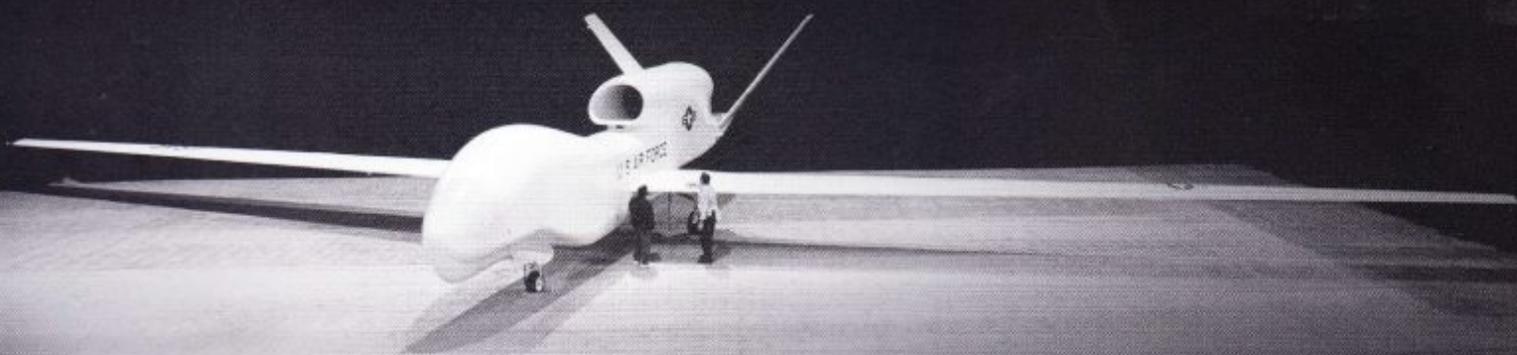


NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

PATHFINDER

The Geospatial Intelligence Magazine

JANUARY / FEBRUARY 2005



► **GEOINT in the Future**

Peter B. Teets on Space-Based Radar
Airborne Drops into GEOINT Picture
GKB—Your Personal Knowledge Assistant
and much more...

Contents

Letter to Our Readers	4
On My Mind	5
Future of GEOINT	6
Space-Based Radar—an Essential Capability	9
Rising out of Crisis, Airborne drops into GEOINT picture	12
Multi-Source Requirements Program	14
Completion of SRTM Data—a Historic Achievement	16
“Unearthing” the Truth in Defense of Our Nation	19
Palanterra Brings Web-Enabled GEOINT	22
NGA Provides Broad Support During Hurricane Season	25
NGA Team Brings GEOINT to PACOM in New Ways	27
GKB-p: Your round-the-clock personal assistant has a leading role in NGA’s transformation	30
Focus on Aiding Analysts Reflects Strategic Intent	32
GEOINT Symposium Winners Propose Innovations	33
Historians Hold Summit Conference	35
DCI, VCJCS Visit; NGA Receives Unit Award	36
Viewpoint: Here’s How We Get to the Future	38

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ON THE COVER

An unmanned aerial vehicle represents “The Future of GEOINT”—the theme of this issue. Rising out of the war on terrorism, UAVs provide capabilities that hold great promise for the future. These and other new processes and technologies are key elements of NGA’s transformation and the fulfillment of the National System for Geospatial Intelligence. Ted Osann designed the cover. Photo by David Gossett, courtesy of Northrop Grumman.

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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**It's a new year
and time to
introduce the
2005 Pathfinder.**

In 2005, the Pathfinder will build on the theme of last year – the Power of Geospatial Intelligence (GEOINT).

This year, we will illustrate how NGA, the NSG and our partners are making a difference through the employment of GEOINT. We will show why Geospatial Intelligence is important from the vantage point of various end uses.

But before we do that, this issue concludes a yearlong look at GEOINT, the Intelligence Community's newest discipline. This issue illustrates the course we have set for ourselves by talking about the future from the perspective of "now, next and after next." Keith Masback frames the story with his lead article by pointing out that the future includes "access, convergence and people." You will find that all three of these concepts are sub-themes of many of the articles in this issue.

Two new collection systems are discussed. Mr. Teets talks to the importance of Space-Based Radar and Cindy Henderson updates us on Airborne. Both of these articles illustrate dramatic sensor and platform changes that bring new capabilities and new challenges. Unburdening the analyst from sorting through the many sources is the point of the article by Stacy Mulligan. And the convergence of technology and analytic expertise to enable the power of GEOINT is clearly shown in the SRTM, undergrounds and Palanterra article.

NGA people make a difference and the agility of NGA to respond to immediate and emerging customer needs is the message of hurricane relief and PACOM support articles, respectively. Both illustrate how NGA is remaking itself as we transition from a product provider to a service provider. Kim Robson and Kim Murphy understand how important it is to enable analysts with effective tools and capabilities. They illustrate some of the things we are doing with their articles on the GKB and HSE. By the time you finish with all of these you should have a good sense of the Power of GEOINT and where the women and men of NGA are taking it.

Finally, I would like to point out that we have refined the Pathfinder format slightly. You will find a series of interesting news items and an opinion piece to close out the magazine.



Mark Schultz
Director, Office of Corporate Relations



On My Mind ...

Work Force Survey and Transformation

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

When we talk about NGA's transformation, we usually use words like *GeoScout*, *Enterprise Operating framework (EOF)* and *Geospatial Intelligence Knowledge Base (GKB)*. Of course, NGA must build this technological basis so it can provide the self-service, tailored on-time solutions, and insightful, actionable and accurate analysis that our customers demand. But we ignore the cultural component of our transformation at our peril. After all, developing technological solutions and inserting them into our processes is (relatively) easy. Making sure that our work force understands and accepts why we need this new stuff—and how to use it—that is our great challenge.

To make sure that we pay attention to the cultural aspect of our transformation, NGA last spring conducted a survey of its entire work force—government and contractor. We wanted to take the pulse of how everyone feels about NGA, in all dimensions. Do they understand where we want to take NGA in the future? Do they know how they as individuals fit into that larger picture? Who is happy with his/her job and who is looking to leave?

In an earlier issue of the *Pathfinder* (September-October 2004), we reported on the results of NGA Survey 2004. We identified areas where NGA does well (for example, training opportunities) and those areas where we need to focus more (working environment). And of course because the NGA is not a monolith, there were interesting differences among our various sites and occupations, as well as pay levels.

Volunteers at Work

Again, our goal with this survey was not simply to get a report card on how we are doing, but to figure out what needs fixing—and how to fix it. So we created a process to do that. For those areas the survey results highlighted as requiring attention, we established focus groups and action teams comprised of a cross-section of the NGA work force, down to

the basic unit. Their mission is to delve more deeply into the survey findings and identify concrete measures that will move us forward. These teams are all volunteers who care deeply about their Agency. I am grateful for their participation in this rigorous process, for the innovative solutions they are advancing, and their continued commitment to making their Agency a better place. These volunteers meet on a regular basis. Their hundreds of recommendations are already working their way up to senior management, where they are evaluated, and whenever possible, implemented as quickly as possible.

NGA continues to transform to provide timely, relevant and accurate geospatial intelligence our customers demand. But to do so, I am depending on the creativity, enterprise and dedication of every NGA employee. I will continue to use this column to keep you informed of our progress. Stay tuned.

A handwritten signature in black ink that reads "James R. Clapper, Jr." The signature is fluid and cursive.

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



Future of GEOINT Depends on Access, Convergence and People

By Keith J. Masback, Deputy Director, Office of Strategic Transformation

As a technical intelligence discipline, it would be easy to think of the future of geospatial intelligence (GEOINT) as almost entirely driven by exotic and powerful new technologies and techniques. NGA recognizes that *technology* is only part of the foundation upon which the future of the National System for Geospatial-Intelligence (NSG) will rely. Technology is only as good as the people—our own work force and our *mission partners*—who implement and operate it. Meanwhile, the intelligence these people and technologies create is only valuable if a consumer can access and understand it, in timelines that make it relevant and actionable to defeating our *adversaries*.

As NGA Director retired Air Force Lt. Gen. James R. Clapper Jr. wrote in the May-June *Pathfinder*, GEOINT is “the power of the picture....” It is the analysis that results from blending imagery, maps, charts and digital displays into dynamic, composite views of features or activities, natural or manmade—on Earth. The term GEOINT is used in two different ways. First, it is an *activity* or a *discipline* that uses remote sensing, spatial data and analytic methods to understand the global security situation. Second, it is also a type of information or intelligence product that is produced from the discipline’s activities.

The Objective Geospatial Enterprise—the unconstrained, desired end-state for all geospatial capabilities—is an environment where people are the focus. Our work force is the heart of the enterprise and its most valuable commodity. Our mission partners are key data providers and mission experts. Our customers are the reason we remain in business, and our adversaries remind us

each day of the threat we face. Mastering these areas, where people are the focus, will enable NGA to produce the best GEOINT products, tailored to customers’ needs, produced by the best technology, using the newest and most effective techniques, improved through the synergies of collaborating with our mission partners, and created by the best managed, trained and equipped work force.

Realizing Vision

The recognition of GEOINT as the discipline driving NGA’s activities is the culmination of the vision that first created NGA, born as the National Imagery and Mapping Agency (NIMA). NIMA’s founders were driven by the concept that geospatial activities—imagery satellites and airborne reconnaissance platforms collecting data that became maps, charts and imagery analysis—were converging and required one Agency to unify the enterprise and fully exploit the power of the tools, technology and personnel. The renaming of NIMA to the National Geospatial-Intelligence Agency embodied the realization that the two cultures of imagery production and map production had been unified into one enterprise dedicated to collecting and exploiting GEOINT and using it to give the best support imaginable to war fighters and policymakers alike.

The future of this discipline is evolving along many paths towards an objective defined by the nine broad goals for the NSG community outlined in the NSG Statement of Strategic Intent. The number one priority for any intelligence enterprise must always be serving the customer with the best information, in the timeliest fashion, tailored to the consumer’s needs and presented in a manner that the consumer

can easily access and understand. To this end, the Objective Geospatial Enterprise must be problem-centric as opposed to agency-centric or technology-centric; we are here to solve problems, not to advocate solutions for their own sake. The nature of GEOINT is evolving but this core value will not change, and NGA will ensure that the mission of serving the intelligence user is never forgotten.

Getting Access

To get the customer the best intelligence, NGA must consider the value added by other intelligence disciplines and discover ways to better fuse our products. The term “horizontal integration” continues to expand and threatens to become unwieldy, but it is important to step back and recognize the key principles its proponents are after

and do all we can to not let those principles get lost in the ether. As advanced as GEOINT is becoming, NGA is increasingly supporting operations where single-INT collection can provide

only part of the story that our customers need. The goal of horizontal integration is, in its simplest form, access—access to all types of information across all intelligence disciplines at all times. NGA must first exploit the synergies that can be found from fusing all sources and types of GEOINT, regardless of the source or method used to collect it. The next hurdle to overcome will be to fuse GEOINT with the complementary disciplines of NGA’s intelligence community mission partners, and provide this data and information to our customers as rapidly as possible. Only by taking this step can we ensure that our

customers will have the persistent insights they need.

Achieving persistent insight is vital because our adversaries have become increasingly proficient at denying and/or deceiving our intelligence enterprise. Investments in new sensor technology and processing and exploitation techniques and tools will expand the scope of what an analyst, and ultimately a consumer, can perceive and understand. These new investments will include a strong focus on advanced GEOINT as well as airborne and commercial imagery.

Achieving Convergence

The Director has made convergence a major initiative, and we are committed to making it a pillar of future GEOINT operations. Convergence means ridding our agency of legacy systems that are isolated from one another and have no common means of linking data. Many of these systems are old, are unique and in certain cases perform duplicate, parallel functions. Maintaining them perpetuates stovepipes that are costly, inefficient, frustrating to work through and ultimately hinder NGA’s efforts to provide our customers with the most relevant and actionable information possible. Our goal is to eliminate most of these systems by the end of decade, moving from the legacy of the past to the modernized capabilities of the future, and to converge into a single operating GEOINT environment.

Along those lines, the NGA Portal will provide all users, internal and external to the NGA enterprise, with the same operational environment on their terminal—a common look and feel—when they access GEOINT online. Operating on multiple networks, the Portal offers immediate access to customers in a common framework. It is essential for furthering our goal of convergence due to its ability to link data and information. Additionally, the Portal

“We who manage, maintain and operate the NSG must accept the challenge to actualize the vision for the Objective Geospatial Enterprise”

—Keith Masback

For the war fighter with forces in contact, constant surveillance is critical.

The radar architecture of the future will consist of a mix of the overhead SBR system and deployable air assets that together provide true global access and persistent

coverage over the theater of interest.

Today, airborne platforms can provide nearly continuous surface moving target indication (SMTI) and synthetic aperture radar (SAR) imagery over a theater—as they did so effectively during Operation Iraqi Freedom.

As we look to

the future, our goal will be to draw on the strengths of space-based and airborne radar systems, and further integrate them with all other sources of information.

Anyone who is familiar with our intelligence processes and war-fighting doctrines can see the organizational challenges in this vision. The IC wants to be sure that the right assets are tasked to meet the clearly defined national needs. The war fighter wants to be sure the right assets are available to meet the needs of forces in conflict.

Integrating Systems

SBR will put to the test our ability to integrate across systems and to share assets among communities of users. I don't believe that it is necessary, or affordable, for the nation to field separate space-based radar systems for intelligence collection and war-fighting support. Every indication from the technologists tells us that an SBR system that is based

on an electronically scanned array will have the flexibility and agility to collect SMTI, SAR and high-resolution terrain information (HRTI) in quantities and qualities to meet the validated needs of all user communities. The current approach to tasking not only won't be necessary, it won't be nearly responsive enough to operate the system.

Lieutenant Gen. Brian Arnold's SBR office at Air Force Space Command's Space and Missile Systems Center (SMC) has put in place a deliberate process to compete and then mature and develop the actual ground and space-based parts of the system. Personnel from across the DoD, NRO and NGA man the program office. Phase A—Concept Development—began earlier this year.

We knew this was going to be a challenging task, and that we were putting SBR on a fast track because the capability will be so important in fighting terrorism. It is at the center of DoD's plan to transform ISR. However, Congress believed we were trying to advance the technology too fast, and the program was too expensive to be affordable. This year the Defense Appropriations Bill cut the Air Force's \$327 million fiscal 2005 request for the program to \$75 million and directed that the effort be refocused on technology that would reduce the overall cost.

DoD and IC Together

As a result, we are building a plan for SBR that will bring together the military and IC and demonstrate to Congress that we can deploy a system that will be both operationally feasible and cost effective. One of the key tasks is to look at the concept of operations (CONOPs) for SBR that we came up with last year and to strengthen it. The CONOPs will look at how to make decisions to task the system; how to collect; where the information goes; and how it will be analyzed and disseminated.

The National Reconnaissance Office and NGA have a long, proud history of providing timely imagery and geospatial products of incredible quality to intelligence professionals, war fighters, and the highest levels of national leadership... "I'm extremely proud of this partnership"

“I’ve had the opportunity to work closely with... and watch the NGA team deliver the finest possible product to our nations leadership and war fighters. You are a tremendous organization with some of the finest professionals it’s been my pleasure to know.”

SBR highlights the importance of horizontal integration and NGA will be an important player in its development and ultimate successful operation.

DoD and the IC must speak with one voice on this important capability if we are going to be successful. I believe that we are on the right path and that SBR will ultimately make a critical contribution to national security.

In the three years I have been DNRO, I’ve had the opportunity to work closely with General Clapper, see his leadership on many difficult issues, and watch the NGA team deliver the finest possible product to our nations leadership and war fighters. You are a tremendous organization with some of the finest professionals it’s been my pleasure to know. Space-Based Radar is an essential capability for the nation. Together with all the members of the SBR team, I am sure we are up to the challenge.

Rising Out of Crisis, Airborne Drops Into the GEOINT Picture

By Cindy Henderson

Before the Sept. 11, 2001 terrorism, airborne imagery was relegated to wet film and specialized exploitation.

Responding to interest across the Department of Defense, NGA began a study in the last months of 2001 to incorporate airborne imagery and information, called "airborne," into the National System for Geospatial-Intelligence (NSG). The goal was to make airborne a key source instead of something treated as "special."

The study led to a road map for incorporating airborne multi-intelligence (multi-INT) into GEOINT to better support the war fighter, homeland defense, and counterterrorism operations. To incorporate airborne, architecture the Air Force already had in place was selected. A management structure was established within NGA and airborne production cells, with capabilities to exploit and disseminate airborne data, began operations.

By the spring of 2003 airborne cells were supporting Operation Iraqi Freedom.

Information collected by U-2 reconnaissance planes and the Global Hawk and Predator unmanned aerial vehicles ran through the Air Force architecture and back to NGA for exploitation and dissemination.

for unexploited digital airborne imagery, began operations in 2004. Prior to the establishment of CALA, data was only saved for about 30 days. Now data can be saved for up to two years. Previously, local sites managed their own storage and the data was not available for community access. Now, for the first time, airborne still and motion imagery are accessible to the larger GEOINT community.

NGA also established the Airborne Roadmap Management Authority (ARMA) in 2004. The Authority has charged each directorate within the NGA to develop a concept of operations for how it will use airborne. ARMA will prioritize requirements for implementation across the Agency and provide inputs to the Agency's Program Objective Memorandum, or long-range planning process.

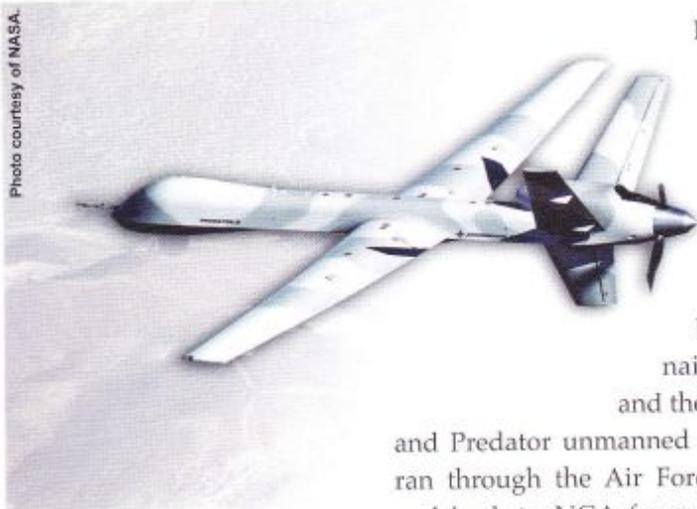
Essential for the institutionalizing of airborne within the NSG, the standup of ARMA is a collaborative effort that reflects NGA's recognition of the importance of airborne for the future.

The Office of Geospatial Management chairs the Authority, provides the community perspective, and ensures that NSG needs are satisfied. The Acquisition Directorate is working on integration to the NGA architecture. The Source Management Directorate and Analysis and Production Directorate are working on the source management, exploitation, and production perspective for the fiscal 2005-2011 time frame. The InnoVision Directorate is providing technology and the Enterprise Operations Directorate connectivity.

CALA and ARMA Stand Up

The Community Airborne Library Architecture (CALA), a central repository

Photo courtesy of NASA.



Predator



U-2

Supporting the War Fighter

A current thrust is to get the capability to exploit airborne imagery out to the military commands. Plans call for fielding airborne exploitation by the spring of 2005. To aid the war fighter, airborne provides commanders with actionable target information by producing consistently accurate target coordinates and error estimates. It can automatically correlate tactical to reference imagery on short notice.

There has also been a push to integrate airborne still and motion imagery into the NSG. From a time when NSG segments did not recognize airborne imagery formats or metadata and analysts had to exploit

motion imagery on stand-alone systems, great progress has been made. Today, analysts can store, disseminate, manage and exploit airborne

still and motion imagery with NSG segments on major systems like the National Imagery Exploitation System (NIES) and Washington Area Library Architecture (WALA).

The Future

The institutionalization of airborne within the NSG is not complete, however. A critical parallel effort involves educating the work force on the advantages and uniqueness offered by airborne imagery. The objective is for analysts to recognize airborne as just another source to satisfy existing

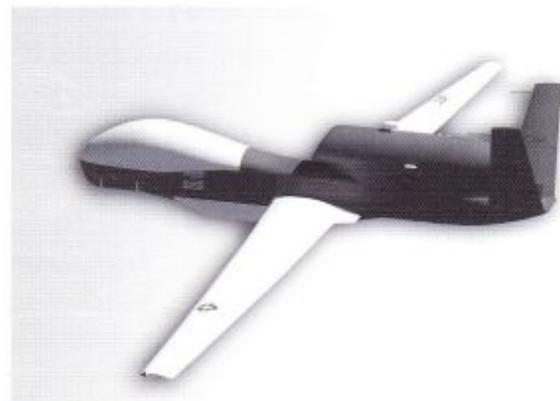
requirements. In addition, enhancements, including technological advancements, are needed to take full advantage of airborne imagery.

Airborne imagery is here to stay. As Jaan Loger, Director, InnoVision Directorate, says, "We will have data sets from airplanes long before we will get data sets from space." NGA officials are planning for the future. Complete integration of airborne into the NSG architecture is envisioned by 2008. Other plans include further integration of airborne into military architectures, as well as state and local systems.

For the Intelligence Community, airborne improves the value of GEOINT with multi-intelligence information, including imagery intelligence, measure and signature intelligence and signals intelligence.

This convergence will be further improved by leveraging airborne information with national and commercial satellite information and geospatial data.

It took the terrorist attacks to provide the impetus for airborne, but it is the continuing need for more and better intelligence and imagery that will drive airborne into the future.



Global Hawk

The Global Hawk, U-2 and Predator are three of the airborne platforms providing data for NGA analysts.

The Multi-Source Requirements Program: Changing the Way NGA Does Business

By Stacey Mulligan

To “champion multi-intelligence collaboration” is one of the strategic goals of the National Geospatial-Intelligence System Statement of Strategic Intent. “NGA will lead the integration of multiple intelligence disciplines into a coherent, multi-intelligence architecture,” the document states.

To accomplish this goal, NGA’s Source Management Directorate has pioneered a Multi-Source Requirements Program (MSRP) that provides imagery and geospatial analysts with an efficient, timely method for acquiring multi-intelligence (Multi-INT).

The combination of geospatial intelligence with other intelligence disciplines, such as human, measurement and signature,

“The team successfully responded to over 800 requests for information in its first year and is poised for continued rapid growth and expansion of its NGA support.”

open source, and signals, provides analysts a much clearer understanding of their subjects. The MSRP team of subject matter experts uses a variety of methods and tools to satisfy requests

for information (RFIs) and proactively searches for ways to access non-traditional sources of intelligence.

Team members bring with them decades of experience in intelligence collection, analysis and reporting from the intelligence agencies of the Army, Navy and Air Force, as well as a history of cooperation with numerous agencies and departments

throughout the U.S. government. Their expertise in specific intelligence disciplines has led to an exceptionally high rate of accurate, innovative answers to RFIs from NGA personnel.

A Dedicated Effort

In its first year of operation, the MSRP successfully responded to over 800 RFIs, with the rate of new requests increasing dramatically over time. The RFI completion rate was 98 percent as of Sept. 28. The team is poised for continued rapid growth and expansion of its NGA support.

Team members created an RFI tracking database that provides historical data on how specific information was obtained, points of contact, and hyperlinks to helpful Web sites. This systematic approach helps ensure their processes are efficient and repeatable.

In addition to conducting multi-INT research for RFIs, the team’s subject matter experts have successfully determined new methods and points of contact for obtaining information for NGA analysts. The MSRP has gained access to sources, systems, programs and databases that some thought would be impossible to obtain. The team has gone from locating new sources of intelligence data to being able to task intelligence assets from various agencies.

The MSRP team has implemented a marketing strategy targeting multiple groups and branches throughout NGA and the Intelligence Community at large, to help spread awareness of their mission. The team has been involved with several

working groups that provide additional opportunities for information sharing, such as the Departmental Program Council of the Open Source Steering Committee, the Intelligence Community Librarians Committee and the National Human Intelligence Requirements Tasking Center.

In all their efforts, the team members have exercised diplomacy while facilitating communications issues that range from breaking down historical barriers of “proprietary” data, to mitigating systems access and firewall limitations for analysts.

Current activities include enhancing the RFI database and creating tutorials for analysts on the various intelligence disciplines. The team is also looking at strategies for multi-discipline collection.

Without a doubt, multi-INT collaboration is the future of intelligence analysis. The Multi-Source Requirements Program is changing the way that NGA analysts do business, as it paves the way toward seamless multi-intelligence collaboration at NGA.

Completion of SRTM Data—a Historic Achievement

By Paul Hurlburt

Topographical information of unprecedented detail is now available over 80 percent of the Earth's landmass, thanks to a cooperative project of NASA and NGA.

NGA used radar measurements astronauts collected aboard NASA's Space Shuttle Endeavour to obtain the information. During the 11-day Shuttle Radar Topography Mission (SRTM) in February 2000, the astronauts collected what amounts to a seamless snapshot of the Earth—at a resolution three times the density of previous global measurements collected over a 30-year period.

The mission literally made a world of difference, in the words of Tom Hennig, who managed the project for NGA. Only about 5 percent of the Earth was covered by data of comparable resolution before the project began. NASA's Jet Propulsion Laboratory processed the raw data before providing it to NGA.

The four-year project culminated last September when contractors working for NGA delivered finished products,

including Digital Terrain Elevation Data (DTED)*, one of the Agency's principal products.

DTED is a uniform matrix of terrain elevation values

that provides basic quantitative data for systems and applications requiring terrain elevation, slope and/or surface roughness information. DTED is available to customers

at several levels of detail. Elevation data provides the foundation upon which imagery and feature data are fused to produce geospatial intelligence.

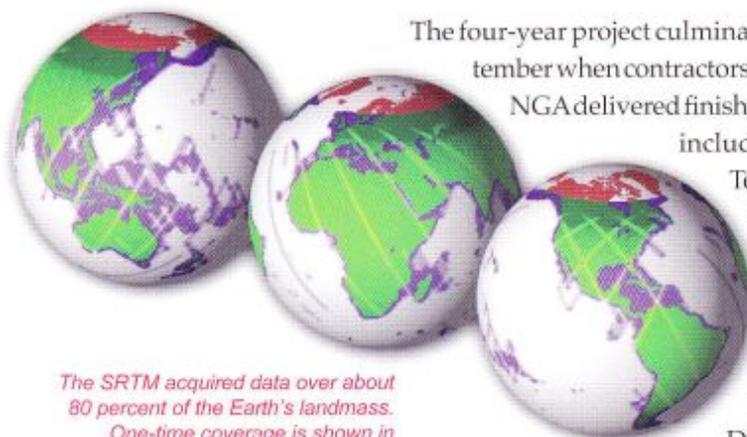
NGA Director retired Air Force Lt. Gen. James R. Clapper Jr. has called the SRTM "one of the best geospatial collection tools in the history of mapping. This mission helps meet our strategic goal of providing the best geospatial information to our customers," Clapper said.

The SRTM DTED covers the Earth between 56 degrees south and 60 degrees north latitudes and comprises 14,277 one-degree-square cells. A one-degree-square cell is about 9,200 square kilometers (3,600 square nautical miles) at the equator (diminishing slightly in size at higher latitudes north and south of the equator).

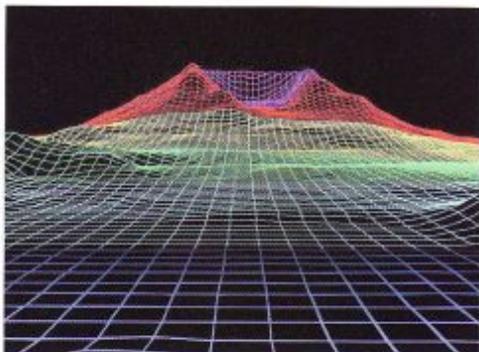
Mast on Display

The National Air and Space Museum's Udvar-Hazy Center in Chantilly, Va., displays a 197-foot-long mast used during the SRTM in its newly opened James S. McDonnell Space Hangar. The museum also displays the canister that contained the mast, which was stored telescopically, along with the Space Shuttle Enterprise.

One of two antennas used to collect the elevation data was attached to the end of the mast. The other was placed inside the cargo bay, allowing for simultaneous collection of dual radar signals that created a "synthetic aperture." The technique, known as interferometric synthetic aperture radar, is used to infer terrain elevation data through comparison of the dual signals.



The SRTM acquired data over about 80 percent of the Earth's landmass. One-time coverage is shown in green, areas covered twice are yellow-green, and areas not covered are red. Most of the area in red lies outside the planned coverage area, as the mission accomplished 99.96 percent of its data collection objectives.



Top: Mount St. Helens is portrayed in shaded relief, based on the elevation data. Bottom: Mount St. Helens is portrayed as a grid of elevation points, like those captured by the SRTM. Elevation ranges are coded by color.

Operating day and night in all kinds of weather, the radar-based system gathered data for areas of the world that had eluded photographic systems, due to cloud cover.

Finished Products

Finished products include DTED 2 at a resolution of 30 meters (98 feet), DTED 1 at a resolution of 90 meters (295 feet), Terrain Height Error Data (random error for each elevation), orthorectified image mosaics at a resolution of 30 meters, and a water body boundary file containing vectors for all the shorelines delineated in SRTM DTED 2.

Production of the SRTM DTED 2 was in direct response to a Joint Staff and Intelligence Community requirement for elevation data to support numerous mission applications and more than 160 different customer systems. DTED 2

provides the elevation component of the NGA Geospatial Intelligence Framework, an essential element of the Joint Vision 2010 concept of information superiority.

All the SRTM DTED 1 and the U.S. SRTM DTED 2 are public domain and are available from the U.S. Geological Survey's Earth Resources Observation Systems (EROS) Data Center. The data is posted on the EROS Data Center's Web site at <http://edc.usgs.gov/products/elevation.html>.

The SRTM data is likely to find many uses that will save lives and enhance economic development around the world. Advancements in aviation safety, mitigation of natural hazards, and smarter and more sustainable development are but a few of the benefits expected to result from the mission.

Quality of Data

Studies have verified that the SRTM data meets or surpasses specifications (accurate to within 16 meters in height and 20 meters horizontally). The vast majority of the cells have an absolute vertical accuracy of 10 meters or less at a 90 percent confidence level. The DTED also appears to meet the horizontal accuracy specification of 20 meters (90 percent).

Furthermore, the data in the cells is extremely complete - over 97 percent of all the cells in the entire collection area have less than 5 percent missing data.

Two contractors, Boeing and BAE, performed the final data editing, which included elimination of large anomalous elevations, interpolating small areas of missing data and identifying, delineating and setting heights of lakes, rivers and oceans. Larger areas of missing data the editors left as voids.

To view a graphic demonstrating the difference between unfinished SRTM

terrain elevation data and finished NGA DTED, visit www.nga.mil and click on "Finished' Topographic Data from the Shuttle Radar Topography Mission" under "What's Hot."

For NGA customers, SRTM products are available from the NGA Gateway and the NGA Dissemination Services Command Center. In addition, the SRTMDTED 2 and DTED 1 are being replicated on DVDs and forwarded to the Defense Logistics Agency where they are available to Department of Defense customers by requisition.

Since many DoD systems have trouble using SRTM data with even small amounts of void, NGA has set up a project to apply systematic procedures to fill the voids. This is essential for maintaining the homogeneity and consistency of the SRTM terrain data. Boeing, one of the finishing contractors, is filling in voids with alternate source data such as existing non-SRTM DTED 2 or DTED 1. Cells are being filled on a priority basis. Current plans call for about half the SRTM cells to be void-filled.

**DTED® is a registered trademark of the National Geospatial-Intelligence Agency.*

Astronauts to Visit

Astronauts who collected the data for the SRTM are scheduled to visit NGA sites in February. Plans call for mission specialist Janice Voss to visit NGA sites in Bethesda, Md. and Washington, D.C., as well as Ideal Academy in Washington, D.C., one of the schools in the NGA School Partnership Program, on Feb. 22. Mission pilot Dom Gorie and mission specialist Janet Kavandi are scheduled to visit NGA sites in the St. Louis area on Feb. 24. One other American astronaut, Kevin Kregel, was aboard the SRTM mission as commander, along with mission specialists Gerhardt Thiele of Germany and Mamoru Mohri of Japan. To collect the SRTM data set the astronauts made 207 tapes—the equivalent of 12,500 CDs.



'Unearthing' the Truth in Defense of Our Nation

Interagency Effort Uses Multi-INT to Find Underground Facilities

By Maj. Mark Esterbrook, USAF

Unearthing the Truth in Defense of Our Nation"—that's the motto of the Director of Central Intelligence's Underground Facility Analysis Center (UFAC). NGA is one of several agencies involved in the Center, which is composed of highly specialized analysts. This involvement is but one example of how NGA is moving toward multi-intelligence (Multi-INT) collaboration.

Simply put, the world has gone underground. Since the disintegration of the Warsaw Pact and the fall of communism, the United States and its friends and allies have faced a changing threat environment that continues to evolve.

These changes are driving modifications in the way knowledge bases, used to protect national security, are

built. The activities of greatest interest are now more geopolitically diverse, and the time available to react with traditional collection and analysis techniques is shorter. Additionally, those who threaten national security have become far more sophisticated and knowledgeable about geospatial capabilities.

Converging Intelligence

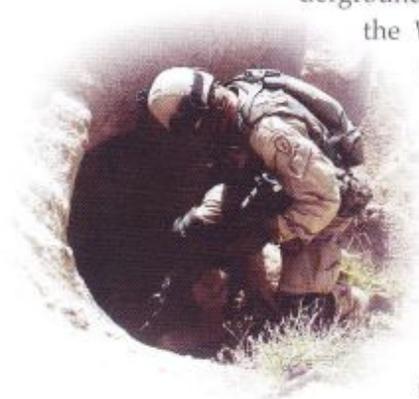
Historically, it was possible to divide knowledge base efforts among the intelligence and non-intelligence agencies because the effort was very detail-oriented and less urgent in many respects. With the potential for strikes in the United States now a much greater reality, the cost of

measured and separate approaches to threat knowledge bases is too dear. The convergence of intelligence disciplines has become an operational imperative in order to provide decision makers with more specific, timely, and focused analysis of where the threat originates from in order to thwart it prior to attacks on U.S. soil and interests.

Enter the UFAC. Created in 1997, the UFAC is a consortium dedicated to detecting, identifying, characterizing and assessing for defeat adversarial underground facilities or Hardened and Deeply Buried Targets (HDBTs). More specifically, the center's mission is to provide intelligence and related data supporting HDBT defeat to national policymakers, weapons developers and military forces and their commanders, and lead the Intelligence Community and Defense Department in that effort.

NGA's Role

NGA plays a key role in this effort by applying many of its primary tradecrafts to the task at hand. As one might expect, geospatial intelligence is one of the most important elements of analysis, especially High Resolution Terrain Information (HRTI) data. In addition, through Defense Intelligence Agency Web pages, applicable maps, related site diagrams, and related imagery are but a mouse click away. But at the heart of NGA's participation is detailed and tailored analysis. Such analysis paves the way for operational uses, including targeting decisions, for intelligence officers and operational forces around the world.



A soldier investigates an underground facility in Afghanistan.

U.S. Army photo



The UFAC includes primary intelligence agencies as well as key organizations outside of the national intelligence community. Each organization contributes its unique skills and capabilities directly to the creation of a truly coordinated response.

The organizations that make up the UFAC include the CIA; DIA's Central Measurement and Signatures Intelligence (MA-SINT) Directorate, Technical Collections Directorate and Intelligence Directorate; the Defense Threat Reduction Agency, NGA, National Security Agency, U. S. Geological Survey, and U.S. Strategic Command Joint Intelligence Center. Without the collaboration of these organizations, the UFAC's ability to successfully tackle the underground mission would be lost.

As shared knowledge is the key to the U.S. military transformation, it is, as well, the key to HDBT defeat. The purpose of underground facilities is concealment and survival. Detection and characterization are difficult at best. Determining function and construction features presents complex collection, analysis and engineering challenges. Typical underground facilities protect and conceal key military and civilian leadership and operations involving communications, command, control and computers, weapons of mass destruction

and terrorism/insurgency. Today the center researches over 10,000 such facilities, and there is a suspected equal number yet to be discovered—a daunting task for any organization!

Knowledge Base

The UFAC knowledge base consists of two elements:

- Individual analysts and engineers. The most valuable knowledge base component is the minds of the UFAC and affiliated analysts, engineers and collection managers. Applications and tools cannot duplicate the associative and intuitive skills inherent in good analysis. The intellectual understanding that is the product of analysis remains a human—not a machine—trait. This makes analyst/engineer development vitally important. The key features of that development are recruitment, training, broad experience and the understanding of need that comes from interaction between the consumer and the UFAC members and affiliates. The UFAC program includes analytic growth in both mission and task. Staying the course on that program is a fundamental management and oversight imperative.
- Consumer-accessible automated databases. Unlike the human analyst/engineer/collection manager, automated databases, at present, tend to be static entities only as complete as their last human input. Two kinds are pertinent to the UFAC. The first is a family of internal support databases. The second is the knowledge repository in which is assembled the essentials of UFAC analyst/engineer understanding in a way that is readily accessible, searchable and interoperable. Technology offers



Multi-intelligence collaboration is the key to defeating hardened and deeply buried targets.

the opportunity to enhance these databases in new and increasingly effective ways

The Future...

Six goals are guiding UFAC development. These will likely evolve with time and experience, but the main thrusts that they represent, which are fundamental to successful intelligence operations, are unlikely to change:

- Bring the multi-discipline UFAC analytic capacity to a level of sustained sophistication that assures its continuing status as an essential contributor to U.S. national interests and security.
- Establish a focused, integrated, supportive relationship with the collection community.
- Lead U.S. HDBT knowledge-building activities and work with friends and allies to ensure broad-based substantive cooperation.

- Establish and maintain an enduring, interactive relationship with each operational, policy, and weapons development/acquisition entity for which underground facility knowledge is mission essential.
- Ensure, through active programmatic support and involvement, the continued examination of new ways to collect against, analyze and exploit underground facilities of all types.
- Sustain funding and, as appropriate, encourage growth for the center and its affiliated activities.

In the final analysis, the fusion of intelligence disciplines, engineering analysis and collection requirements is not a future pipe dream. It exists in the here and now and the UFAC represents yet another resounding success story in NGA's pursuit of true Multi-INT collaboration.

With Palanterra, Web-Enabled GEOINT Comes of Age

By Mark Riccio

The rapid pace of today's information and technology cycles, and the massive volume of available relevant geospatial and intelligence data have challenged traditional NGA processes.

NGA has responded with Palanterra, a system that provides the intelligence, defense and homeland security communities the architecture for integrated geographic information and Web-based dissemination, visualization and analysis. In real time, Palanterra provides decision makers a common operational picture of geospatial intelligence (GEOINT) for homeland security and homeland defense (HLS/HLD). GEOINT is information that depicts, describes and assesses physical features and geographically referenced activities.

NGA is using the system to support organizations such as the White House Situation Room, U.S. Northern Command, Joint Forces Command, Department of Homeland Security, FBI and Coast Guard. Palanterra is a key system in

the interagency effort known as Project Homeland. (See page 24.)

Advantages of Palanterra

Palanterra integrates a broad range of evolving and emerging information-processing capabilities, providing a comprehensive set of tools for characterizing the dynamic HLS/HLD environment. This convergence enables users to leverage an expanded set of analytical tools, bringing together capabilities for accessing information and organizing processing techniques.

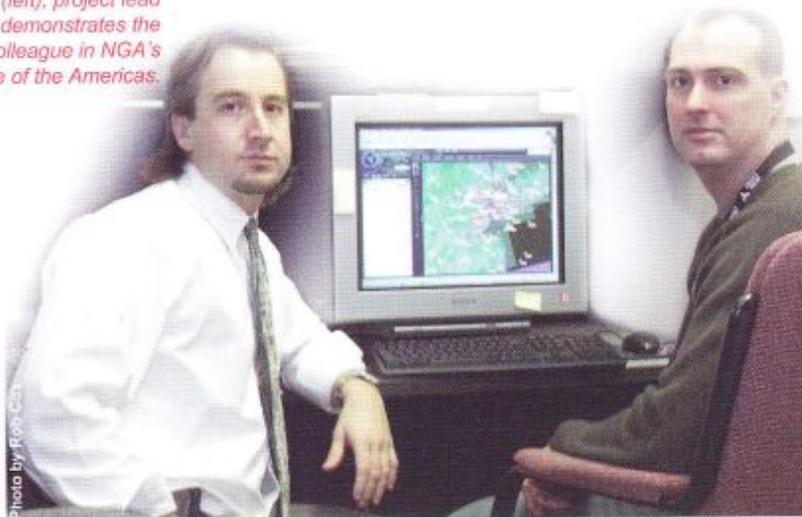
Palanterra also incorporates a diverse range of the best available data sources, including federal, state, local and commercial. This information, coupled with emerging HLS/HLD requirements, has assisted in meeting the HLS/HLD mission.

Customers use commercially available Web browsers to access the data, stored in a GEOINT-centric object-relational database. The Palanterra Web site automatically spawns a graphical user interface (GUI) that allows customers to run applications on their personal computers or workstations. A thin-client interface, the GUI leaves Palanterra's server to perform many operations, like the servers that handle many operations for e-mail users. The graphical interface also lets users point and click, avoiding the need to type a lot of text.

Recent Developments

Palanterra's Web-enabled geospatial databases have superseded hardcopy maps and charts as the key

Mark Riccio (left), project lead for Palanterra, demonstrates the system with a colleague in NGA's Office of the Americas.





Palanterra provides a common operational picture for homeland security, with Web-based dissemination and access.

medium for recording, organizing and visualizing HLS/HLD-specific GEOINT, whether from imagery or other intelligence source data. The Department of Homeland Security is implementing Palanterra to support mission-specific operational, situational and strategic awareness processes. Its Geospatial Management Office has called Palanterra “a smart plan for an initial operating capability.”

During fiscal 2004, NGA received Defense Appropriations supplemental funding to improve and enhance Palanterra’s operational capabilities in support of HLS/HLD. NGA used a rapid integration and implementation process to enhance smart text searching and display, incorporate dynamic data feeds (air traffic, maritime traffic, weather...), and provide training for users, among other enhancements.

For fiscal 2005, NGA has been identified to receive supplemental funding to continue improving and enhancing the operational capabilities of Palanterra for HLS/HLD.

These include:

- Improvements to the Palanterra user interface
- Enhanced real-time tracking capabilities
- Integration of GIS server-based objects

- Three-dimensional visualization capabilities via the Web
- Training

From Concept to Reality

Palanterra has evolved beyond its initial instantiation supporting the 2002 Super Bowl. The system is now being replicated to provide NGA customers with 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.

Palanterra is but one example of advancing technologies that are transforming NGA’s imagery and geospatial tradecrafts. By unifying NGA’s unique ability to model the environment and to remotely monitor dynamic events, the NGA Palanterra system has helped transform a conceptual framework of the NGA disciplines into an integrated approach to the collection, analysis and dissemination of geospatial intelligence for NGA and its customers.

Grace Hopper Award

NGA’s Palanterra has won a Grace Hopper Award. Palanterra won the award for government technology leadership in homeland security by providing a common operational picture for users. The Academy of Technology Leadership and Government Executive magazine sponsor the Hopper awards, which drew 260 nominations last year. Nine winners were selected. Riccio, who submitted the nomination, accepted the award on behalf of NGA during a presentation in San Diego Dec. 9. Admiral Grace Hopper (1906-1992) was a pioneer developer of programming languages, including the Department of Defense-sponsored Common Business-Oriented Language (COBOL). She coined the word “debug” for fixing programming errors.

Project Homeland Focuses on Sharing Data

Project Homeland aims to enhance the sharing and integration of geospatial intelligence (GEOINT) to support homeland security and homeland defense (HLS/HLD). Through Project Homeland, NGA is collaborating with the U.S. Geological Survey (USGS) to support the Department of Homeland Security (DHS) and Department of Defense (DoD) with timely, relevant, tactical, operational and strategic data, products and services.

Project Homeland will strengthen dialog among HLS/HLD stakeholders, which also include industry and state and local government, to enhance understanding of HLS/HLD needs and how well they are being fulfilled. Proof-of-concept activities with selected federal, state and local partners will test and demonstrate enhanced capabilities based on commercial off-the-shelf technology.

Lessons for improving geographic information systems will be learned through an integrated, incremental implementation model designed to drive out and establish cross-organizational work flows applicable to HLS/HLD day-to-day operations.

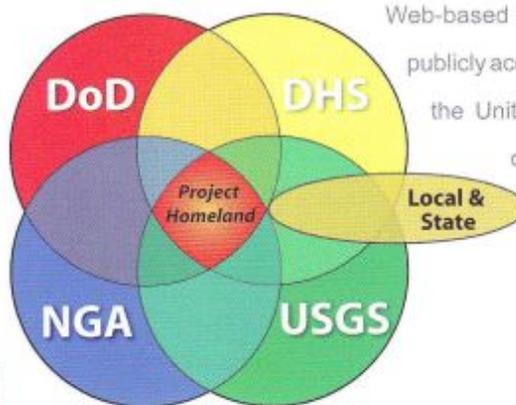
Project Homeland supports the following key objectives:

- Better analytical competencies and tradecraft.
- Automated sharing of geospatial information between and across participating agencies.
- Web-enabled common operational frameworks with interagency services, such as tools for data fusion and integrated analysis.
- Standards to provide a foundation for integrated HLS/HLD spatial databases.

Proof-of-concept pilot programs are exploring technical and policy issues associated with data synthesis and collaborative efforts between state, local and national systems, including NGA's

Web-based Palanterra and the USGS National Map, a publicly accessible online database of geospatial data about the United States. Another pilot program involves the customization and implementation of Palanterra for DHS.

NGA and the U.S. Geological Survey are primarily data producers, while the Department of Defense and Department of Homeland Security are primarily data consumers. State and local government are likely to be both data producers and consumers. All are involved in Project Homeland.



NGA Provides Broad Support During Hurricane Season

By Michelle Herman

August 13, Charley...September 6, Frances...September 16, Ivan...September 25, Jeanne ...

During 2004, Florida became the first state since 1886 to be struck by four hurricanes in one season. The ensuing destruction prompted the largest relief effort in the history of the Federal Emergency Management Agency (FEMA).

NGA supported FEMA in preparing for and responding to these hurricanes, as well as in the recovery effort, through its Readiness, Response and Recovery Branch.

In the past two years, the geospatial and imagery analysts who comprise the branch have responded to more than 75 natural and manmade disasters worldwide. They have deployed to disaster scenes seven times and produced more than 1,500 disaster response/recovery products.

For the hurricanes in Florida, the branch provided strike probability maps to assist emergency managers in directing

initial resources. The maps were updated regularly as new information from the National Hurricane Center became available. The branch used archived commercial imagery and, to get the latest information, tasked new imagery over multiple coastal cities.

With support from NGA's North America Homeland Security Division, the branch also provided numerous maps of critical infrastructure affected by the hurricanes such as energy, emergency services and schools. The branch has worked with the Homeland Security Division to expand support for readiness operations, with the goal of producing more integrated products for situational awareness, visualization and analysis.

After the hurricanes, the branch provided daily imagery-derived damage assessments to FEMA and the U.S. Northern Command. The damage assessments fell into several categories: limited (superficial damage, such as missing roof tiles), moderate (including missing roofs and damage to most light structures), extensive (some buildings and homes destroyed) and catastrophic (most buildings and all mobile homes destroyed).

To assist with recovery, FEMA may request deployed assistance at one of its Disaster Field Offices (DFOs). NGA can deploy analysts and equipment within 24 hours. Three analysts deployed to the DFO in Orlando for Hurricane Charley. The deployed analysts provided tailored geospatial information and analytical solutions using data from the Homeland

NGA can deploy analysts and equipment to disaster scenes within 24 hours.



Photo by deployed NGA Team

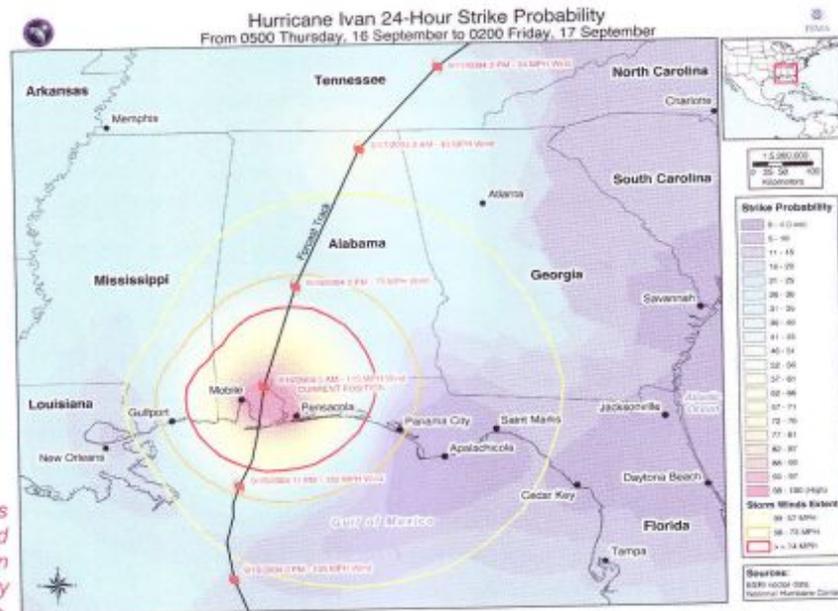
Security Infrastructure Program and commercial imagery resources.

One of the important uses of these products was to help local officials select safe temporary housing sites for some 15,000 victims. The team was scheduled to remain in Orlando for four weeks, but the arrival

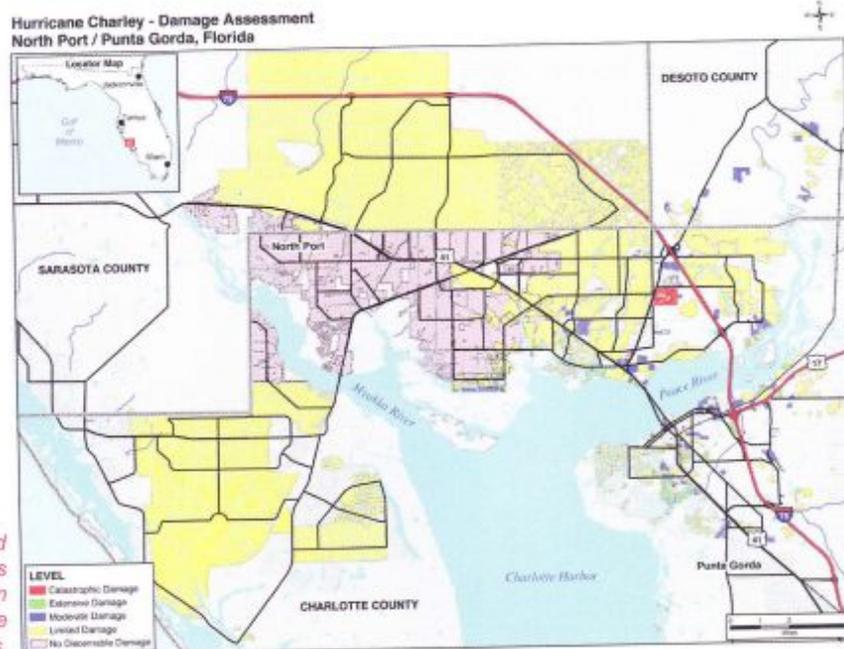
of another hurricane—Frances—forced their return to Washington, D.C.

Hopefully, next hurricane season will not be as devastating as this year's. In any case, the Readiness, Response, and Recovery branch will be there through all of its phases.

Strike probability graphics NGA provided helped emergency crews to plan response and recovery efforts in advance.



The NGA team provided damage assessment graphics for specific neighborhoods in Punta Gorda, Fla., one of the hardest hit areas.



NGA Team Brings GEOINT to PACOM in New Ways

By Richard Craven

Last year at this time the NGA Support Team (NST) to the U.S. Pacific Command (PACOM) was feeling confident. We had succeeded in convincing the Command Group that significant gains could be made by consolidating our 24 NGA imagery and geospatial analysts at the Joint Intelligence Center, Pacific (JICPAC) into a cohesive autonomous organization that we called the Technical Analysis Group (TAG).



For the first time, NGA personnel were under the control of the NST, were not dispersed throughout the building, and were not constrained to working analysis beneath their level of expertise. The Command was able to take better advantage of the combined expertise of TAG analysts, collocated in a large common bay, and their efforts received greater recognition. Morale significantly improved and our analysts began to produce both higher quality legacy products as well as new ones based increasingly on combining the disciplines of imagery and geospatial analysis. Members of the TAG received numerous notes and comments of appreciation from fellow analysts as well as senior JICPAC managers.

Command-Driven Change

But big changes were on the way for the entire PACOM intelligence enterprise. During the spring, the newly appointed PACOM Director for Intelligence (J2), Rear Adm. Jack Dorsett, began developing a plan that would radically reshape the structure and mission of the JICPAC. Dorsett's intent was to refocus the JICPAC

onto what he and PACOM Commander Adm. Thomas Fargo believed was the true core mission of the JICPAC—operational intelligence support to the PACOM war fighter.

The effect of these changes was to increase intelligence support down to PACOM Joint Task Forces (JTFs). In fact, the JICPAC reached down to individual JTF service components to provide appropriate intelligence support. At the same time, more traditional production, such as analyst input to the Military Intelligence Data Base and the production of standard intelligence products, was shifted back to the national production level, particularly to the Defense Intelligence Agency.

The transformation involved a wholesale reorganization of the JICPAC around four core Operational Intelligence Cells (OICs): two country-focused cells, a cell focused on transnational issues (counterterrorism, counterproliferation) and a cell for contingencies (such as non-combatant evacuation operations, or NEOs) and South-Southeast Asia. According to Dorsett's vision, the OICs would occupy large open bays, which would house the command's political-military all-source analysts, as well as signals, imagery and human intelligence assets, and targeting and collection management—all working on their respective OIC's core mission.

Seizing an Opportunity

Faced with a fundamental change in our customer's organization and mission focus, we on the PACOM NST perceived an opportunity to introduce true geospatial intelligence (GEOINT) capabilities to the OICs. We worked closely with the PACOM J2 and his senior staff to redefine NGA's



The Ko'olau Mountains loom over Makapu'u Beach, as photographed by author Richard Craven.

role and operational relationship with the JICPAC.

Quickly revising the memorandum of understanding and concept of operations that govern our JICPAC operations, we proposed to assume responsibility for all imagery analysis operations within each of the four OICs and to set up a new NGA-centric organization, termed the Advanced Geospatial Intelligence Cell (AGIC). Composed of both military and civilian analysts, the AGIC would take over the advanced GEOINT analysis and development work of the Technical Analysis Group.

Each regional/functional OIC would have a unified GEOINT Branch, led by a senior NGA analyst with a senior non-commission officer deputy.

The GEOINT branches became a reality on Aug. 15, 2004 when the JICPAC formally adopted its new organizational structure and mission orientation.

In the intervening months, the new GEOINT branch structures have worked well, and the new branches are getting numerous notes and comments of thanks from JICPAC co-workers and leaders alike.

And what can we say of the AGIC, successor of the short-lived but revolutionary Technical Analysis Group?

Addressing Tough Issues

The AGIC's mission retains the advanced GEOINT development objectives of the former Tactical Analysis Center, namely to address the PACOM J2's and PACOM Commander's tougher intelligence issues. To do this, the AGIC has forged partnerships with NGA's Center for Advanced Geospatial Intelligence Science and Analysis (CASA) and a small but highly effective National Security Agency NST. (See the sidebar on the establishment of CASA.) We are also working to build important partnerships with the Army's 205th Military Intelligence Battalion's



measurement and signature analysts in nearby Fort Shafter, Hawaii.

The AGIC is also working to insert GEOINT analytical and visualization technologies identified by the InnoVision Directorate's Geospatial Intelligence Advanced Test bed. Some of the technologies currently housed in the AGIC bay include the Motion Imagery Exploitation workstation (T-MIEC)—to handle airborne imagery, the developmental Ocean Surveillance System (OSS)—to improve the rapid identification of targets on the Ocean Survey Imagery Collection System (OSICS), an EarthViewer Keyhole Server—to support PACOM visualization initiatives, specialized software—to institutionalize geospatial information system applications by JICPAC personnel, and the Pacific Intelligence Prototype Exploitation

System (PIPES)—developmental software to assist in target recognition.

The AGIC thus presents the PACOM NST with the opportunity to introduce PACOM (and especially JICPAC) to select AGI technologies that can assist in working the commander's toughest intelligence problems. These capabilities can be assessed by the command in the crucible of the new OICs and more quickly integrated into new multi-intelligence fusion initiatives. At the same time, the command can assume more risk with new NGA initiatives, because they occur outside of normal JICPAC production channels. NGA gains the opportunity to include military imagery analysts in the drive to improve GEOINT production within the JICPAC. NGA analysts retain the ability to improve the quality of analysis within the command, and the quality of their NGA experience in Hawaii.

Center for Advanced Geospatial Intelligence

NGA has established the Center for Advanced Geospatial Intelligence Science and Analysis (CASA) to mainstream advanced geospatial intelligence (AGI) across the National System for Geospatial-Intelligence (NSG) community. NGA, through CASA, will

- Integrate AGI into geospatial intelligence (GEOINT) and the imagery science tradecraft
- Enable analysts and scientists with requisite infrastructure, training and tools
- Provide access to a world-class imagery science knowledge base
- Conduct expert, fused AGI exploitation and analysis

To accomplish the AGI mission, the CASA will leverage a diverse community of highly skilled scientists, analysts and staff.

GKB-p: Your Round-the-Clock Personal Assistant Has a Leading Role in NGA's Transformation

By Kim Robson

Imagine this: Tomorrow, when you sit down at your workstation, your personalized knowledge service will have "read" the usual reports on your issues and scanned all available networks for related information. It will have ranked the information based on criteria you identified. And it will have told you who has read the same reports and looked at the same images.

All this information will be displayed for you in graphical or tabular form: tagged geographically to a base image or map and linked to current and earlier reports.

At your command, your knowledge service is now ready to launch tools to analyze and exploit the data it has just gathered on your issues.

Roll Out of GKB-p

Just this kind of working environment is the goal of NGA's Geospatial-Intelligence Knowledge Base Prototype (GKB-p). The InnoVision Directorate is leading an NGA and contractor team to design and develop an operational prototype.

The first roll out of the GKB-p is scheduled for October 2005 with live demonstrations. During the spring of 2006, the GKB-p will be operational for use on focused issues. Efforts for full scaling and insertion into the operational baseline are scheduled to begin in the following summer under GeoScout, NGA's principal contract vehicle for delivering transformed mission and corporate capabilities.

Customers, analysts and managers will be able to direct the system to access data and information about a particular region

or issue of interest and have it organized and displayed in a geospatial context. They will be able to launch from their desktops the full power of GEOINT designed to provide the right data to the right analyst for the right problem.

The time it takes to consolidate and rationalize the volumes of data from different "stove-piped" systems has become crushing. Studies indicate that such data-processing efforts may siphon as much as 80 percent of an analyst's time. Data sources are coming in faster than we can see or analyze them with traditional methods. With the future promising even more data volumes, a better way to organize, catalogue and access data, is imperative. By doing the legwork and presenting relevant information automatically, the GKB-p frees humans to pursue more in-depth analysis.

The GKB-p will provide a knowledge service that's like a round-the-clock personal assistant dedicating to searching, researching, notifying and prioritizing relevant data and information customized to criteria, in real time. It will troll for relevant data continuously, while you're at home and while you're at work, ensuring that you miss nothing whether you are off the job or on.

Transformational Role

The Geospatial Intelligence Knowledge Base plays an important role in helping achieve the strategic goals of NGA's transformation: customer self-service, deep analysis and tailored real-time solutions. Specific ways it furthers transformation include:

- Creating more time for analysis by giving analysts and external customers a way to find, organize, and maintain data.
- Providing analysts with tools to explore what-if analyses and to capture their own or other analysts' methods and re-use them later.
- Making information more meaningful by providing context and relevance. The GKB-p enriches the data in usable data stores and maps "events" and "relationships" to alert analysts of changes and patterns of interest that they might otherwise have discovered only through chance.

Your personalized knowledge service will enable you to adapt quickly to changing adversaries and issues by performing analysis faster and more accurately; it will give you a better understanding of context and relevance, and it will help you collaborate more effectively.

Architecture and Design

The GKB-p builds on recent work by organizations and individuals. For example, many organizations have begun posting their data to Web sites for external consumption: the GKB-p will ensure that you can access this information without having to know its precise location. Similarly, some organizations have developed shared work group data stores for internal data sharing: the GKB-p will enable analysts to share with NGA analysts across the agency and with external customers, as well.



With the Geospatial Knowledge Base, users will be able to launch from their desktops the full power of GEOINT designed to provide them the right data for the right problem.

Beyond providing centrally available layers of data and information, the GKB-p will have a *foundation* layer containing physical models of installations, equipment and activities and an *intelligence* layer with imagery of the Earth. Overarching these layers will be a *knowledge* layer and *knowledge services*, a critical innovation that will propel NGA's transformation.

Collocating all NGA data into a single database alone would not enhance analytical efforts. Data must be extracted, defined, catalogued and contextually understood before it is useful.

Through its *data dashboard*, GKB-p users will be able to discover, retrieve, analyze and update core data. The data dashboard will rationalize, tailor and transform the data into knowledge, thereby driving efficient processing and analysis.

Automated processing capabilities such as change detection and target monitoring will be used to trigger notifications and launch user-selectable applications for immediate analysis. As data sources continue to expand, automated processing will provide an increasing role in pre-screening contents for relevance to selected issues, "abnormal" activities and "alerts" triggered by the knowledge service.

In short, the GKB-p is uniquely designed to provide data access, data inventory, data translation, data definition, data cataloguing and knowledge creation while focusing on problem solving and analysis. The GKB-p blended approach of "bottom-up" data organization and "top-down" problem solving will produce a robust and repeatable knowledge base enabling efficient analysis and problem solving.

Focus on Aiding Analysts Reflects NGA's Strategic Intent

By Kim Murphy

A rapidly changing global security environment has placed a heavy burden on the nation's defense and intelligence communities. As noted in NGA's Geospatial Intelligence Basic Doctrine (online at www.nga.mil), the future presents significant challenges to both the NGA and the Intelligence Community. Among the challenges are increased flows of data from an array of new sensors, growing demands from a more diverse customer base and requirements to provide both predictive and targetable intelligence to the war fighter.

The National System for Geospatial Intelligence (NSG) Statement of Strategic Intent reflects the need for change: "Because the anticipated volume of collection can easily outpace the expansion of the analytic work force, the NSG plan must include implementation of the most advanced, analyst-aiding technologies." While multiple NGA programs focus on advanced technologies, there has been less focus on the key modifier within this quote: Technology must be "analyst-aiding" and be designed with the analyst in mind.

In an effort to help prepare NGA analysts for the geospatial intelligence (GEOINT) environment, NGA Deputy Director

Joanne Isham tasked the InnoVision Directorate's Frontiers Office to assess the state of Human Systems Effectiveness (HSE)—first within NGA and later across the broader defense and intelligence communities.

Human Systems Effectiveness goes beyond simply designing a better computer interface for analysts. HSE draws from a broad foundation of engineering and scientific disciplines, including systems engineering, ergonomics, safety, sociology, psychology and human effectiveness. It brings together insights and lessons from several fields of study and practice, such as research into understanding the analyst's cognitive processes, and tailoring software and analytical processes to the abilities, preferences and working styles of analysts. The aim of HSE is to harness the latest engineering, scientific and social practices to create the most efficient and productive environment for the NGA analyst.

As the lead for NGA's HSE Initiative, the Frontiers Office is working closely with the Agency's Key Components. The HSE team is also leveraging NGA research programs involving the Massachusetts Institute of Technology, the University of Maryland, Purdue University and others that sponsor HSE-related studies. Simultaneously, the team is working with the Air Force Research Laboratory, a leader in the field of human effectiveness, and is looking at efforts undertaken by mission partners such as the CIA.

The team's ultimate goal is to promote HSE across NGA and specifically to embed HSE metrics, principles and practices into systems engineering and acquisition programs. To help promote HSE, a forum meets quarterly to encourage collaboration across the growing HSE community of interest. The team solicits participation by anyone involved in research, technology development, and identification of systems requirements.

"The aim of HSE is to harness the latest engineering, scientific and social practices to create the most efficient and productive environment for the NGA analyst."

GEOINT Symposium Winners Propose Innovations In Persistent Surveillance and Spectral Technology

By Jennifer Lafley

Photo courtesy of the U.S. Geospatial Intelligence Foundation



Jaan Loger, Director of InnoVision, congratulates one of the 2004 Innovation Award winners.

In an effort to encourage partnerships with industry and academia to find new and innovative solutions to geospatial problems, NGA's InnoVision Directorate began awarding its "Innovation in Geospatial Intelligence (GEOINT) Broad Agency Announcement (BAA) Award" in 2003. Broad Area Announcements use creative and innovative approaches to encourage contract proposals. (See the sidebar on page 34.)

Seven organizations won awards totaling \$1 million at the first GEOINT symposium in New Orleans. The winners returned to New Orleans for the 2004 conference to present their papers and demonstrations.

The winners, particularly in academia, were thrilled to attend the conference, hear the speakers, and present their materials.

"This is a real privilege to be able to present my paper to such a distinguished group," said Ling Bian, a professor at New York University / State University of New York, who presented a paper on "Content Based Image Retrieval for Manmade Objects."

The Broad Agency Announcement had requested two categories of proposals:

- Thesis-grade scientific/technical paper(s) that addressed general or specific GEOINT concepts, ideas, approaches and/or techniques; and
- Advanced systems, tools, software or products that demonstrate significant value when added to GEOINT products, data, information, knowledge, decisions, approaches and/or techniques of persistent-surveillance imaging (or other persistent sources).

The selection committee, headed by Stephen Long, InnoVision Technical Executive, reviewed 153 proposals from 30 organizations.

2004 Winners

For the 2004 awards, Long's committee reviewed 82 proposals from 40 organizations. Laura Snow, Deputy Director of InnoVision, announced the winners at the GEOINT symposium. The five winning organizations will receive research and developments contracts of varying amounts totaling \$1.1 million.

Proposals for 2004 were requested in two areas of technical interest:

- Full Spectrum (application of hyperspectral and multispectral imaging and novel remote sensing technologies)
- Persistent Surveillance (applications of persistent surveillance imaging (or other persistent sources).

InnoVision Director Jaan Loger thanked all of the companies that participated. "We received excellent proposals and

look forward to working with the selected companies on solving geospatial problems facing the nation," he said.

The 2004 winners are—

The Charles Stark Draper Laboratory Inc.

Area of Interest: Spectral Technology
Award Amount: \$250,000

Proposal: "Spatio/Temporal Automatic Cuing Using Wavelet Packets." Draper proposes to develop a tool set that combines spectral decomposition (using wavelet packets) with non-Gaussian detection methods and spatial filtering to provide an automated exploitation tool that will provide cues to structures and activities of military significance.

ITT Industries, Advanced Engineering and Sciences

Area of Interest: Spectral Technology
Award Amount: \$219,570

Proposal: "Advanced Tasking for Spectral Technologies with the MESO/RUSTIC Rural and Urban Dispersion Capabilities and the SPEED Sensor Simulation Tool." ITT proposes to create a spectral technology advanced tasking software tool that will "simulate before you task," thereby improving the accuracy of spectral studies.

Advanced Software Resources Inc., the ADAM Systems Group

Area of Interest: Persistent Surveillance
Award Amount: \$229,982

Proposal: "AFF Enabled Geospatial Digital Asset Management Engine." ADAM/ASR

proposes to create a geospatial asset management and intelligence system capable of handling the broad range of multimedia now available, in addition to the metadata and information-rich data traditionally collected by the intelligence community.

Raytheon Company, Intelligence and Information Systems

Area of Interest: Persistent Surveillance
Award Amount: \$206,563

Proposal: "Assured Tracking from Variable Rate Multi-Source Imagery." Raytheon proposes to demonstrate mobile target tracking and real-time predictive re-tasking that can be used with national and tactical surveillance collector platforms, in the context of tracking high-value targets for long periods (30 minutes or more), with gaps in sensor coverage ranging from 1 to 3 minutes.

Leica Geosystems GIS & Mapping LLC, Leica Geosystems Defense Solutions

Areas of Interest: Persistent Surveillance and Spectral Technology
Award Amount: \$109,534

Proposal: "Time Change Representation and Approaches for Updating and Managing Temporal Geospatial Intelligence Information." Leica proposes to incorporate a time-series component extraction engine into ERDAS Imagine software. This will allow time-dependent change analysis to be performed across any data type within the existing NGA framework.

What is a BAA?

Broad Area Announcements use creative and innovative approaches to encourage contract proposals in research areas identified by the government. BAAs contain technical objectives for a research area instead of the usual statement of work and performance specifications, which are left to the offeror to develop. Awards are based on order of merit rather than competitive range. After a contract is awarded, refinements to the statement of work may be negotiated.

NEWS BRIEF

Historians Hold Summit Conference

Office of NGA Historian

Senior historians from 10 agencies with intelligence functions gathered in NGA's Historical Research Center for the first conference of its kind. The goal was to learn what each other is doing, discuss common problems, and perhaps develop joint programs. This was part of the larger intelligence community trend towards greater sharing of information and projects. The history staff of the National Security Agency co-hosted the conference.

Representatives from the State Department, FBI, Department of Homeland Security, Joint Chiefs of Staff, Office of the Secretary of Defense, and Army Intelligence and Security Command, along with representatives from the CIA, National Security Agency, National Reconnaissance Office and Defense Intelligence Agency all participated.

Each historian presented a summary of his or her program. Martin Gordon, the NGA Historian, explained how his office is involving the retirees in conducting their own interviews. The Homeland Security historian talked briefly about her work starting a program in a new agency composed of older organizations. The FBI historian talked about reviving his history program, which lapsed in 1992.

The surprise was how differently each office is working towards the same goals. The largest program, that of the State Department, had Congressionally

established goals especially in publishing an open history of U.S. foreign relations. The Office of the Historian is required to obtain declassification of documents that shed light on the conduct of American foreign policy, as appropriate for these volumes. This is probably the oldest federal historical publications program, having published over 350 volumes since Congress and the State Department started this effort in 1861.

The Joint Chiefs of Staff Joint History Office is another of the older programs, beginning in 1945. One branch documents and writes about operations such as those in Iraq and Afghanistan. The other branch focuses on the history of Joint Chiefs of Staff as an institution, how it functions.

The smallest programs focused more on insuring the heritage of their agencies was preserved and made available internally. Some agencies maintained museums within the history programs. Others located their museums elsewhere in the agency. Several were building visitors centers that would have a historical component. One history office refused to become involved in exhibits. This discussion on the variety of approaches to making history visible was useful to all at the meeting.

The group agreed to start meeting regularly, each meeting to be hosted by a different agency. The Joint History Office will sponsor the next meeting.

DCI, VCJCS Visit NGA

Agency Receives Second Joint Meritorious Unit Award

By Bill Byrne

NGA personnel heard from two leaders representing the symmetry of the Agency's command structure during separate visits to Bethesda Oct. 20.

In the morning, newly appointed Director of Central Intelligence (DCI) Porter J. Goss shared his vision of the Intelligence Community; in the afternoon, the Vice Chairman of the Joint Chiefs of Staff, Marine Gen. Peter Pace, presented NGA with its second Joint Meritorious Unit award in five years. As both an intelligence and combat support agency, NGA reports to both the DCI and the Secretary of Defense.

Goss said that his key message was that all agencies of the Intelligence Community are one team. NGA's contribution to national security is well known and widely acknowledged. In his daily briefing to President Bush, he found NGA products helpful and valuable for the clarity they provide, he said. He praised NGA's use of unmanned aerial vehicles to

provide operators with real-time integrated geospatial, signals and human intelligence. This teamwork has resulted in "new product, services and a new way of doing business"—especially at the tactical level, he said.

NGA Director retired Air Force Lt. Gen. James R. Clapper Jr. attaches a Meritorious Unit ribbon to the NGA flag, following presentation of the award by the Vice Chairman of the Joint Chiefs of Staff, Marine Gen. Peter Pace, left.



Photo by Larry Franklin

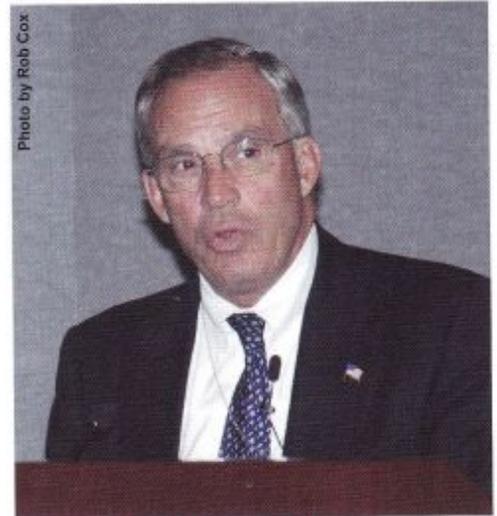


Photo by Rob Cox

Director of Central Intelligence Porter Goss speaks at NGA. It was Goss' first visit to NGA since his appointment as DCI the previous month.

Since 9/11 the Intelligence Community can no longer afford to operate in a parochial "stovepipe" environment and must share as a team, Goss stated. Part of speeding up that team-sharing process is to take advantage of extant technological interoperability—especially databases, Goss said, pledging full support to analysts in the Intelligence Community in terms of resources and tools to carry out the mission.

For his part, Pace observed that his workday began with briefings that included NGA products. These products are important to Washington-based national-level decision makers, he said, while also calling attention to the "incredible service that NGA is providing to the folks in the field." The Vice Chairman further cited NGA's "enormous amount of effort to streamline the processes that support the war fighter in the field" and described

NGA as “making a difference every day” throughout the world.

Joint Meritorious Unit Award

Following his remarks, Pace presented the Joint Meritorious Unit Award to NGA for providing “critical geospatial intelligence



The Vice Chairman of the Joint Chiefs of Staff, Marine Gen. Peter Pace, addresses NGA personnel. NGA is “making a difference every day” throughout the world, he said.

support” during the period Sept. 11, 2001 to Dec. 1, 2003. See citation below.

NGA Director retired Air Force Lt. Gen. James R. Clapper Jr., who led the Agency during this period, accepted the award on behalf of the Agency.

The Agency also received the award in July 1999 for providing “world-class imagery, imagery intelligence and geospatial information support to the combatant commanders and national command authority.” Specifically the Agency was cited for its support of operations in Bosnia, Iraq, Afghanistan, Sudan, Kosovo and Serbia during a period of less than three years—“all while maintaining a global intelligence watch.”

Citation

“The Joint Meritorious Unit Award is presented to the National Geospatial-Intelligence Agency, which distinguished itself by exceptionally meritorious achievement from 11 September 2001 to 1 December 2003. The Men and Women of the Agency displayed superior vision, creativity, competence and dedication as they provided critical geospatial intelligence support in response to an attack on Sept. 11, 2001 and for Operations Noble Eagle, Enduring Freedom and Iraqi Freedom. Whether at the site of the World Trade Center, at federal and state agencies, or side by side with the war fighter, NGA contributed directly to successful operations. By their exemplary performance of duty, the members of the National Geospatial-Intelligence Agency brought great credit to themselves and the office of the Secretary of Defense.”

VIEWPOINT

Here's How We Get to the Future

By Eric Schwarz

Picture yourself as a soldier in the field, communicating with your command via a personal digital assistant (PDA) and availing yourself of NGA services. Your wireless PDA has imaging capability and it's "secure at rest" (all the data it contains is encrypted, even when the device is turned off, so that if it falls into the wrong hands, it can't be used). It's equipped with a Global Positioning System (GPS) receiver as well as an integrated inertial measurement unit—a micro gyroscope that lets images taken with the PDA be mapped onto the earth.

Being in the field location for the night, you upload images of local features, including nearby hills and rivers, and send them to NGA. Then you use your PDA to set up a 24-hour, 5-kilometer geo-protection cylinder around your position with a 30,000-foot ceiling. You select the option to be notified of the presence of Red Forces and Blue Forces, that is friends and foes, and over flight. NGA watches the world for you.

Or, consider one of these scenarios:

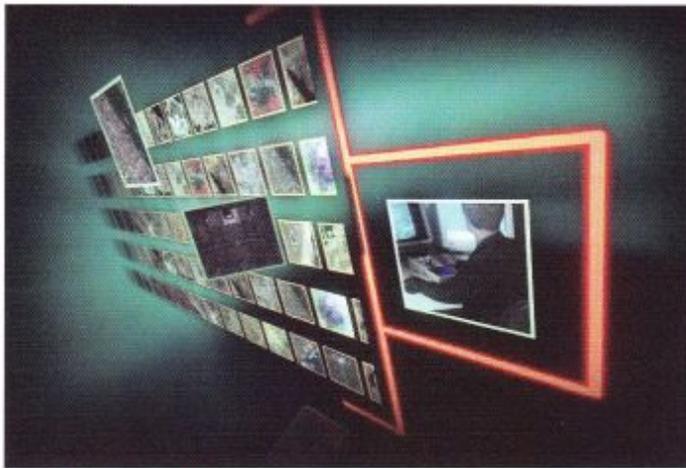
An NGA imagery analyst has the power within her work space to create her own work flow in concert with the way she works best. She sets up geospatial areas of interest that are monitored for new source from a variety of intelligence disciplines to tip her off to new actionable intelligence. Reported changes indicate the presence of meaningful activity, and she calls on the advanced technology at her fingertips to create endless chains of actions to cross correlate source, initiate data mining, cue imagery, and literally bring the universe of information to her desktop for analysis, in a presentation style she's requested.

An NGA geospatial analyst's command customer requires an immediate symbolic information product to identify optimal avenues of traversability (ingress/egress) from a current location to a desired endpoint. The analyst can access the unit's equipment specifications, such as vehicle size, and analyze road networks and cross country mobility options from his work space. He adds current variables into consideration such as weather, soil and geology and current Red and Blue locations to create information that will intuitively convey the options to the command customer.

An NGA source analyst interacts via a visual interface with the world's sensors to determine how to gather the right combination of imagery sensed from the electro-magnetic spectrum to satisfy source information requirements for NGA analysts. She tasks by interacting with sensor facsimiles that instantly show her the available options and allow source to be collected and distributed to those who need it.

Applying Our Knowledge

Technology! It is crowned as the great redeemer for the Agency to guide us into the future. It enables us to do things we could never do before in timelines we once thought impossible. Do not believe, however, that "technology" just shows up to NGA in a semi-tractor trailer and gets loaded to the work space, magically putting us clicks away from all we want to know and causing intelligence to flow to our customers like water from a fountain. Neither should you rest in the belief that technology is provided only by hard-working scientists and engineers and that



Technology is inherent in the application of tradecraft. Technology involves applying our knowledge for the future that we want and envision.

NGA's Office of Strategic Transformation and Acquisition, Enterprise, and InnoVision Directorates will deliver what we want for our future and the future of the Agency.

In contrast, consider what "technology" is and can be. My favorite definition of technology is straight from the dictionary: *"technology: the practical application of knowledge."* It is not just hardware and software and black boxes. Technology is inherent in the application of tradecraft, process improvement and enterprise components and services. Technology for NGA is applying our knowledge for the future that we want and envision!

Beyond "Requirements"

Requirements! Certainly, NGA is driven by requirements, and its technology is crafted to meet its customers' needs. It is the process in which we live. Henry Petroski, author of *"The Evolution of Useful Things,"* suggests that innovative technology is never a response to requirements but a response to people's

wants and desires. To illustrate, he points out that for centuries the knife was just fine as the primary utensil for eating, in spite of occasional cuts on the mouth. Although there was not a requirement for it, people wanted a fork for fashion and the sheer novelty of it. Today, could you do without one?

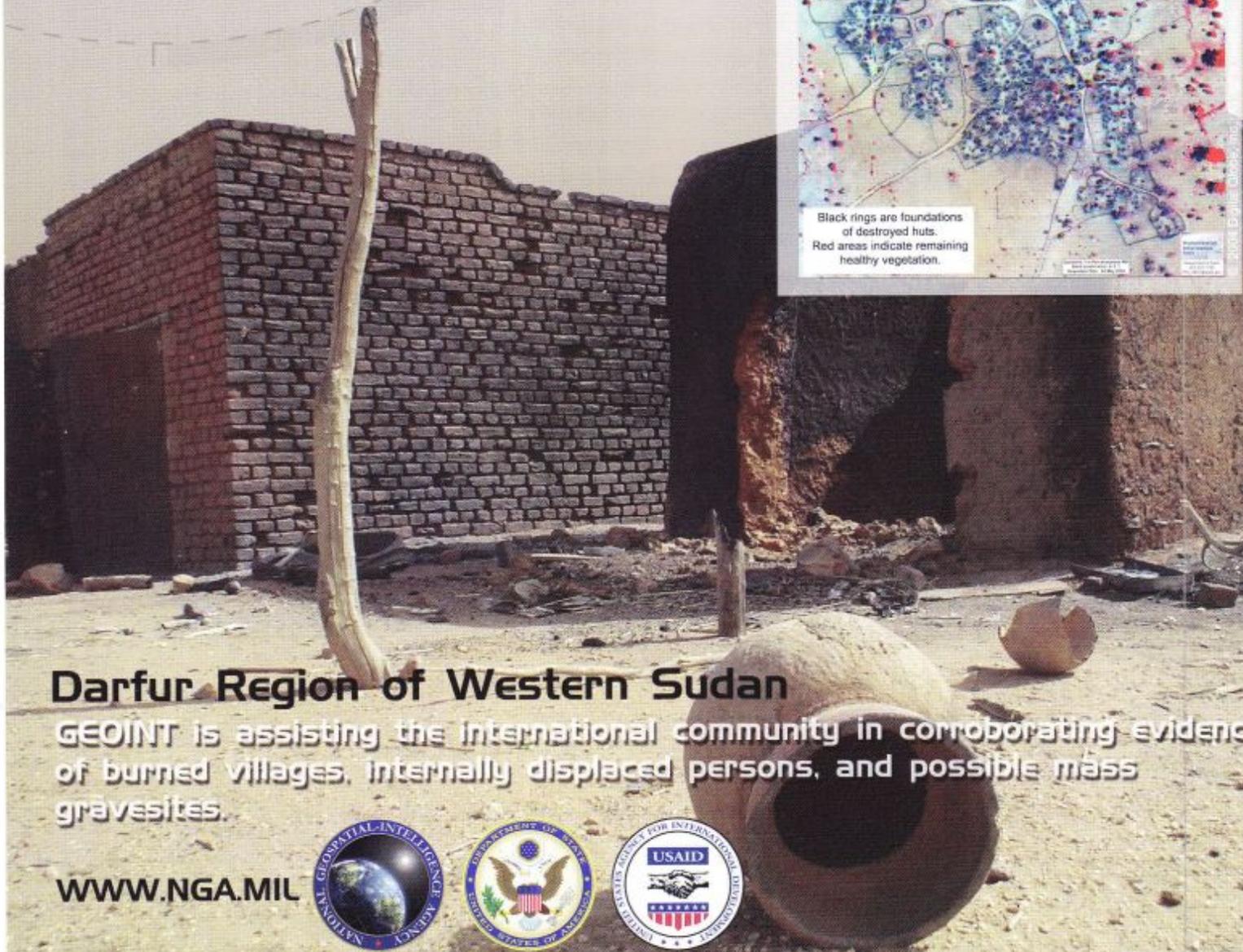
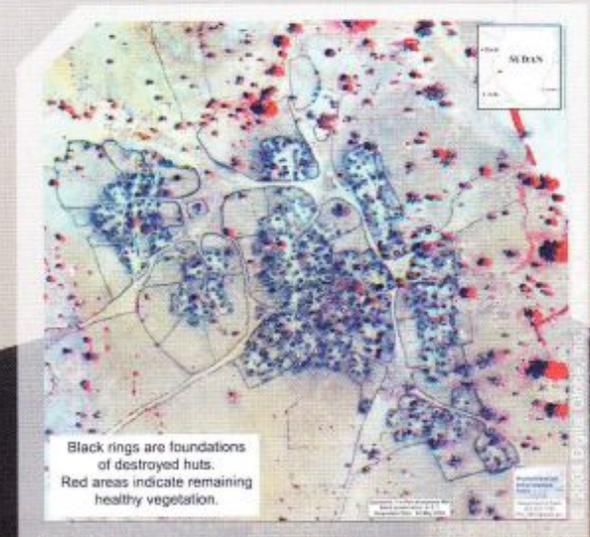
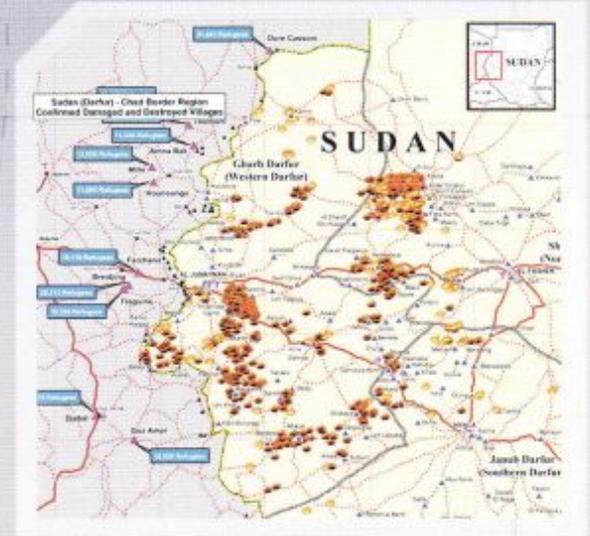
As Petroski points out, innovative technology extends beyond requirements and reaches into a world of unconstrained possibilities. NGA's Office of Strategic Transformation and Acquisition, Enterprise and InnoVision Directorates are chartered with bringing the future to the NGA community. They work hard within their means, but they need the help of all NGA employees to apply technology where we can and apply the knowledge we possess. This is the "technology" that will decide the future of geospatial intelligence (GEOINT). Envision what lies beyond the boundaries of constrained requirements!

The future of GEOINT will be what we, the NGA community, collectively want and desire it to be. Ultimately, it will depend on the "practical application of knowledge"—our knowledge. The future of GEOINT relies on our ability to consider what we want and desire and our ability to make it known. I ask you to think in the future, to imagine what can be, to apply what you know and above all, to communicate your vision, your expertise, and what you believe geospatial intelligence will be for the NGA community. Envision your own scenarios and make them real. You have the power of technology!



GEOINT

It Makes the Difference



Darfur Region of Western Sudan

GEOINT is assisting the international community in corroborating evidence of burned villages, internally displaced persons, and possible mass gravesites.

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About the Authors

Keith Masback was recently appointed Deputy Director, Office of Strategic Transformation. He was previously Director of the Frontiers Office in the Directorate of InnoVision.

An employee of Northrop Grumman Information Technology/TASC in Chantilly, Va., **Cindy Henderson** supports NGA's InnoVision Directorate.

A contractor with BAE Systems, **Stacey Mulligan** supports the Multi-Source Requirements Program as an open-source intelligence specialist. She has a master's in library science.

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Mark Riccio is the project lead for Palanterra and the Technical Executive of the Office of Americas. He earned his bachelor's in geography and remote sensing from the University of Connecticut and master's in national security from the U.S. Naval War College.

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Kim Robson is serving on a rotational assignment as the Program Manager for the Geospatial Intelligence Knowledge Base Prototype. An executive in NGA's Acquisition Directorate, she also manages programs for the Integrated Information Environment in the InnoVision Directorate. In an article in the September-October Pathfinder, she shared some of the benefits she has experienced as a result of serving on a rotational assignment.

Kim Murphy is a consultant with a background in cognitive psychology working in the InnoVisions Directorate's Frontiers Office.



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Jennifer Lafley is the InnoVisions Directorate Communications Team Lead. She came to NGA in 2002 from the Military District of Washington, where she was Media Chief. She was previously a public affairs specialist for NGA, the Defense Mapping Agency—a predecessor organization, and the Defense Logistics Agency. She was also a reporter for Northern Virginia Newspapers.

Bill Byrne was assigned to the Public Affairs Office in October through the Intelligence Community Assignment Program. He came to NGA from a position on the Joint Staff at the Pentagon.

Eric Schwarz is the Technology Director of the InnoVision Directorate's Information Integration Office.



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