critical domestic vulnerabilities; from GEOINT preparation of the environment to supporting disaster relief and consequence management operations; from supporting military assistance to national special security events to providing a common operational picture that can be shared by military, federal civil, state and local units alike.

The NGA Support Team assigned to the U.S. Northern Command supports military assistance provided to national special-security events like the G8 Summit in Georgia below.



Embedding GEOINT

The NORTHCOM NGA Support Team provides tailored support to exercises and real-world operations on site as required through a combination of permanently assigned analysts and augmentees on temporary duty. These team members reach back to NGA's Office of Americas/North America and Homeland Security Division, and other NGA elements to obtain extensive indirect support as well. The team conducts or facilitates:

- Interaction between Command and NGA subject-matter experts,
- On-site training for Command analysts,
- Imagery and geospatial process and policy reviews/changes,
- Support to key Command functions and forums.

The team has initiated several important efforts, the most significant being the proactive embedding of GEOINT into

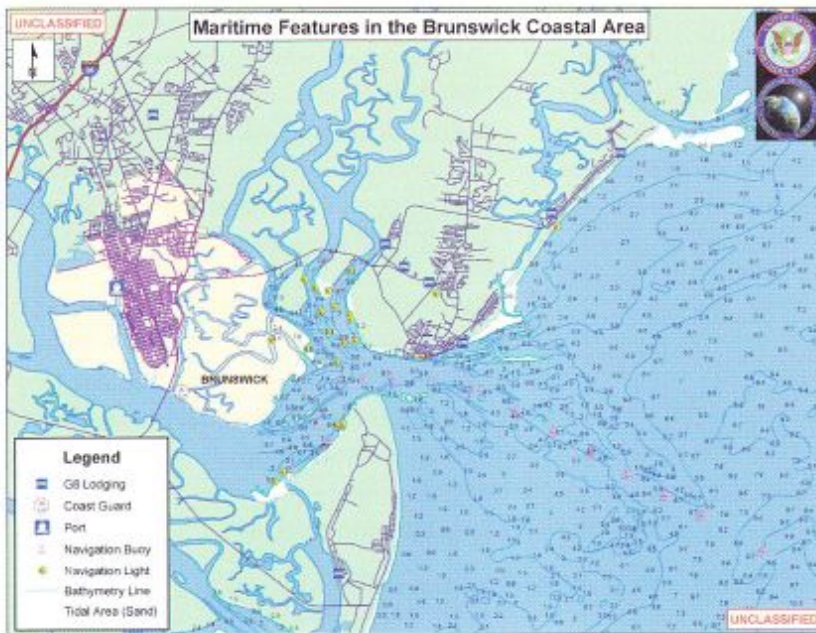
the front end of the Command's key processes—intelligence analysis and fusion, planning, operations (to include deployments) and logistics. NST members are directly involved in customer outreach, joint projects, Command planning forums and working groups.

In their NORTHCOM support role, team members supported military assistance provided to national special security events like the Presidential Inauguration, to border security operations and to recovery operations following the Columbia space shuttle disaster.

Direct Partnerships

To ensure timely information sharing and clarity of responsibilities, the team has established direct partnerships with several other NGA Support Teams with whom there is mission overlap. Team members have worked with NGA counterparts supporting the U.S. Pacific Command on homeland-defense issues for Alaska and Hawaii and with NGA counterparts





To support military security planning for the G8 Summit in Georgia the NGA Support Team assigned to the U.S. Northern Command created a graphic of maritime features in the area, among other products.

supporting the U.S. Strategic Command on missile defense and strategic-force monitoring. Similar partnerships have

involved counterparts supporting the U.S. Southern Command, U.S. Transportation Command and Department of Homeland Defense.

The team also works on multi-intelligence counterterrorism and vulnerability analyses with forward-deployed analysts in NGA, the Defense Intelligence Agency and National Security Agency. As a result of this collaboration, the team has been able to provide fused multi-intelligence products to NORTHCOM.

NORTHCOM's establishment provides a clear example of our national resolve to defend the homeland. The establishment of the NORTHCOM NGA Support Team stands as yet another example of NGA's commitment to provide tailored GEOINT services in support of our national security objectives.

NORAD's Operation Noble Eagle

In addition to supporting the U.S. Northern Command, NGA's Support Team also provides substantial support to NORAD—the North American Aerospace Defense Command. This U.S.-Canadian combined defense command was established in 1958 to provide aerospace warning and control over the two nations. Born during the height of the Cold War with a primary focus on the Soviet Union, NORAD continues to ensure American and Canadian air sovereignty against potential foreign aggressors.

Since Sept. 11, 2001, NORAD has been directly responsible for air-defense operations over the United States as part of Operation Noble Eagle, the domestic war on terrorism. NGA support to NORAD remains imagery-intelligence heavy as we monitor and assess foreign strategic threats. However, the advent of Operation Noble Eagle has resulted in a growing need for geospatial and integrated GEOINT within the bi-national command.

Border Security Gets a Fresh Look

By Tim Peplaw

Our nation's borders can't always be looked at as a line. All air and sea ports of entry can be viewed as a border, because they provide an initial entry point into the United States. Some of these official ports of entry are in the middle of the United States.

Considering border security from this viewpoint, NGA has developed multi-layered seaport and airfield models as well as products geared toward international boundaries.

In the format of a geographic information system, the seaport and airfield models are layered with commercial satellite imagery, geospatial information and the latest visualization technology, like Red Hen Global Positioning System motion imagery and 360-degree iPIX imagery. (See sidebar.)



The U.S. Border Patrol uses an unmanned aerial vehicle to patrol the U.S. border. NGA is providing geospatial intelligence in a series of patrol sectors along the Canadian and Mexican borders.

The "immersive views" provided by these models contain a wealth of information. At the same time, they bring a common operational picture to the desktops of NGA customers, including the U.S. Transportation Command and Transportation Security Administration.

In areas where the border is indeed a line, NGA is providing geospatial intelligence (GEOINT) in a series of patrol sectors along the Canadian and Mexican borders. These new products in hard- and softcopy provide a look at different features and critical infrastructure in close proximity to the border. They contain imagery and geospatial data on features like emergency services, land use, utilities, transportation and population density. The softcopy version allows users to "drill down" through the different layers of information.

Working Together

NGA supports the border-security community through an integrated team of geospatial and imagery analysts known as the Border and Transportation Security Branch. Besides creating products, the team analyzes and reports on major intelligence problems related to border security, addressing issues related to smuggling as well as counterterrorism.

One of the major impacts the branch has had on the community is by way of the Border Issues Working Group, which the branch conceptualized and chairs. The group was formed last summer to coordinate border-related activities within NGA. As the group gained momentum and took on substantive issues, the need to expand to the interagency level became apparent. The NGA Support Teams assigned to these agencies enabled much of this to happen.

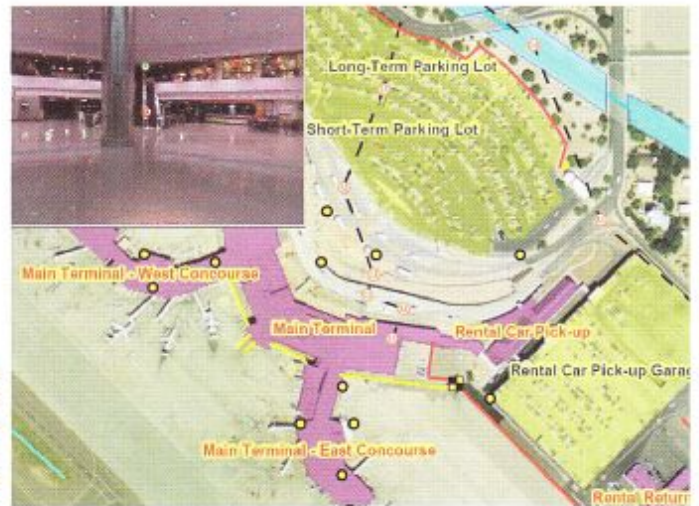


Photo courtesy of the U.S. Border Patrol

This working group has become the perfect forum for sharing information and intelligence and discussing issues that we have a common interest in. Today, the Border Issues Working Group is not only made up of NGA elements, but also the Central Intelligence Agency, Defense Intelligence Agency and Defense Human Intelligence Service, Department of Homeland Security and U.S. Customs and Border Protection, National Counterterrorism Center,

National Reconnaissance Office, National Security Agency and Medina Regional Security Operations Center, and U.S. Northern Command and Joint Task Force-North.

The interactive 360-degree image at top left allows users to view everything at the picture's location by pointing and clicking with a mouse. The scene is from the main terminal of the Tucson Airport, shown in the larger graphic. Both images were produced by NGA border-security experts.



Latest Visualization Technology

The seaport and airfield models NGA has developed include the latest visualization technology, like Red Hen Global Positioning System (GPS) motion imagery and 360-degree iPIX imagery.

Red Hen systems provide the capability to match video and still photography to GPS positional information captured at the same time the photographic data is collected. Users have the ability to watermark the GPS information onto still images and can also create video files with the GPS information embedded into the video stream. In addition, the video application allows them to create geospatial data based on where they traveled, for example, a vector file delineating a road.

The technology known as iPIX provides 360-degree "immersive" photography. The hardware and software incorporates two 185-degree fisheye images and stitches them into a seamless 360-degree interactive image. Users can move around the image to view everything at the picture's location by pointing and clicking a mouse. The system provides the capability to link images and integrate GPS positional information.

Connectivity Is Key at Special-Security Events

By Cheryl B. Gilbert and John P. Patten

In recent years, NGA has been highly successful in adapting imagery, imagery intelligence and geospatial information tradecraft designed to hold an adversary at risk overseas to the domestic problem of homeland security. NGA support has been fine-tuned through the experience gained in meeting the demands of nearly 30 special-security events since 2002.

Key to providing seamless and comprehensive security support to highly visible events like the Super Bowl and Presidential Inauguration was the cooperation of numerous offices. Cross-Agency coordination included the sharing of technology systems that enabled on-site analysis and connectivity. NGA's Office of Global Support was a key contributor that made seamless connectivity possible.

Connectivity Is Key

Perhaps the greatest challenge during any crisis deployment is robust two-way connectivity with forward-deployed geospatial-intelligence analysts and technicians on the scene.

The Office of Global Support has traditionally relied on transportable satellite

systems: specifically, the NGA Deployable Communications System (NDCS) and the Mobile Integrated Geospatial-Intelligence System (MIGS). Both of these links provide exceptional service and have been called into action almost continuously since the beginning of Operations Iraqi Freedom and Enduring Freedom.

Although designed and built for overseas crisis deployments, the MIGS served as NGA's key forward-deployed link during the Democratic and Republican National Conventions in Boston and New York. NGA support to these two national special-security events represented a sea change for the Agency; for the first time, the Office of Americas successfully deployed analysts, technicians and front-line systems into a very high-profile domestic environment, supporting the FBI and Secret Service in a federal command post.

As it turned out, the presence of the MIGS (a camouflaged Humvee, with attached 2.4-meter satellite dish and olive drab tent) in the middle of New York City (one of the most heavily "connected" cities in the world) did generate considerable attention and dialogue! Although support to those domestic events was indeed a resounding success for the Agency, it resulted in a comprehensive review of NGA's concept of operations for future special-security events and crisis-response scenarios and led to a complete re-engineering of NGA's deployable communications systems.

New System at Cutting Edge

First fielded and demonstrated at the FBI's Joint Field Office during the Presidential Inauguration, and again at the 2005 Super Bowl in Jacksonville, Fla., the NGA

Former Department of Homeland Security Secretary Tom Ridge answers questions from the press at the Republican National Convention.



Terrestrial Communications System (NTCS) has added new cutting-edge capability to an already formidable suite of deployable equipment.

Deployable to any urban location worldwide, the NTCS uses secure, commercially leased connectivity to provide two-way access to NGA's networks and data. NGA's deployed analysts and staff officers are able to arrive with light, rugged and responsive connectivity, and occupy a small footprint at their operational location, whether it's a joint command center, an embassy or a hotel room. In the future, the inherently scalable NTCS will be capable of enabling an extremely effective reach-back package: portal access, e-mail on three networks, secure phones and video teleconferencing.

Coupled with one of NGA's new "light-deployable" analytical workstations, NGA has a remarkable capability and capacity to serve an extremely wide variety of customers and partners, anywhere in the world, at a moment's notice.

Interagency Coordination

External partnerships are also crucial to NGA's domestic security operations. These include data acquisition and sharing agreements, like the partnership with the U.S. Geological Survey, and operational arrangements like those with the Department of Homeland Security and FBI.

The partnership with the U.S. Geological Survey has resulted in a single, integrated, multifunctional database of nationwide critical infrastructure data as described in the "21st Century" department.

Partnerships with internal and external entities have enhanced the agility and depth of support NGA's deployed personnel have brought to special-security events. These partnerships have enabled seamless operations that provide the best protection to the American public in very challenging circumstances.

With NGA's unique fusion of intelligence-threat information, geospatial analytic expertise and information solutions, the Agency has become an essential part of the larger effort to keep America safe.

A Coast Guard petty officer looks over New York City during security preparations for the Republican National Convention. NGA deployed a transportable satellite system to serve as its key forward-deployed link during the Democratic and Republican Conventions. Systems like the Mobile Integrated Geospatial-Intelligence System, used in Afghanistan and Iraq, have provided a model for deployed support in a domestic environment.



GEOINT Enhances Stateside Force Protection

By Robert L. Hicks

In the past, stateside military customers relied on NGA and its predecessor agencies for military installation maps, topographic line maps and other standard products they used for domestic training and facility management.



A Trident submarine from Kitsap Naval Base conducts maneuvers in Puget Sound, Wash. The security needs of domestic military customers are the focus of NGA's Defense Issues Branch.

Now, the Homeland Security Division's Defense Issues Branch is reaching out to U.S. forces at home to demonstrate the power of geospatial intelligence (GEOINT) for meeting, not only their traditional requirements, but also their need for enhanced force protection. The branch supports the U.S. Northern Command, U.S. Pacific Command, Alaska Command and domestic military service elements.

In most cases, base-level training, installation management and security needs can be met by creating unique tailored mission-specific data sets.

NGA is collaborating with the Defense Installation Spatial Data Infrastructure (DISDI) program to enable geographic information system (GIS) personnel on domestic military bases to create products like the military installation map. The DISDI program is managing the transformation of military GIS operations for

the Office of the Deputy Under Secretary of Defense.

Supporting GIS on Base

Base GIS shops have expanded their capabilities exponentially. Most facilities already have extensive base infrastructure data sets. NGA is collaborating with the DISDI program to combine this data with standard NGA data such as Digital Terrain Elevation Data (DTED®) and national data sets procured by NGA for the Homeland Security Infrastructure Program (HSIP). The homeland-security program combines imagery, geospatial data and intelligence pertaining to critical infrastructure into a single, integrated database, with the U.S. Geological Survey's National Map as the foundation.

Base-level GIS production puts control of the product into the hands of the users, allowing them to update data on the spot and tailor applications as their needs change. Since GIS personnel on base are the most knowledgeable about their data, they are the most logical stewards of that data. At the same time, base-level production frees NGA analysts to create value-added GEOINT analysis. Small volumes of graphics can be printed locally for special events or training. If large-volume print runs are required, NGA can assist as needed. Through the National System for Geospatial-Intelligence, NGA and the Defense Department will strive to ensure standardization and consistency of data, processes and products.

Focus on Force Protection

Base geographic information systems have enabled NGA to broaden its analytical effort and enhance force protection. The Defense Issues Branch is focused on force



Above: Members of NGA's Defense Issues Branch check out a submarine display at the Bangor, Wash., submarine site of Naval Base Kitsap. The team visited the base to study ways to protect base facilities and infrastructure using geospatial intelligence.

Bottom right: An NGA analyst captures 360-degree "immersive" imagery during a visit to Naval Base Kitsap, on Puget Sound opposite Seattle, Wash.

protection in support of our domestic military customers. Geospatial analysts are reaching out to locate domestic military customers who have concerns regarding anti-terrorism and the protection of their facilities and infrastructure. The branch collaborates with base security and GIS personnel to develop a geospatially focused vulnerability and threat-assessment analysis. The analysis and resulting products give decision makers information to utilize resources more wisely and safeguard military assets and infrastructure better.

Developing a deep understanding of the issues is the key to the success of vulnerability and threat-assessment analyses. To provide the most relevant and useful GEOINT available, NGA analysts conduct research both online and on site to become knowledgeable about the facilities of a base, its security issues and the surrounding region.

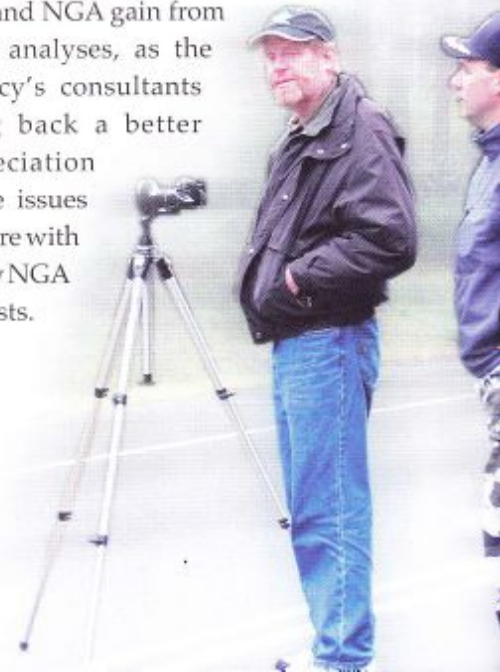
Using all the available data, geospatial analysts create a unique, advanced analysis that addresses the issues and concerns that have been raised. The GEOINT provided routinely includes a line-of-sight or view-shed analysis, route analysis, shoreline analysis, "fly-through" visualization or scene visualization. The

analysis is communicated through the use of force-protection graphics, other tailored graphics, and the latest visualization technology, including iPIX 360-degree "immersive" imagery.

Building on Record

The Defense Issues Branch has a long track record of support to the U.S. Northern Command (NORTHCOM) NGA Support Team, U.S. Transportation Command, FBI and National Special Security Events. Branch analysts successfully introduced realistic GEOINT products to many exercises and operations. On deployment to NORTHCOM for homeland security exercises, they demonstrated the full range and utility of NGA's Palantir™ system, which provides a common operational picture for visualizing, analyzing and acting upon the latest GEOINT in real time. The system's initial deployment in these exercises paved the way for full-time operation at NORTHCOM.

Branch analysts continue to promote and demonstrate the value of GEOINT and to educate customers on the utility of geospatial analysis and products. Much remains to be done to show what NGA can bring to bear on the security of our homeland. Currently, branch analysts are expanding their efforts to apply GEOINT in solving security issues at military installations across the country. Both the base and NGA gain from these analyses, as the Agency's consultants bring back a better appreciation of the issues to share with fellow NGA analysts.



Our Heritage

Above the Earth to Know the Earth

By Martin Gordon

After the Civil War, interest continued in climbing above the Earth to see, map and interpret what was out there. The new U. S. Army Signal Corps hired a balloonist to work with its weather forecasting program, but Congress shifted that program to the Department of Agriculture. The Signal Corps purchased a new balloon and established a balloon detachment at Fort Logan in Colorado. Military ballooning was also gaining popularity in European armies.



During World War I, both the Americans and the Germans used pigeons to take pictures of enemy lines.

Attention also turned to the use of kites that carried small instruments aloft for military uses and gathering meteorological data. An American researcher, William A. Eddy, by the 1890s had learned how to raise his kite chains to an estimated 4,000 to 6,000 feet. He took the first aerial photographs taken from a kite in the United States in New Jersey in 1895. Having perfected his ability to take clear photographs from varying altitudes, Eddy approached the Navy about a system that used kites to see beyond the horizon in 1897. The Army

used Eddy's system in its Cuban campaign during the Spanish American War. Kites remained in use until gradually replaced by airplanes.

When the war with Spain broke out in 1898, the Signal Corps had the Army's sole balloon. Deployed to Cuba during the American invasion, the balloonists detected a route that enabled U.S. forces to deploy more rapidly into the battle of San Juan Hill. But positioned too far forward, the balloon soon became a marker of American positions for Spanish artillery. It was withdrawn from action after only three ascensions. The Signal Corps' interest in balloons continued after the war, however, with several officers giving serious study to the challenges of aerial observation.

As armies realized the advantages gained by aerial observation, they next turned to camera-carrying pigeons. In 1903, the Germans developed a 70-gram pigeon camera that took 38 mm negatives automatically every 30 seconds. In World War I, the U.S. Army used pigeons to take pictures of enemy lines with a variety of cameras before returning to base.

Eventually technology overtook these ways of climbing above the Earth's surface and the airplane became the aerial platform of choice.

As in the past with the use of cameras attached to kites and pigeons, we still seek to employ the latest technologies for the good of our nation. Today we have stronger capabilities with persistent surveillance, new sensor types and new exploitation techniques. New sensor types, called phenomenologies, will assist us with the age-old task of stealing secrets in combat environments.

21st Century

NGA Pioneers Homeland Security Database

By William Mullen

NGA's Homeland Security Infrastructure Program is designed to support homeland security and defense at both the strategic (national) and tactical (local) levels. While some of the data comes from government data sets—federal, state and local—most is acquired from commercial sources. NGA's overall effort includes imagery, elevation data, standard map data, street information and industry data sets relative to major infrastructure sectors.

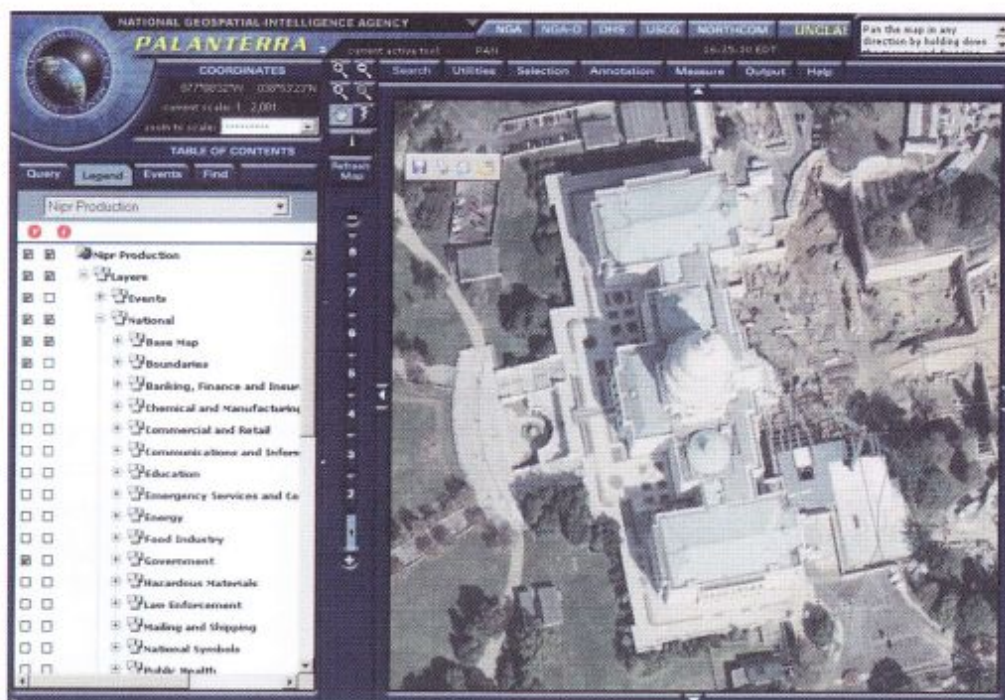
Gold Database

The data in NGA's Homeland Security Infrastructure Program is at a much larger scale than data used in NGA's traditional products. Data from the U.S. Geological Survey's National Map approaches the scale, or ratio, of 1:20,000 (for example,

1 inch equals about a third of a mile) and urban-area data needed to support National Special Security Events may be at scales of 1:500 (for example, 1 inch equals approximately 40 feet) or larger.

The data may not have been developed by commercial or governmental agencies for homeland security and defense. For example, data developed for mail services may lack the accuracy of data needed to plan routes for homeland defense. With contractor support, NGA processed and selected a "best of" compilation of various data sources to create a "gold" database of homeland security infrastructure.

The Gold Database comprises data from across all national infrastructure sectors. It is the synthesis of all vector, or feature, data holdings for use in conjunction with local



The U.S. Capitol is shown in a screen capture from NGA's Palanterra™ system. Through Palanterra™ customers have seamless access to the best available data from the convenience of their desktops.

databases from individual urban areas as well as imagery and elevation data sets. It is the foundation for analysis and production by NGA and for the information provided to external customers via Web services like NGA's Palanterra™.

Interoperability Challenge

NGA has focused on providing information to key decision makers in the shortest time by ensuring that the data is in a format that works with commercially available software and is accessible via the Internet.

Interoperability poses a significant data-management challenge that is yet to be overcome. Creating a national set of central homeland-security infrastructure databases and repository layers, from multiple disparate datasets, with differing geographic coverage, data contents, accuracy and quality is a complex task still to be done. The requisite data management of multi-source metadata, operations auditing, data cleansing and the wide variety of possible data-merging operations presents a considerable challenge for NGA.

Solving the interoperability problem is a priority. But first, use of the Gold Database simplifies data management and tracking, provides a foundation for analysis and production and simplifies Internet dissemination.

NGA's North American and Homeland Security Division has also funded a Computer-Assisted Design/Geographic Information System (CAD/GIS) Technology Center to create a physical-data model, data dictionary and logical model to support homeland-security mission requirements. The models correlate with the cartographic standard of the Geospatial Intelligence (GEOINT) Foundation Database.

Data Dissemination

Another challenge is to enable customers' access to homeland-security data, when they need it, on any network they may use. The development of NGA's Palanterra™ (described in the January-February 2005 Pathfinder) is an important step toward meeting this challenge.

Palanterra™ provides a common operational picture on multiple networks. Through Palanterra™ NGA customers have seamless access to the best available data from the convenience of their desktops. This data includes detailed critical infrastructure information and dynamic, temporally sensitive information on a national scale.

Customers use commercially available browsers to access the data. The Palanterra™ Web site automatically spawns a graphical user interface that allows them to run applications on their personal computers or workstations. The Palanterra™ server performs many operations, like the servers that handle operations for e-mail users. The graphical interface lets users point and click, avoiding the need to type a lot of text.

Most customers also need the ability to manage, store and process data locally within their footprints. Consequently, data replication and mailing DVDs and Firewire drives to customers has become a critical NGA push to end-users.

Future

NGA has designed a flexible and dynamic system to support the homeland security and defense mission. The Agency continues to enhance the structure and content of its homeland-security infrastructure databases through coordination with its many stakeholders. Current development efforts will only strengthen NGA's already robust and heavily used Homeland Security Infrastructure Program.

Industry**Collaboration Improves Homeland Security Data**

By Martin Tierney

NGA could not have developed its Homeland Security Infrastructure Program without close partnerships with commercial vendors. With its integrated database of imagery, geospatial data and intelligence pertaining to critical infrastructure nationwide, the program provides a common operational picture for the Department of Homeland Security, Department of Defense and Intelligence Community.

NGA's North America and Homeland Security Division used commercial data to build the infrastructure database and continues to use it for maintenance. Currently there are contracts with six firms covering sectors like transportation, emergency services, manufacturing and electric power. The data sets provided by these contractors comprise over 30 layers of information, satisfying requirements of two Presidential directives and the National Strategy for the Physical Protection of Critical Infrastructures and Key Assets. Purchasing commercial data allows analysts to spend more time analyzing data and creating geospatial intelligence (GEOINT) tailored to the customer's needs.

Data Life Cycle

Since 2003, Techni Graphics Systems (TGS) of Wooster, Ohio, has performed an independent review and locational accuracy assessment of the commercial data sets NGA has purchased. The process has resulted in data improvements for both NGA and the vendors that provided the data. Coined as the "data life cycle,"

the process has matured to the point where many of the NGA data vendors are working directly with TGS to refine and enhance their databases to more accurately meet the needs of NGA and the homeland security community.

Dee Vaidya, TGS President and Chief Executive Officer, commented on the NGA contract and TGS' role in the homeland-security mission: "What we have learned is that commercial data vendors have lots of data that meets the needs of their traditional customers. For the HLS mission, TGS' role has been to refine this 'raw data' to insure that each listed entity truly exists, is accurately pinpointed geospatially, and—once verified—meets the criteria" of the homeland-security infrastructure database.

"To us this is not just a job, it's a critical mission," Vaidya added. "Our people take great pride in doing all the research to get data right; we are very proud to be playing this role in supporting NGA and the mission of homeland defense."

The data life cycle began with emergency services. Minnesota-based Explore Information Services LLC provides a national database of fire and police stations, and Missouri-based MCH provides a number of databases, including hospitals, ambulatory services, schools and universities, day care centers and a variety of other critical layers.

John Christenson of Explore Information Services LLC has been working with NGA and TGS since 2003.



To create special products like this site map for the G8 Summit in Georgia, NGA support teams access a homeland security infrastructure database, among other sources. NGA purchased commercial data sets for the database and turned to a company in Ohio to review and validate the data.

“From the onset, NGA has expressed the importance of delivering comprehensive and accurate data,” he said. “As the police and fire data sets have expanded, so have their scope. The fire station data set has evolved to include attributes on equipment, communications and capabilities.”

Implementation of the data life cycle has resulted in data that is “more defined and modified for emergency preparation and response,” said Mary English of MCH.

Comments like these have created a very positive working partnership between NGA and the commercial sector, ultimately yielding the best possible product for our customers.

More Accurate GEOINT

The Homeland Security Infrastructure database is widely used across the federal government and is now being considered by Department of Homeland Security for use as the common operational picture for state and local authorities.

Having strong commercial partnerships and a quality-control mechanism in place has produced one of the most accurate GEOINT databases available for homeland security. The program has also proven to be an excellent example of government and government contractors working together.

Partnerships

NGA and USGS Focus on Homeland

By Rex Tugwell

NGA has been partnering with the U.S. Geological Survey (USGS) since July 2002 to provide comprehensive geospatial information in support of homeland security. The confluence of USGS' domestic mapping mission and NGA's support of national security objectives reduces agency production costs, increases efficiency and enables a more comprehensive, geospatial database to be maintained for federal, state, local and military organizations.

The shared responsibilities include:

- establishing and maintaining a program to provide geospatial information for homeland security, that is within the budget constraints of the organizations,
- coordinating each agency's plan to acquire and provide geospatial data,
- providing and disseminating geospatial data services,
- acquiring, operating and maintaining the necessary system capabilities, and
- contributing to geospatial standards.

The U.S. Geological Survey, headquartered in Reston, Va., is working with NGA to provide the nation's most comprehensive infrastructure database.

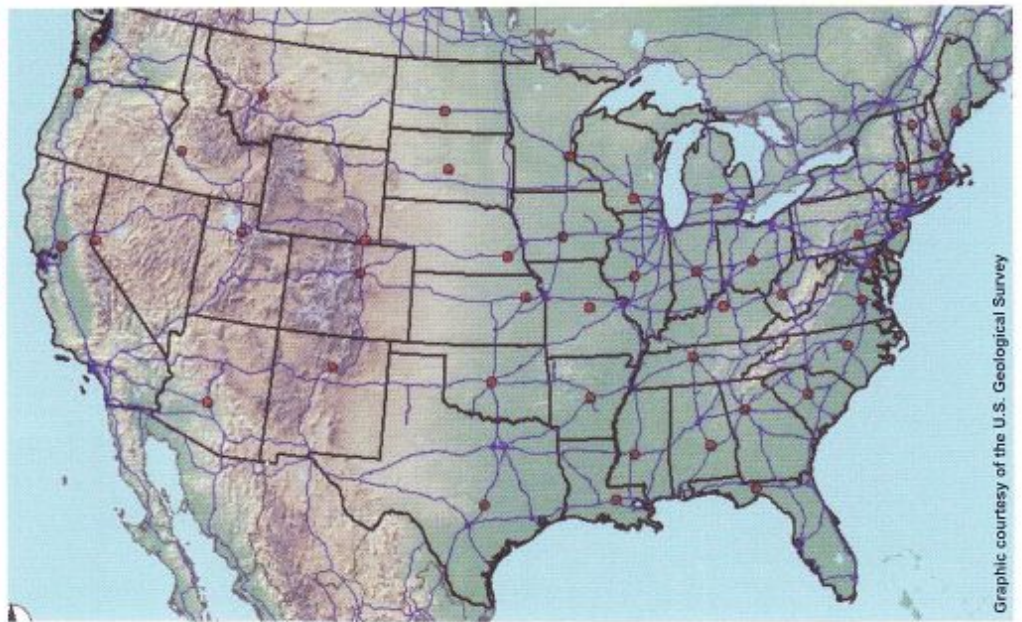


According to Henry (Hank) Garie, Chief of Geographic Information Integration and Analysis at the USGS, "the USGS values NGA as a working partner" in the acquisition of homeland security infrastructure data. With the two agencies working together, "the federal government presents a unified approach to the nation for maintaining specialized types of coverage over urban areas." The partnership also allows both organizations "to service their respective customers with the most current data sets," he added.

NGA and USGS formed a "tiger team" to develop the vision for their new



The U.S. Geological Survey's National Map provides the foundation for the Homeland Security Infrastructure Program envisioned by the two agencies. NGA's activities complement those of the USGS by providing and integrating urban and national infrastructure data beyond that available in the National Map.



partnership and implement a strategy. The team's report outlines the need to broker data across the Department of Defense, Intelligence Community and federal civil communities and develop the next generation of database architectures and systems. The report also establishes a requirement to "explore geospatial data and analysis of joint value" to local communities in understanding and managing security risks.

The team's implementation strategy taps data-access capabilities of the USGS and builds upon base geographic information contained in the USGS National Map, a publicly accessible online database of geospatial data about the United States. The effort also calls for additional data to establish a Homeland Security Infrastructure Program, with the focus on building data sets for 133 urban areas.

The USGS is continuing to develop sustainable partnerships with federal, state local and private-sector organizations to acquire, integrate, maintain and disseminate base geographic information for the National Map. At the same time, USGS is brokering access to information and data in support of the Homeland Security Infrastructure Program.

Building and maintaining a distributed archive and interoperable, Internet-based access capability is part of the effort. An example of this type of government collaboration occurred in Nashville, Tenn., where the partnership between NGA and USGS enabled everyone, including local government, to obtain geospatial data each needed at a fraction of the cost of obtaining it alone.

NGA's activities complement those of the USGS by providing and integrating urban and national infrastructure data beyond that available in the National Map. NGA continues to establish and maintain partnerships with other federal and private-sector organizations to acquire, integrate and broker critical infrastructure data with a focus on enhancing geospatial-intelligence efforts.

Through their partnership, NGA and USGS are obtaining vital geospatial information from all levels of government and building a database of vital importance to our nation's interests. This homeland-security database will aid decision makers and first responders alike and ultimately benefit the American public.

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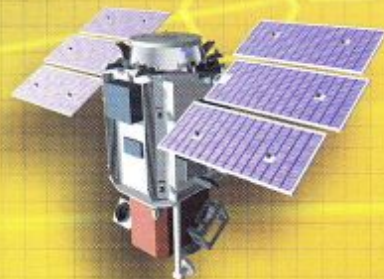
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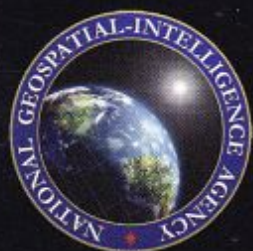
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