



## I EDITOR'S MESSAGE I



Call it what you will — transforming, evolving, advancing — the world of geospatial intelligence, and those who have access to it and a need for it, is changing and growing exponentially. This issue of Pathfinder addresses that certainty.

Good guys, bad guys, Wall Street investors, lost travelers, intelligence analysts — all want to capture and use time and space knowledge to their advantage.

But in the game of realpolitik — the “who” question isn’t nearly as important as asking “what and how.” What separates the quality and accuracy of that information and how it’s used are the real game-changers.

Today’s GEOINT environment is a survival game of the fittest, and who picks the best strategy determines who makes it to the next round.

In the last decade, the National Geospatial-Intelligence Agency has been the reigning GEOINT champ. Director Robert Cardillo plans to keep it that way. At the 2015 GEOINT Symposium last June, Cardillo announced NGA’s game plan — the new strategy — and its roster of players — Team GEOINT.

According to Charles Darwin’s “Origin of Species,” the species that survives is the one that is best able to adapt and adjust to the changing environment in which it finds itself.

Adapting and adjusting applies to organizations as well. In one of this issue’s cover stories, “Persistence: How We Get and Convey Geospatial Intelligence” [page 24], you’ll read about how NGA is adapting and adjusting its GEOINT strategic initiatives.

Another relevant Darwin quote worth noting is, “In the long history of humankind (and animal kind, too) those who learned to collaborate and improvise most effectively have prevailed.”

If there were such a thing as the GEOINT Survivor playbook, the Team GEOINT concept would come straight from its pages. Read “Team GEOINT Goes to Sea” [page 20], and “Enterprise Challenge” [page 26] as examples of how the agency is collaborating with Team GEOINT to ensure success and longevity.

Finally, in my interview with the Director of National Intelligence, James Clapper, he reflects on his leadership in the days following 9/11 and the “Genesis of GEOINT” [page 30].

In today’s GEOINT game, our adversaries are the real competitors. Given the diverse array of threats, the stakes have never been higher.

  
V/r,  
Regina Galvin  
Editor

*The Pathfinder* promotes awareness and understanding of geospatial intelligence, and is published by National Geospatial-Intelligence Agency’s Office of Corporate Communications.

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Approved for Public Release, 15-595.



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# NGA SALUTE Lt. Col. Allison Day

*By Jacquelyn Karpovich, NGA Office of Corporate Communications*



Photo by Tony Boone

**W**hen your kid comes home from college and says, “Mom, look what I did today,” you might expect an article published in the school paper, an A on an exam or even an ill-advised tattoo. Most parents don’t expect their daughter, who never participated in organized team activities or showed any interest in the military, to suddenly announce she’s joined the National Guard.

“I decided on the military when I was in college and starving,” said Army Lt. Col. Allison Day.

Much to her parents’ and Day’s surprise, she enjoyed her basic training experience — so much so that when she returned to school, she joined the Army ROTC program.

“When I came back to college, I looked at other majors because I really was not happy with my current major, journalism,” said Day. “I was good at it, but I just wasn’t excited about it. So, after I came back from basic training, I had this confidence that I could do all kinds of other stuff and I ended up switching to forestry. It was math and science and things I had avoided all my life. I had to work really hard, but I enjoyed it so much that I ended up doing really well in it.”

After her five years in the National Guard, Day graduated college and was commissioned in the Army, where she’s served for the last 20 years.

“I think that everybody should serve the country somehow,” said Day, who had also explored options with the Peace Corps before joining the National Guard. “The military is very cool in that you get a little slice of the whole American pie. I get to work with people from New Jersey and Alaska and Samoa and just wherever, so it’s been a very broadening experience for me.”

And, it turns out that forestry degree was the start of a career for Day in the military. Her first tour was with a topographic unit in Hawaii doing terrain analysis. After a company command in Fort Riley, Kansas, Day applied and was selected for a fully-funded graduate school program with a follow-on assignment to the U.S. Military Academy. She earned a master’s degree in remote sensing and geospatial information systems from the University of Wisconsin, Madison, and then taught geography, photogrammetry and surveying at West Point.

In her current position, Day’s background serves her well at the National Geospatial-Intelligence Agency. She works in the Military Support directorate where she supports the acquisitions process for the military services, analyzing the geospatial needs of emerging and future land warfare systems.

“We look at their standards and what they are proposing and how they plan to use our data,” said Day. “I check and see — are we still going to be producing that? Are there new things coming out that would be more efficient? Is it going to be interoperable? Having my background helps me understand the standards, system capabilities, and how the program fits into the larger geospatial enterprise.”

Much of Day’s career has been spent achieving a balance between work, military deployment, education and family.

“Balance is the big thing,” said Day. “Whereas maybe I used to volunteer for a lot more things, I have to be realistic in my expectations for everything now. So, maybe I don’t volunteer to lead Boy Scouts, but I will sure help and be involved.”

Day’s advice for work-life balance, “Know your limits and don’t expect to be perfect at everything.”

With four children ranging from 10 years to 6 months old, Day said that “everything kind of focuses around the munchkins right now.” And, it seems her education and career interests are already inspiring the next generation of her family.

“They can read a map very well,” she said. The family does a lot of camping, hiking and biking and Day said they check out every museum possible, but especially the area battlefields.

“My eight-year-old can pick out the War of 1812 uniform versus a Civil War uniform, so they enjoy dressing up,” said Day. “They do play soldier, but they also really like being astronauts.”

Day retires from the military in January 2016, but it’s that first experience in basic training that still holds some of the most meaningful lessons for her.

“Just because you haven’t done something doesn’t mean you won’t be great at it,” said Day. “You have to have confidence that as long as you work hard at something, you can do whatever you set your mind to. I think that lesson learned, that I got from basic training, has applied to everything I have ever done since.” \*

# I AM NGA AMANDA PARK

By Kris Mackey, Office of Corporate Communications

Amanda Park is a self-proclaimed workaholic. She won the National Geospatial-Intelligence Agency's Analyst of the Year in 2014 but insists she was "just doing her job." When asked about her professional accomplishments, she prefers to change the subject and boast about her two Chihuahuas, Biskit and Brady, and her wife, whom she says she rarely sees due to her work.

Park was born in Sevilla, Spain, and raised in northern California outside of Beale Air Force Base where her father was stationed and where her interest for the U.S. military was born.

"At the time, Beale was home to the [Lockheed SR-71] Blackbird and the U-2. When I was 17, my father took me to the 9th Reconnaissance Technical Group and I was able to see an actual roll of SR-71 film. From then on, I was hooked," said Park.

After high school, Park graduated from photo interpretation school and served seven years in the Air Force. Her last assignment was to the United States Central Command in Tampa, Florida. When she separated from the service, she was immediately hired by the National Imagery and Mapping Agency as one of the original 117 analysts deployed to support teams around the world. She has been with NGA for the last 20 years and now serves as a senior GEOINT analyst.

Jose "Joe" Estrada-Rivera, deputy chief of the NGA Support Team to CENTCOM, said Park's knowledge base is impressive.

"Her military experience helps her put things into operational context, and her guidance is highly valued by the command," said Estrada-Rivera.

Park's primary role is to understand and influence the analytical effort and direction of the NST and to advise analysts and managers at all levels on GEOINT tradecraft, said Park's supervisor, Patrick Holden.

"In this role, she researches internal and external production, level of effort and requirements, and provides unbiased information to NST leadership so they can ensure the proper employment of our limited resources," Holden said. "Park is that person you want in the conversation before making decisions that could make or break an NST mission."

Because of Park's subject matter expertise, last summer she was called on by NST leadership, flag officer leadership within the Director of Intelligence office, and people at the Director of Operations level for critical mission support.

"Park also provides substantive awareness of regional issues throughout the Middle East, Near East, and South and Southwest Asia," said Holden. "Most importantly, she is charged with mentoring analysts across the NST due to her vast knowledge, experience, and





*Park and her wife enjoying some rare family time.*

being well-liked and respected here.”

According to Holden, Park has mentored hundreds of analysts in her 20 years and various roles with CENTCOM.

“She has helped developed some of the best analysts in the community due to her selfless service and mentoring abilities, as evidenced by the five NGA analysts that were either quarterly or yearly award winners under her mentorship,” Holden said.

Navy Senior Chief Petty Officer Joshua M. Didier, an intelligence specialist, is a product of Park’s mentorship. They worked together for four years at CENTCOM, both in Tampa and overseas.

“Amanda Park is my friend, boss, mentor, leader, manager and subject matter expert,” said Didier.

Early in his career, Park was Didier’s supervisor. He credits her as having an immediate impact on his career.

“Our initial interactions were rocky. I was a young analyst with limited

experience. I found her extreme attention to detail frustrating, but her passion for all things geospatial and her outgoing personality were inspiring,” said Didier. “We became dear friends during long hours, working products on conflicts in Yemen where I quickly realized how respected she is at NGA and in the CENTCOM community for her knowledge and her passion.”

Didier said Park is the greatest driving force behind his leadership style.

“When she became the USCENTCOM NST operations officer, I became her deputy,” Didier said. “She taught me that you must set a standard for your people and never erode your goals to meet modified objectives. She explained that people enjoy their work and want to work with a leader who helps them achieve things they didn’t know they could accomplish.”

Didier said that Park’s tough approach is balanced with humor and accessibility.

“She always keeps her door open to

give advice, professional or personal, and she can always make you laugh,” said Didier.

Park’s reputation has her on call for briefing or hosting countless civilian and military dignitaries, which have included four NGA directors, then CENTCOM commander, General Tommy Franks, several CENTCOM intelligence directors, the director of Australia’s Defence Imagery and Geospatial Organisation, and others.

For all of Park’s success, she remains humble.

“I just think I do my job well and I want to share my knowledge and work ethic with others,” Park said. “I work too much, spend too little time with those I care about, and am in a constant state of sleep deprivation. That’s not a complaint. I thrive in that environment. But, if anyone knows of a 12-step program for workaholics that can be done on an abbreviated schedule, like three steps in one day, please contact me.” ✨

# READY OR NOT — THE MOVE TOWARDS PERSONAL SPATIAL DATA INFRASTRUCTURES

By David J. Coleman, Ph. D.

*Editor's note: The analysis and opinions represented in this article are strictly the author's and do not necessarily reflect the positions of the National Geospatial-Intelligence Agency, the intelligence community or the Department of Defense.*

The term “spatial data infrastructure” has come to mean that critical mass of processes, policies, standards, enabling technologies, mechanisms and key datasets required in a jurisdiction to make geospatial data readily available to a growing community of end users. Especially over the past two decades, government organizations have invested billions of dollars in SDI implementation through development and updating of digital framework datasets, metadata creation efforts, and development of Web-based geoportals for access and downloading of geospatial datasets.

Today, we take for granted the legacy of these SDI programs. Location-based services on smartphones, smart cars and wearable computers all make use of the positioning and mapping infrastructure originally put in place to support public-sector national SDI programs in the United States, Canada, Australia, Europe and elsewhere around the world. Many of us now depend on location-aware mobile applications to help us find particular locations, and even each other. Updates to existing map features (particularly roads and trails) are provided voluntarily through user contributions or sometimes unconsciously by users of these apps as the locations of their cellphones and other navigation devices are tracked in real time.

We are now seeing significant private investments in proprietary positioning and mapping infrastructures, including mobile apps, to support indoor — think shopping malls, sport stadiums, museums — location-based services for navigation, customer tracking and business intelligence, distribution logistics, and emergency response.

These apps will enable consumers to search and find products, services or points of interest within a given facility. Once there, customers or visitors can access further information about a product or service and, in some cases, information on similar or competing nearby products and services. Integrated with information from other sensors and point-of-sale terminals, such information offers valuable business intelligence to businesses and organizations.



As long-time smartphone and tablet users, and now users of smart cars and watches, we have come to expect seamless interaction between key applications on our various devices. Just like our email interacts with our contacts database when we send messages, “geofencing” services trigger certain actions whenever someone leaves or enters a given geographical area. Going forward, the challenge is to determine which particular combinations of integrated apps or channels of mobile information services consumers will use to create their own personal SDI, or pSDI. In pSDIs, standardized services, agreements and device interoperability will enable users to: (1) learn and predict patterns of usage, consumption and travel (major/minor, outside/inside) over time; (2) select and integrate data from a wide range of different public, private, social and personal data channels; and (3) employ the results to seamlessly and transparently meet the unique needs of a person in different personal, business and social contexts.

But aren't all the services we require for a pSDI either already available or in testing today as part of individual apps or services?

Well, yes they are — a least to some extent. That said, many such indoor navigation and tracking services are still standalone and rely on different standards for positioning and communications. They do not operate well or exchange data easily with services offered by other vendors, and may not offer seamless and consistent positioning service and accuracy.



Further, as attractive or useful as these services sound, they can come at the price of your privacy. In today's online marketplace, if you are not paying for a product, then chances are you may be the product. Collection of information concerning online browsing and purchase decisions is now commonplace, as is tracking the location of individual cellphones and other devices. By collecting and integrating information from the various apps and services you use daily on different devices, a virtual profile representing your daily movements, consumer preferences, personal opinions, relationships and travel plans may be created — with or without your knowledge.

Privacy regulations vary from country to country, and no single organization has easy and integrated access to all the online social networking, financial transactions, Web browsing and personal navigation activities that transact on a daily basis. That said, we can expect that: (1) several organizations will have access to different subsets of that information; and (2) higher and broader levels of integration will continue to take place in the near future.

Further, experience shows that such services, whether inside or outside government, are susceptible to cybersecurity breaches. For further consideration, I recommend reading, "Technocreep," a recent book by Thomas Keenan, which offers examples and assessments of the privacy risks involved in today's online society.

Regardless of your position or concerns on these matters, personal spatial data infrastructures are quickly becoming a reality. How consumers balance tradeoffs between convenience and personal privacy with respect to services built atop these infrastructures — and how consumers, legislators and legal systems around the world react — remains to be seen. ✨

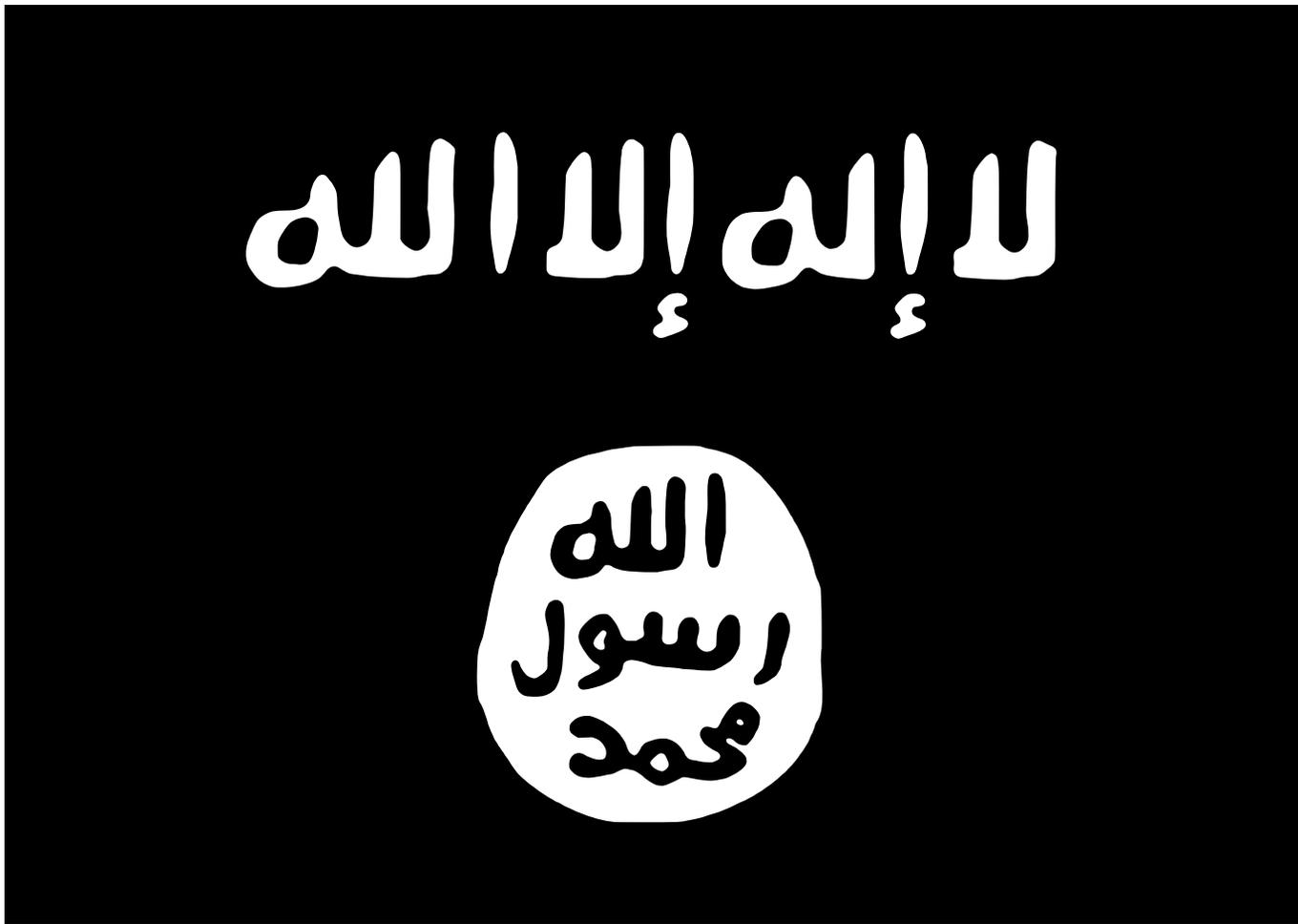
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*Have an idea for a GEOINT or National Security Viewpoint contribution? Send your query to [Pathfinder@nga.mil](mailto:Pathfinder@nga.mil).*

## WHAT TO READ ABOUT ISIL?

By Youssef Aboul-Enein

*The views expressed in this article are those of the author and do not reflect on the official policy or position of the National Geospatial-Intelligence Agency, the National Intelligence University, the Department of Defense, or the United States Government.*



As a National Intelligence University faculty member who focuses on teaching about the nuances of Islam, Islamist political theories and militant Islamist groups, I have been asked what is there to read about the Islamic State of Iraq and the Levant? I am pleased to say an NIU student drew me towards one of only two serious books on this group published so far; meaning out of the slew of initial books on the group, only two have the kind of analytic rigor worthy of considering. The book my student recommended was Michael Weiss and Hassan Hassan's volume, "ISIS: Inside the Army of Terror" (New York: Regan Arts, 2015).

Michael Weiss is a columnist for Foreign Policy and Hassan Hassan is an analyst with the Delma Institute at Abu Dhabi. They start from the beginning, and discuss the spiritual origins of ISIL from the al-Qaida in Iraq and its founder, Abu Musab al-Zarqawi. The authors highlight Zarqawi's vicious sectarian violence and note it was AQI that began the recruitment videos featuring music, action, violence and gore, realizing that Zawahiri monologues were not attracting a younger generation to the al-Qaida narrative. Pages offer nuances of perfect storms that enabled ISIL to take form from the violent handling of the Bashar al-Assad regime of Arab Spring protestors that fueled an insurgency to Iraq's prime minister's merciless

sectarian politics that alienated the Sunnis.

The killing of Zarqawi in 2006 and his predecessor Abu Ayyub al-Masri in 2010 creates a chaos within AQI that enables Abu Bakr al-Baghdadi to take over. Chapters discuss the schisms within and between al-Qaida senior leaders and ISIL. The book also delves into the Syrian government's role in enabling militant Islamists to cross into Iraq during Operation Iraqi Freedom. Pages contain perhaps one of the more comprehensive biographies of Abu Bakr al-Baghdadi, weaved together from fact and fiction; I shall leave it to the reader to deduce proximate reality about the ISIL leader, also known as Caliph Ibrahim.

The second serious book on ISIL is by Jessica Stern and J.M. Berger, well-known academics in the field of terrorism studies. Their book, "ISIS: The State of Terror" (New York: Ecco, 2015) also starts with AQI and Zarqawi and delves into aspects of the schisms inherent among various militant Islamist factions in Syria, and the fights between ISIL and Zawahiri that included ISIL's likely assassination of a Zawahiri emissary. Readers will learn how the Khorasan Group would be a creation of AQ to compete with ISIL for recruits, and there is a decent discussion on the economics of ISIL. There is ample discussion and ideas on the level and influence of foreign

fighters within ISIL's ranks and provides thoughts on why those from the United States and Europe may be attracted to join the group. Like the first book, it analyzes the social media use by ISIL in recruitment, and delves into the nuances of how the organization funds itself and its pseudo-state.

What is clear in both books is that the continued marginalization of the Sunni population in Iraq and Syria will continue to fuel the insurgency. That is why seeing how Sunnis will be treated after the take over of Tikrit by predominately Shia ground forces with some Sunni tribal support backed by Iran will be pivotal in the coming weeks. If you are interested in these books, visit the NGA Research Center. You can also get a book CD version of Jessica Stern and J.M Berger's book for your commute or exercise routine. There is nothing like a deep dive offered by such books to aid in analytic rigor. I also thank my NIU student for educating me by introducing me to the Weiss and Hassan book. \*

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**Editor's Note:** Navy Cmdr. Aboul-Enein is on the faculty of the National Intelligence University and teaches the graduate-level Islam elective. He is the author of several books on the Middle East, and is better known for his book "Militant Islamist Ideology" (Naval Institute Paperback, 2013).

Have an idea for a GEOINT or National Security Viewpoint contribution? Send your query to [Pathfinder@nga.mil](mailto:Pathfinder@nga.mil).

# CENTCOM AREA OF RESPONSIBILITY

## Human Geography Facts about CENTCOM

1. The U.S. Central Command's area of responsibility includes 20 countries in the Middle East and Central Asia, spanning an area of 4.6 million square miles.
2. According to the CIA World Fact Book, approximately 594.1 million people live in the AOR as of July 2014. Pakistan is the most populous country and comprises 33 percent of the AOR population, while Bahrain is the smallest with 1.3 million people. CENTCOM's area of responsibility is also home to Kazakhstan, the world's largest land-locked country.
3. Eleven of the world's 20 oldest continually inhabited cities are located in the AOR. They include one city in Afghanistan (Balkh), two in Iraq (Kirkuk and Arbil), four in Lebanon (Tyre, Beirut, Sidon, and Byblos), one each in Egypt (Faiyum) and Iran (Shush), and two in Syria (Damascus and Aleppo).
4. CENTCOM possesses the most energy resources of any AOR — 64 percent of the world's petroleum reserves and 46 percent of the global natural gas reserves may be found here. Five of the 10 countries with the largest oil reserves are in this AOR; they include Saudi Arabia, Iran, Iraq, Kuwait and the United Arab Emirates. The AOR is also rich in other minerals and deposits. Globally, Kazakhstan is among the top 30 producers of gold. Afghanistan's mineral deposits, which include copper, iron, aluminum, gold and silver, may be worth \$1 trillion.



Information and map provided by  
NGA Office of Geography.

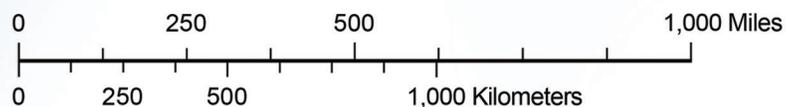


“ In the Middle East, we will dismantle terrorist networks ... ”  
– *National Security Strategy, 2015*



Arabian Sea

Indian Ocean



# GET SMART

By Sara Barker, Xperience Communications

The National Geospatial-Intelligence Agency wants to know what matters to its customers, partners and employees. Specifically, NGA wants to know which of their products and services these consumers find useful. Why? The agency is renewing its focus on delivering value to customers.

“Gaining a better understanding of what our customers value will enable us to better inform the effectiveness of our operations,” said Barry E. Schuler, the director of the agency’s Xperience directorate’s Business Intelligence office.

According to Schuler, NGA is transforming how it does business by better aligning what customers need to resource allocation and new capability investment. This transformation supports NGA’s strategic goal of driving accountability and value by tying program and performance to customer impact.

NGA Deputy Director Sue Gordon has stated that NGA must get smarter about what it can do to bring real value to customers. “And while we don’t like to focus on the negative, the truth of the matter is that if we don’t start holding ourselves accountable by measuring our part in our customers’ success, agency programs risk falling victim to the budgetary ax,” said Gordon. This is where the value of business intelligence, or BI, comes in.

NGA applies BI — which includes processes and technologies that transform large volumes of raw data

into meaningful information — to understand and analyze national security issues. The same types of BI processes and technologies are helping NGA’s BI office gather insights to make smarter business decisions. And that education has already begun according to Keith Krut, chief of the Analytics division in NGA’s Xperience directorate’s BI office.

“We’re doing this, not only by gathering data and adding it up, but through identifying meaningful linkages and trends within and across data sets,” Krut said. “And that can provide the agency insights into the products and services customers value most.”

According to Krut, BI can provide these insights at every level of the agency. For example, the Customer Compass webpage on the Globe — NGA’s secure web presence — allows agency analysts to see first-hand how many customers are accessing the online products they author. The Customer Compass, a BI dashboard, provides instant feedback to analysts on their work.

And these metrics can reveal more than simply whether the customer is clicking on a product. Using the Customer Compass, analysts can also determine if the path to reach a GEOINT product requires too many clicks. That user behavior data is a direct reflection of what the customer values and can inform decisions from what GEOINT products the agency

should focus on, down to where to feature the products on the Globe.

BI is also poised to start informing decisions at the corporate level, according Todd Sweet, deputy director of NGA’s Xperience directorate’s Knowledge Curation office. Sweet wanted to explore how well NGA’s GEOINT Stories, a key feature of the Globe, aligned to customer need. GEOINT Stories — five stories on trending and important GEOINT topics that appear on the Globe homepage daily — are curated from multiple resources across various directorates.

“Using the Customer Compass, I can show the value of GEOINT Stories as evidenced, not only by the number of customers clicking on them, but, more importantly, whether or not these stories are driving customers to explore the specific links to the NGA GEOINT products referenced in the stories,” said Sweet.

Armed with customer behavior insights from reports and dashboards like the Customer Compass, decision makers can take steps to correct any misalignment between NGA resource allocation/capability investment and value to customers.

Behind the decision-informing power of BI is an intricate world of data engineering and processing that includes “big data” technologies. The agency is at the cusp of realizing the benefit of these technologies. Once in place, they will enable NGA data scientists to shift their focus from simply capturing and managing data to actively drawing insights from it for decision makers on a regular basis.

“BI can be a game changer for organizations that seek to build effective customer relationships and improve strategic decision making,” said Christy Monaco, Xperience directorate deputy director. “As NGA evolves into a customer-centric enterprise with a keen emphasis on delivering consequence, data-driven decision making is a business imperative.” \*

# Business Intelligence Challenges

By Sara Barker, Xperience Communications

The complex world of business intelligence poses some challenges for the National Geospatial-Intelligence Agency. Currently one of NGA's biggest BI challenges is growing its data science workforce. Data scientists — who use mathematics and programming to deliver unique insights for decision makers based on data — are key to making BI a success at NGA.

“We need to foster a robust data science workforce,” says NGA data scientist Kevin Compher. “A good data scientist is curious and confident in taking risks with nontraditional approaches.”

Data scientists have rigorous math and programming skills, make sense of diverse data sources and draw out valuable insights from them.

NGA's second BI challenge is the way its data is currently architected, or stored.

“We currently have our data in silos,” says Compher. “And the biggest problem with this is that silos don't automatically connect to each other and they don't scale.”

To generate meaningful insights from these disparate data sets,

it is necessary to manually link them to each other. According to Compher, the lack of a usable and impactful architecture can be frustrating NGA's data scientists and others who require it to generate meaningful insights for decision makers.

However, there is a hope ahead. A suite of capabilities that will advance data management is being envisioned under a program called Visualization Analytics Data Lake solution, or VANDL. VANDL enables the agency to automate “joins” across its disparate data sets.

For example, under VANDL, data regarding customer demands can be joined to data regarding gaps in production to reveal areas that need attention and, in turn, inform decisions regarding resource allocation.

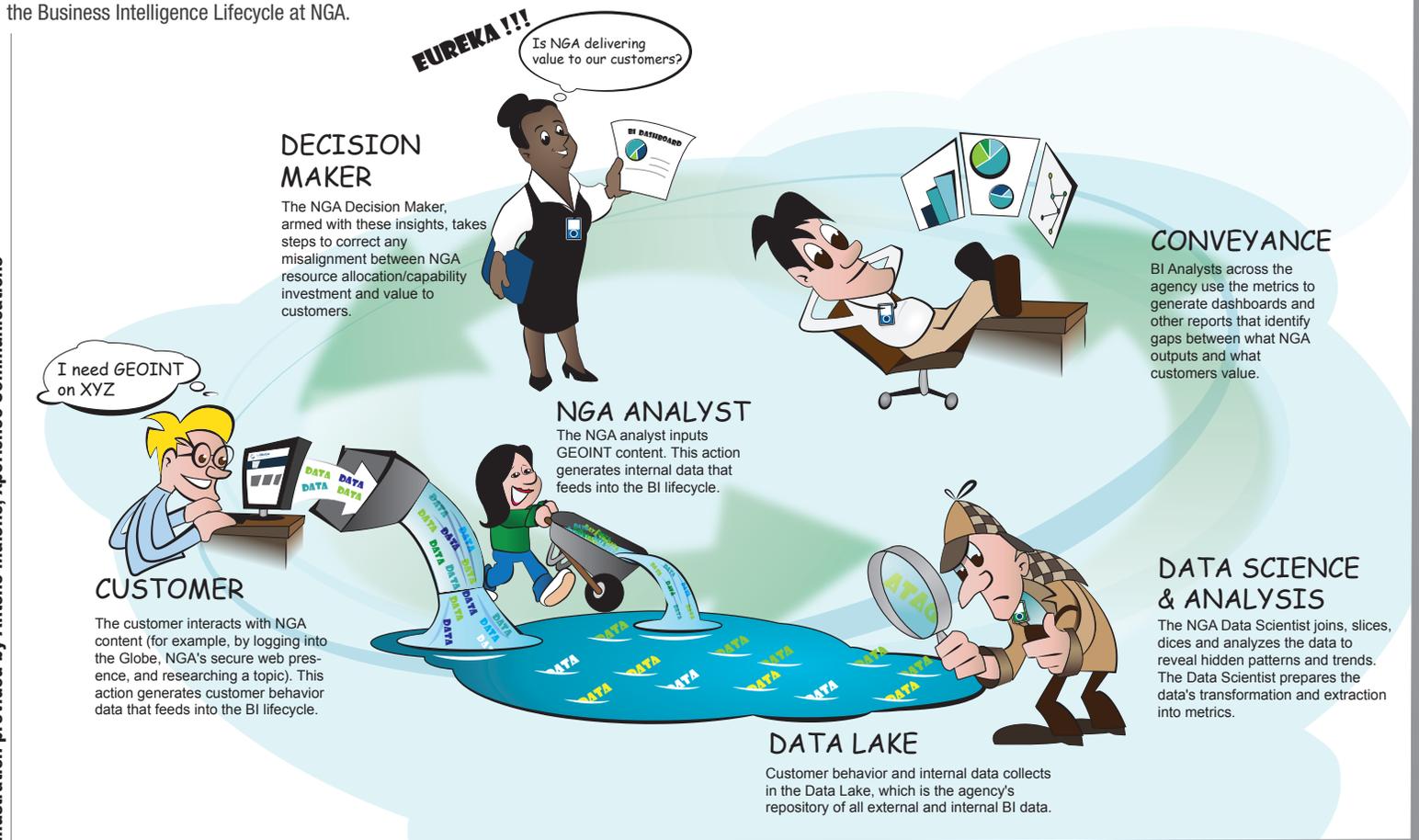
According to Deputy Director Sue Gordon, NGA knows the data that it's currently collecting would yield much more valuable insights when easily linked with other datasets.

“VANDL is a no-brainer,” Gordon said. “We've got to move in this direction.” ✨



## NGA'S BUSINESS INTELLIGENCE LIFECYCLE

Here is an example of how customer data moves through the Business Intelligence Lifecycle at NGA.



# NGA CYBERSECURITY IN THE ERA OF THE ENTERPRISE BREACH

By Evan Frank, CIO-T Communications Team

Addressing cybersecurity in his Feb. 26 statement for the record, “Worldwide Threat Assessment of the US Intelligence Community,” submitted to the Senate Armed Services Committee, Director of National Intelligence James Clapper highlighted a mission threat that the intelligence community must deeply consider as it moves toward greater transparency and engagement with both government and commercial partners.

“Cyber threats to U.S. national and economic security are increasing in frequency, scale, sophistication, and severity of impact,” Clapper wrote. “Overall, the unclassified information and communication technology networks that support U.S. Government, military, commercial, and social activities remain vulnerable to espionage and/or disruption.”

These cyber threats, both internal and external, are orchestrated by independent groups and nation-states who seek to infiltrate combat support agencies like the National Geospatial-Intelligence Agency, an agency that collects, stores and shares vital geospatial information and intelligence affecting the warfighter on the ground, at sea, and in the air.

The recent system breaches at the U.S. Office of Personnel Management are evidence of the increasingly advanced cyber threat, and the impact to more than 21 million people demonstrates the scale this type of unmitigated vulnerability can have on the federal government, its workforce and its mission.

Yet the ability to conduct and support national security operations in an increasing open and transparent online environment — especially for GEOINT — remains a key to the success of the U.S. national security mission.

As NGA continues to adopt cloud-based strategies and collaborate with industry leaders to move more into the open, its level of risk to cyber-attacks increases, and the OPM breach serves as a reminder that adversaries have a vested interest in stealing and exploiting vital government information and intelligence.

To mitigate this threat to the GEOINT mission, NGA’s Cybersecurity Office, under Acting Chief Information Security Officer Matt Conner, works to ingrain sound cybersecurity at the root of the agency’s culture and daily operations to ensure the GEOINT data and products relied on

by NGA's mission partners and analysts are trustworthy and uncompromised.

"Historically, cybersecurity has been a parallel discipline, almost a black art," Conner said. "We need to build security in and not bolt it on."

When applied across a massive enterprise, Conner stresses the importance of contextualization, turning an abstract concept into commonplace practice.

"As the Director [Cardillo] is fond of saying, conveying consequence and marrying context with content, we find the 'so what,'" Conner said. "We're trying to look at enterprise risk assessment in association with mission areas, not as a [system] number or project X, but on the basis of mission safety. Instead of a pie chart of findings, the team says, 'NGA's mission is at risk.'"

For NGA, the majority of its cybersecurity expertise resides in the newly merged Office of the Chief Information Officer and IT Services directorate, known as CIO-T. But impactful cybersecurity requires engagement from everyone at NGA — from the analyst to the public affairs officer, with cybersecurity experts continuously partnering with the workforce to mitigate risk and ensure the safety of GEOINT information.

Sara Hood, a cyber-focused GEOINT analyst, said that post-OPM breach, personnel within the Analysis and Source directorates are more aware of the threat and willing to take part in a coordinated effort to secure the network. She welcomes the idea of cybersecurity officers, system engineers and system administrators building better lines of communication with her team, if for nothing else than to explain the give-and-take in maintaining an acceptably secure and operational network.

"Our work has been so greatly affected," said Hood, referring to the impacts of recent cybersecurity breaches. "People are very much aware of what could happen if proper security is not followed. We are not only responsible for securing NGA data, but other sources as well. I think we take that for granted sometimes. We are only as strong as our weakest link."

NGA's Cybersecurity Operations Cell has worked for more than two years across agency directorates and with external entities like U.S. Cyber Command to detect and deter cyber threats. Complementing the cell, the Cyber Operations branch fights daily to sustain system and policy compliance across enterprise systems, and the Cyber Assessment division's blue team coordinates and conducts penetration testing to help identify impactful vulnerabilities for mitigation or removal.

CAD deputy chief Mitch Smoot leads the blue team, a direct extension of the CS office's reach across all NGA programs. Smoot understands the need for greater

engagement through program and system lifecycles because his team helps serve this need.

"We work directly with the cyber defenders, the security control assessors, and the system administrators to identify the root cause of vulnerabilities," Smoot said. "We've had a positive influence. We've become the finders, the fixers, and the trainers."

As Conner said, the idea of building in the role of cybersecurity from beginning of system and program development is critical. To do so requires those outside of the cybersecurity workforce to gain a greater desire to incorporate cybersecurity by design, and an understanding of the risks to the GEOINT mission if these best practices are not put in place.

"As NGA analysts, we need to understand there are state and non-state actors ready to utilize malicious tools to deny, destroy, degrade and disrupt our operations," said NGA cyber-focused GEOINT analyst Bradley Wors. "This should be a constant reminder to the NGA workforce to remain vigilant and grasp the importance of cybersecurity as we continue to rely more heavily on advanced technology in the future."

Conner is in the process of establishing the interaction that Hood and her team hope for through the Vulnerability Management Panel, a group initiative between CIO-T's cyber operations experts and cyber-focused representatives from other NGA directorates. The goal of the panel is to help collaboratively frame the massive amounts of collected cybersecurity data for informed prioritization of risk and to allow IT executives to make better-informed funding and resourcing. Analysts like Hood will have the opportunity to work directly with the VMP.

The most vigilant cybersecurity program cannot lock every backdoor opened through negligence or malevolence, so Conner and his CS division chiefs accept a certain level of risk not simply to sustain operations, but also to free resources to consider probable threats and focus on identifying and minimizing the most severe risks. Conner believes the VMP is the right direction to follow.

"Everything is ripe for us to get the attention we need," Conner said. "All eyes are on us now, and we need to deliver."

NGA and its employees should remain vigilant in the cybersecurity mission space because, as former CSOC chief Dale North explained, eyes of all types will be on all of "us" for the foreseeable future.

"This is not a short-term problem," North said. "Short term for the adversary is three to five years; long term is 10 to 20 years. They are looking to develop individuals, find the weak spots. This is how it applies to NGA — everyone is not a [cybersecurity] analyst in our core mission, but everyone sits at a keyboard, from the director to the new pay band 2. That's our target surface." \*

# WORKING TO BUILD A SUPERVISORY CULTURE

Thomas M. Cooke, Foundational GEOINT Division, Rivanna Station NST

“Lead, follow or get out of the way!” These words have resonated with me throughout my entire career, and they still hold true today. Having been a supervisor most of my 13 years at the National Geospatial-Intelligence Agency as well as during my previous military service, I’ve seen firsthand that strong leaders in supervisory positions made the difference between success and failure. When the NGA Supervisory Council was established in 2011, I knew NGA

understood this too, and I wanted to be part of it.

The NGASC continues to mature and evolve, and has now picked up the gauntlet to lead the effort to deepen a corporate supervisory culture and further develop leaders within NGA. Last April, the NGASC Chair, Mark Spivey, briefed NGA’s Director Cardillo on the new NGASC mission statement, “to act as the stewards of

the NGA supervisory profession” with a vision “to create, promote and sustain a supervisory culture for the 21st century NGA workforce.” Cardillo endorsed the vision, stating in a message to the workforce, “You have heard me say that I recognize and appreciate the difficulty and criticality of all our supervisors ... and it’s incumbent on all of us to spend the time and energy to ensure their success.”

I consider it a privilege to be a supervisor, and when I became aware of the NGASC, I was more than excited to apply and to serve. Now that I’m a member, I truly appreciate the successes the forum has enjoyed by addressing the challenges facing supervisors across NGA. For example, the NGASC spearheaded the effort for the agency to adopt supervisory competencies as part of performance reviews and is now working toward a standard training curriculum for new supervisors. This initiative was only possible because a cadre of experienced supervisors were provided access through the NGASC to advise senior leadership on a significant issue. Most recently, the NGASC has partnered with the Mission-Talent Alignment and Career Services initiatives to assist supervisors in the critical role of advising and mentoring their subordinates on their future career aspirations. As Deputy Director Sue Gordon has told the workforce, Career Services is here to stay and supervisors can do wonders by understanding it. She also encouraged supervisors to really understand what CS is all about, and my NGASC colleagues are up to the challenge.

Supervision is as much an art as a science, and the strength of the council is derived from its ability to leverage the great diversity brought to an issue by those willing to

assist. We don’t suffer from a lack of interest; member drives are always successful. The motivation is high and the reasons for taking on more responsibility and committing up to 10 percent of their time to develop a supervisory culture are as varied as the offices in which the members work.

Council member John Hangsleben, an HD instructor who joined the NGASC this year, said he felt privileged to work with NGA supervisors.

“As a former supervisor myself, I can relate to the issues and challenges they face and I want my students and all NGA supervisors to know they are not alone,” said Hangsleben. “Resources exist that can help them manage, grow and succeed in their assigned duties, and I am proud to make things better for my students.”

Council member Brandie Schieb, from the Maritime Safety Office, offered a slightly different perspective.

“I joined the NGASC because I believe development of supervisors is just as important as development of analysts,” Schieb said. “Supervisors have the power to make an average group outstanding if they know how to empower their people, have difficult and courageous conversations, and help them understand their role in achieving the greater mission.”

Jodicus “Wayne” Prosser provides direct GEOINT support to military customers at Fort Hood, Texas. His council membership provided an avenue for him to represent external supervisors and express their concerns.

“I recognized that personnel changes such as Mission-Talent Alignment and Rank-in-Person were going to have significant impacts upon the external workforce that may not have been foreseen by senior leadership,” said Prosser.

Mark Spivey, the NGASC Chair, said he joined NGASC because supervision is much more than the mechanics of timecards and PeopleSoft.

“Supervisors play a critical leadership role in guiding, mentoring, motivating and developing employees, and they will continue to do so in the future,” said Spivey. “Employees must understand and embrace the new direction NGA is taking, and middle management is where employees always look for answers and direction. Transformation is personal — it happens at the individual level and supervisors must have the tools and network to help them convey the complete picture for each of their employees.”

The NGASC has embraced servant leadership as its model toward serving the agency in general, and supervisors in specific. I’m proud to be part of an effort dedicated toward building a supervisory culture that will serve as the bedrock of stability across the agency during future periods of change. As the adage goes, the one thing that remains constant is change, and Deputy Director Gordon has charged supervisors to help the workforce navigate a major change. The NGASC is working to help the supervisors stay ahead of the curve. ✨

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Tom Cooke is a retired military officer who now enjoys the ability to wear more than one type of suit to work as a civilian supervisor within NGA.

“Supervisors have the power to make an average group outstanding if they know how to empower their people.”

# MATHEMATICAL MINUTIA: GEOMATICS INCREMENTAL IMPACT

By James Friederich, Geomatics Office

Through the end of the Second World War, military operations were historically theater based. But with the advent of global mission profiles, the requirement for precise positioning, navigation and timing became essential. The advent of unmanned weapons, precision-point positioning and Global Navigation Satellite Systems established the importance of accurate geospatial intelligence, which became a dependency for shaping U.S. military doctrine.

The National Geospatial-Intelligence Agency's role in the defense and intelligence communities is predicated on providing the critical accuracy and precision that defines the geospatial location of events and features on the surface of the Earth. NGA also provides this same accuracy and precision to airborne and orbital platforms to enable and maximize their own intelligence gathering and navigation missions.

Over the course of 50-plus years, NGA geodesists, orbit analysts and geodetic surveyors in the Geomatics Office within the Source directorate have been global leaders in defining, refining and updating models of the Earth that provide the fundamental basis of accurate geospatial intelligence. It was once said that one of NGA's predecessors, the Defense Mapping Agency, was the best keep secret in the Department of Defense. And today, perhaps the geomatics tradecraft is best keep secret within NGA. The foundational math and science of geomatics unpins all positioning, navigation and timing operations throughout the National System for Geospatial Intelligence.

Geomatics is a relatively new term within NGA, but it is built upon traditional geodesy and cartography components, including work from the Greek mathematician Eratosthenes, studies on gravity by Carl Gauss, and modern mathematical applications of geodetic surveying and satellite orbital mechanics.

The disjointed theater and regional based maps of the 1940s were unsuited for the evolving post-World War II global missions. The DOD needed global maps and charts to support international positioning and navigation, and the existing regional geodetic systems could not provide an accurate worldwide basis.

Necessity is the mother of invention, and in 1960, the Army Map Service, an NGA legacy agency, began to develop the required worldwide system to unify geodetic and cartographic data and provide compatibility between the coordinates of widely separated areas of interest. The combined efforts of the Army, Navy and Air Force lead to the DOD's World Geodetic System 1960, or WGS 60.

The WGS is the standard for DOD use in mapping, charting, positioning and navigation. It comprises a standard coordinate system for the Earth, a standard ellipsoidal reference surface (the datum or reference ellipsoid) for the size and shape of the Earth, and a gravitational equipotential surface (the geoid) that defines the nominal mean sea level.

Other factors driving the WGS development were the start of the space age for satellite tracking and earth monitoring and the advent of the Cold War. Preparedness necessitated a standardized, NATO-wide geodetic reference system in accordance with NATO standardization agreements. Not only does the WGS provide one geodetic framework for multinational operations, but it ties together ground-, airborne- and space-based operations into a single geodetic framework.

Since 1960, there has been an increasing amount of earth observations, data gathering, refinements, and technology and technique improvements. Data from satellites and new surface gravity revealed better information about the size and shape of the Earth. Updates to the WGS were published in 1966 and 1972. In 1987, the latest global geodetic reference frame, World Geodetic System 1984, was published and it is the current global geodetic system for DOD.

In the last 25 years, NGA geodesists have updated WGS 84 several times to meet two important criteria — an increase in precise users' accuracy requirements and maintaining alignment to the Earth, which is always changing.

"These updates include improvements to the Earth Gravitational Model, the World Magnetic Model and the reference coordinates for the WGS 84, which defines the center of the Earth," said JN Markiel, Ph.D., a senior orbit scientist in the Geomatics Office. "Each of these changes introduces incremental improvements, sometimes only a few centimeters, but they are necessary to meet the increasingly stringent requirements for precise positioning and navigation and to maintain alignment with our dynamic planet."

Refinements derived from NGA's geodesists may seem like mathematical minutia or scientifically arcane to a layman, but this work is critical to understanding the world and integrating that scientific knowledge into intelligence gathering, positioning and navigation. \*

James Friederich is a senior geosciences scientist in the Geomatics Office and is well positioned in the agency to deal with the gravity of ensuring the accuracy in geospatial intelligence.

## WHAT'S YOUR STORY?

Tell us your personal, unclassified version of the work you or your office does for NGA for possible inclusion in the next Pathfinder. Send your 600 word or less account to [Pathfinder@nga.mil](mailto:Pathfinder@nga.mil). Submissions may be edited for clarity and length.



## GEOINT GOES TO SEA NGA'S SHIP RIDER CHARTS A TRUE COURSE WITH THE NAVY

*By Anne Helms and Marc Steiner, Military Support Directorate*

Limited by low Internet bandwidth and cyber threats, U.S. sailors aboard even the most advanced aircraft carriers in the world often rely upon data, images and products that are produced and prepackaged elsewhere rather than benefiting from the same on-demand access to geospatial services enjoyed by anyone with a smartphone.

“At sea, Navy geospatial intelligence operations take place in a communication-restricted environment. It’s not uncommon for shared and low bandwidth limitations to define our capacity to exploit imagery in support of our mission and our own safety of navigation,” said Petty Officer Matthew

Jumper, stationed aboard the carrier USS Theodore Roosevelt.

The very nature of the carrier environment — with its multiple operational priorities from daily flight operations to combat drills — makes employing new intelligence community technologies and techniques especially challenging. This reality drives the Navy’s requirement to balance enabling technologies and engineering with military planning standards and operations to accomplish its national security objectives.

The National Geospatial-Intelligence Agency’s longstanding partnership with the Navy continues to provide



Photo by U.S. Navy Public Affairs Office

capable, I'm in favor of a greater level of on-site and federated support with the experts."

It was during a late 2014 visit to U.S. Fleet Forces Command in Norfolk, Virginia, that a conversation between Inman and John Scali, deputy director of NGA's Military Support directorate, turned to the scope of technology, data and products needed shipboard versus those actually available in order to ensure the best support of military decision making. From that discussion emerged one of the most unprecedented partnerships to date between NGA and the Navy.

In the spring of 2015, NGA deployed veteran imagery analyst Rob Stiver aboard the USS Theodore Roosevelt as the first of two "ship riders" in a pilot program. Stiver has provided dramatically improved access to geospatial resources, demonstrated how GEOINT can be applied to fleet operations for the duration of a Navy deployment, and captured lessons learned, which will become a model for use by other intelligence community partners.

"This collaborative effort with NGA is driving us forward to a Navy enterprise in which the right

people, tools and processes are in place to address key intelligence and operational problem sets by thinking geospatially," said Inman. "The insights we're gaining make us smarter as far as aligning systems, data and training to meet mission requirements."

Scali said NGA's embedded approach to GEOINT support has proven it can work just as effectively afloat as it does ashore in the Middle East, the Horn of Africa, or in any other deployed locations.

"This effort differs from our standard model of positioning a regional GEOINT analyst at a single geographic location for expertise on a particular area or issue. Progressively, we're seeing that by taking on a 'train, coach and mentor' stance, our efforts are informing more people and serve as a force multiplier for enduring post-deployment effects," said Scali. "It's my hope that this experiment will influence the Navy's training programs to include greater emphasis on GEOINT in support of fleet operations."

After learning the realities of low-bandwidth communications aboard the ship, Stiver reached back to Military Support personnel at NGA and was remotely trained on a streaming

critical linkages between GEOINT-related systems, products and processes. To that end, NGA Support Team members are embedded with fleet operations around the globe to help develop GEOINT solutions that address the Navy's unique operational environment.

"I'm a big fan with an obvious bias toward retaining, and even expanding, the current level of NGA support to the fleet," said Navy Capt. Carl Inman, U.S. Fleet Forces Command. "In comparison to the other services, Navy use of GEOINT is still in the early stages, though it's progressing. Until our enterprise is fully operational



Photo by Rob Stiver



U.S. Navy photo by Mass Communication Specialist 3rd Class Jonathan Snyder

imagery service available through NGA's OCONUS [Outside Continental United States] data center. Stiver was then able to use his training and instruct the Navy analysts on this new imagery access technique, which mitigated the bandwidth constricted environment typical on most ships. Using the service, the analysts aboard the USS Theodore Roosevelt are now able, for the first time, to stream imagery to their workstations in seconds versus waiting hours using alternative means. This capability alone has created immediate impact for the Navy customer by expediting intelligence operations.

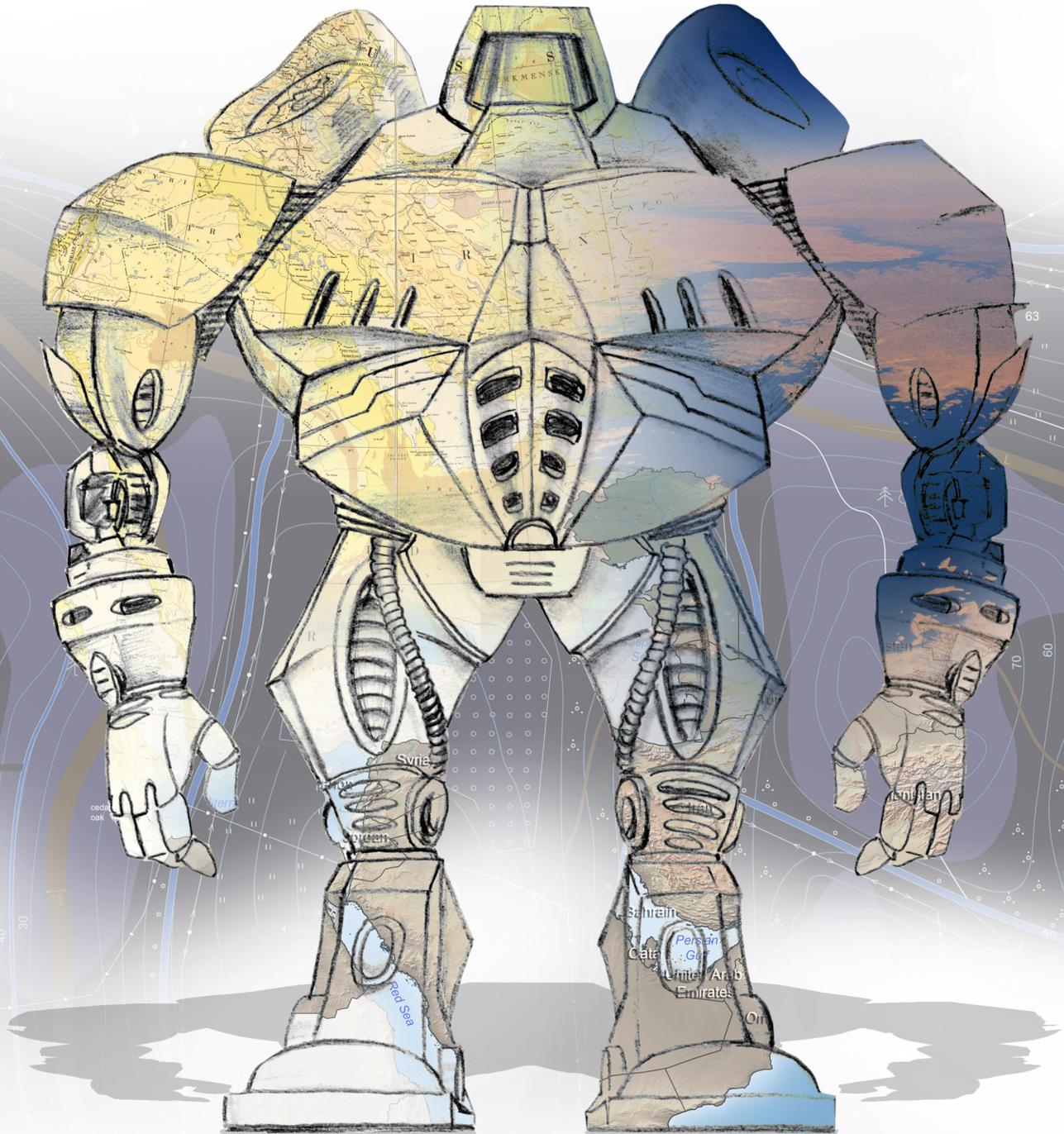
“This is probably the most challenging and rewarding experience of my NGA career,” said Stiver. “It’s incredibly satisfying to be able to give these sailors the proficiency to make better use of GEOINT at a tactical level; but on a larger scale, my being here gives the Navy a foundation to formulate new and improved tactics, techniques and procedures for the entire fleet.”

While he is not the first NGA analyst to board a carrier, Stiver’s unique mission reflects a mounting awareness across U.S. and allied governments that the ability to counter primary

security threats is deeply dependent on investment in key partnerships, intelligence and leading-edge technologies.

“GEOINT is one of those force multipliers for the Navy. We are continually bringing these elements together, learning from each other shipside, and being reminded that our collective knowledge adds up to more than the sum of its parts,” said Stiver. “It’s pretty humbling to think about the importance of what we’re doing out here today, when you remember that only 500 years ago, people thought the Earth was flat. Without GEOINT, we still wouldn’t know the difference.” ✨

# The Transformation of GEOINT



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# THE TRANSFORMING WORLD OF GEOINT PERSISTENCE: HOW WE GET AND CONVEY GEOSPATIAL INTELLIGENCE

By Paul Frommelt, Office of Corporate Communications

**B**etween the 5th and 4th centuries, many Greek tragedies employed the use of a mechanical crane, known as a “mechane,” to lift an actor into the air as a way of dramatically inserting a character into a scene. The character, often a deity making their first appearance in the third act, would use their omnipotence to resolve the play’s central conflict and bring about a hasty resolution.

The use of the mechane became so commonplace in Greek theatre that the Latin term, “*deus ex machina*” — which translates to “god from the machine” — was used to describe the unexpected last minute godly intervention in the tragedies.

The term “*deus ex machine*” has endured in popular culture, as modern-day storytellers mine the rapid advancements in technology — the mechane of the 21st century — and its relationship with the human mind for their art.

This relationship between human and machine is central to the future of the National Geospatial-Intelligence Agency. In a keynote address at the 2015 GEOINT Symposium last spring, NGA Director Robert Cardillo said that geospatial intelligence, or GEOINT, is at an “inflection point.”

“In the next five years ... more than a dozen constellations, hundreds of [small satellites] will launch and continuously scan the earth,” Cardillo said. “It means our analysis of world events is going to be holistic and persistent.”

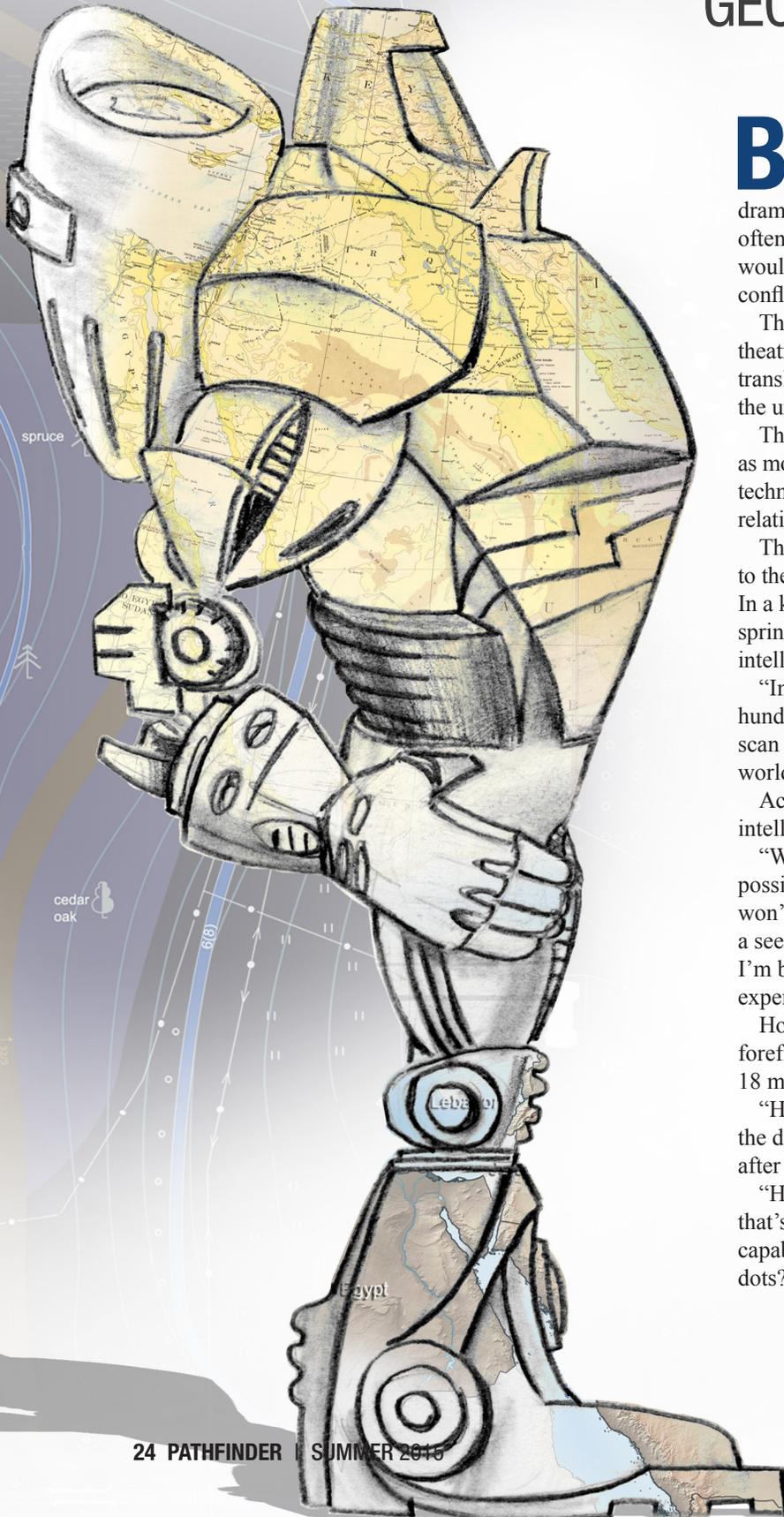
According to Cardillo, this proliferation of sensors forces intelligence agencies like NGA to pivot.

“We have to change our mindset, to investigate multiple possibilities and better understand this complex situation. We won’t need to balance a finite collection capability against a seemingly infinite set of GEOINT requirements. And I’m betting on our people — those brains — because their expertise is our ultimate value proposition.”

Holistic and persistent GEOINT analysis has been at the forefront of Jennifer Daniel’s brain for the better part of 18 months.

“How do we create coherence from chaos?” asked Daniel, the director of NGA’s Persistent GEOINT Office, a month after Cardillo’s speech.

“How do we take all this stuff that is out there now and that’s going to be out there in the future, maximize its capabilities, understand what it tells us, and connect the dots? How do we get answers faster so we can provide that



information advantage to our customers who can then use it to deliver consequence and succeed in their mission?”

These are questions that Daniel and her 30-person team have been working on since her office stood up in May 2014 at the request of former director Letitia Long.

“This is not about transforming one part of our enterprise, it is not transforming one part of NGA, or one part of the NSG [National System for Geospatial Intelligence], it is about transforming the environment of how we get GEOINT and how we convey GEOINT,” said Daniel.

The first part of that transformation is clarifying, once and for all, what persistent GEOINT means.

“One understanding, one vision,” said Daniel.

So what is persistent GEOINT? According to Daniel, the best way to answer that question is to first dispel a common misconception.

“Some people have the impression that persistent GEOINT as being about a ‘dwell’ capability, like what we get from full-motion video ... where you can dwell over an area on the ground for a period of time and track activity and look at activity,” she said. “That is one part of persistence, but it’s not the only part of persistent GEOINT.”

The official definition of persistent GEOINT, as developed by Daniel and her team, is: “a focused intelligence strategy to obtain geospatial content with sufficient periodicity and duration to detect change, characterize activity, infer behavior, and discover unknowns — where the rate of information refresh equals or exceeds the rate of change.”

Simply, according to the team, persistent GEOINT is not about sensors or automation or processing or models, it’s about the synthesis of all of these things to accelerate data to answers.

According to Sherry Prewitt, defining persistence can be difficult because the term is so malleable.

“Persistence is based on your target or your issue,” said Prewitt, who runs the Frontiers division of NGA’s Office of Geospatial Intelligence Management and is tasked with looking holistically across the GEOINT missions to understand and address future analytic needs.

Daniel and her team are interested in maximizing the capability of any and all sources of information, from federal, commercial and international satellites, to airborne, terrestrial, subsurface and open source.

And once you have access to all that data, how do you sort through it, organize it and tell the analyst what is important?

Enter automation.

“Machines assisting humans,” said Daniel. “It’s not machines taking the place of humans. Let machines do what they’re good at and let humans do what they are good at.”

And when we say “machine,” we are focusing on the software and coding, rather than the hardware, said Prewitt.

“Hardware is easy,” she said. “Software and code is much more difficult. There are thousands and thousands of lines of code that need to be written.”

According to Daniel, automation works in a number of ways, from connecting the data, organizing objects, tipping and cueing, and predicting outcomes.

“It’s four times faster for a human to get to the answer by using the assistance from the machine, than it is by having a number of people do that same function without a machine by searching through the images,” said Daniel.

“We have examples of automation connecting the dots and discovering things that humans looking at that same set of data were not able to discover. Getting to persistence is taking these types of capabilities and building them, making them more accurate and stronger, and continuing to build them across the enterprise.”

According to Prewitt, automation is key for NGA to fully leverage the amount of information — imagery and data — that is being ingested.

“For us to fully leverage the capabilities that you would get from small satellite companies, for us to fully leverage all of our overhead capabilities, from a timeliness perspective, we have to have automation,” she said. “I’m talking about being able to process all of that information in a quick manner, being able to react to that processed information from a machine perspective. That doesn’t mean that you have to have eyes on every bit of information.”

For now, the persistent GEOINT environment of the future remains, well, in the future.

Daniel and her team, and NGA as a whole, are currently laying the foundation for that environment, which includes focusing on building up the agency’s initiatives in GEOINT Services, Next-Gen Collection, and advanced analytic techniques, and reaching out to industry, academia and government partners.

“All of these are building that foundation that we can leverage to get into the future,” said Daniel. “We have a number of prototypes at NGA as well as in the community that are working on using machines to detect activity, to detect changes, to pull data together. Many of these are in the prototype environment, many of these are at the very beginning stages. We need to continue to push forward and build on them to get to where we need to be in the future.”

Pushing an entire intelligence discipline into the future is not easy work. Nor is it instantaneous. There is no “deus ex machina” in the third act.

“Getting to a persistent GEOINT environment is not a big bang,” Daniel said. “You are not going to get there overnight and turn a switch and all of a sudden you are going to be there. We have to purposefully take what we are doing now and build to the future.” ✨

| FEATURE |



# ENTERPRISE CHALLENGE

Demonstration reveals how GEOINT tools and tradecraft have transformed

By Jeanne Chirrop, NGA Office of Corporate Communications

Anyone who has seen the

1986 movie “Heartbreak Ridge” understands how essential integration and interoperability are to survival.

At the height of the action, the Marine sergeant played by Clint Eastwood struggles alongside his men, as different branches of the military fail to collaborate to rescue them. The irony that the platoon is saved by using a commercial source — a credit card to phone home — is not lost on National Geospatial-Intelligence Agency employees. One of NGA’s new strategic goals is to leverage commercial sources as much as possible.

“At the time [the movie was made], troops on the ground only had interpersonal radios for communication ... Yet they could connect with basically anyone, anywhere, at any time, if they could get to the commercial telephone service,” said D.K. Stewart, who came to NGA after retiring from supporting Air Force special operations.

Stewart believes the movie serves as an analogy for the importance of standards — for both technology and behavior.

“The reason that commercial services work is because of the standards,” he said. “They have to be interoperable. They don’t do well if they exclude customers.”

Fans of “Heartbreak Ridge” know that the film was based on an event that occurred in Grenada in 1983. Knowledge of the situation influenced introduction of the Goldwater-Nichols Department of Defense Reorganization Act of 1986, which formally established the Joint Chiefs of Staff and the combatant commands NGA supports today.

## The tipping point

Notwithstanding reforms brought about by Goldwater-Nichols, the sharing of geospatial intelligence remained difficult. Just how much so came to light during the terrorist attacks on Sept. 11.

“There were a lot of issues with getting GEOINT into the hands of policy makers so they could make decisions,” said John Sherman, who was the White House Situation Room duty officer on 9/11.

According to Sherman, GEOINT capabilities were unconnected at the time. At one point, he collaborated with his peers by holding different telephone handsets to each of his ears — one connected to a representative of the Air Force and the other to one of New York Mayor Rudy Giuliani’s aides.

“Everything required a lot of manual work back then,” he said. “We would print out a map from a website, and cut and paste information from emails. It was all very time and labor intensive.”

The types of information Sherman and his counterparts used in 2001 are now increasingly available through shared platforms and databases.

“The wartime scenario we went into after 9/11 forced a lot of integration,” he said. “The customer didn’t have time to go to different places to get information.”

Personnel in combat zones in Afghanistan and Iraq became the biggest innovation drivers.

“Tools and expertise began changing quickly, not just because warfighters didn’t have time to be information integrators, but also because they were becoming savvier,” Sherman said. “They had started to understand the power that GEOINT brought them.”

## Evolution of tools and tradecraft

The military services and many DOD agencies share information today through a common desktop environment known as the Joint Information Environment, or JIE. Within the intelligence community, a growing number of employees use the Intelligence Community Information Technology Enterprise, or IC ITE, and NATO allies have a separate network. DOD and IC entities, including NGA, are developing the Defense Intelligence Information Enterprise, commonly known as DI2E, to integrate cross-domain intelligence from these various venues for reliable battlespace awareness.

Developing the DI2E is central to the Enterprise Challenge, an annual event to test the interoperability of data-sharing technologies across the DOD enterprise. (Prior to 2012, the EC was known as the Empire Challenge.) The EC engages every branch of the U.S. military, key combatant commands and several U.S. allied nations in demonstrating state-of-the-art GEOINT capabilities. This year, large-scale testing occurred in NGA’s InnoVision Laboratory Environment as well as at more than 15 additional sites across the United States, Canada, Australia and the United Kingdom.

The underlying purpose for the EC is to ensure that U.S. and allied warfighters, and the decision makers who direct them, have the capabilities for understanding where adversaries are and what they are doing — at all times and in real time. They need to be certain of the location of mission partners, to know exactly where civilians are and to know targeting data is reliable. Geospatial intelligence provides the foundation for this.

NGA leads and executes the event each year.

“When you commit forces somewhere, you have to do everything you can to ensure that they’re safe,” said retired Navy Cmdr. Joseph Smith, who has been involved with the EC since its inception. “That means making sure their data systems work as they should.”

Ronnie Stanfill, NGA’s manager for EC-15 held earlier this year, agreed. Stanfill is a retired Air Force fighter pilot and former squadron commander who has a long history with the EC.

“It is critical that warfighters have confidence that the information they have is accurate and complete, especially for targeting purposes,” he said. Most important, said Stanfill, is to nurture a culture of information sharing.

“Once we started understanding that there was a family of systems, that’s when we began to think about how they needed to be connected — for instance, how the full-motion video used by the Air Force would be more useful if it combined analysis from the Army, and so forth,” he said.

Tracking the evolution of the EC culture shows how GEOINT tools and tradecraft have transformed over time.

“We’ve gone from compliance to conformance, and are now moving toward true compatibility,” Stanfill said.

The continuum started with stove-piped systems, according to Mark Mogle, a former Air Force imagery analyst and NGA contractor who has been involved with the EC for more than a decade. In stove-piped systems, data were shared by way of email from analyst to analyst. Outside the classified environment, data were often shared by exchanging computer diskettes, said Smith.

The advent of metadata tagging enabled true data sharing, and the integration of tagged services soon followed. The DI2E framework will allow all mission partners — including international allies — to ingest data into whichever platform and security level they normally use for mission accomplishment.

A milestone on the road to integration came when the community began to view GEOINT as a service, said Dave Cacner, one of NGA’s GEOINT IT experts. In the past, many data types required a unique repository dependent on a specific software application in order to be viewed and used. Separating datasets from applications enabled the data to be consumed independently, grouped or combined with intelligence or operational information, he said.

GEOINT applications have also evolved from stand-alone systems to more agile, customizable services that can be shared and even used on mobile platforms.

Royal Air Force Maj. Andy Mangan, the United Kingdom’s representative to this year’s EC, cited the sharing of common services as a top outcome of international collaboration to date.

“The NATO Top 10 apps — and really understanding what they can do — are proven benefits of the Enterprise Challenge,” Mangan said.

Cacner explained that the GEOINT data architecture is also being overhauled. Originally designed on a World War II-based tasking, processing, exploitation and dissemination model, the architecture is too linear to keep up with the volume and pace of today’s data.

“GEOINT data continues to grow substantially, and it’s no longer enough to push data to multiple global locations. We need to enable rapid data access, discovery and visualization over common networks that minimize bandwidth dependencies for information flow,” Cacner said.

Moving forward, Mangan said that building the proper DI2E architecture is critical.

“We’ve got to get things right at the outset,” he said, because the architecture is the foundation upon which all GEOINT will be shared by allied military forces.

## EC-15

Intelligence, surveillance and reconnaissance sensors are at the center of both GEOINT and the EC. Modern ISR sensors have transformed over time to handle increased collection (i.e., big data), larger file sizes (i.e., large data) and new types of data (e.g., LIDAR, hyperspectral), according to Cacner.

Interoperability of ISR sensor data among FVEY partners is a major focus of the EC. The “Five Eyes,” commonly abbreviated as FVEY, denote an intelligence alliance comprising the United States, Australia, Canada, New Zealand and the United Kingdom.

“After all, when we fight a war, we do it as a coalition,” said Mogle.

FVEY partners view the EC as beneficial for reasons other than straight technology interoperability. Mangan cited sharing lessons learned. Air Force Maj. Jamie Miller, the Canadian representative to EC-15, cited cost-effectiveness, as duplicative services are avoided and partner technologies are leveraged.

Among services now shared by FVEY partners are those that connect reporting with video imagery and video imagery with maps. The same technologies connect GEOINT to other intelligences — to signal intelligence and human intelligence, for instance.

“We need to be wider than just GEOINT in order to provide high-fidelity intelligence to the warfighter,” said Miller.

## Humanitarian aid and public safety

Interoperability is about more than battlespace preparation. Integrated content and services are also critical for humanitarian assistance and safety of navigation.

U.S. agencies team with international partners for disaster relief and rescue efforts. Examples include assistance following the 2010 hurricane in Haiti, the 2013 typhoon in the Philippines and the earthquake in Nepal in April 2015. International coalitions have fought Ebola outbreaks in West Africa and monitored previous pandemic threats, such as the spread of bird flu in Asia.

NGA's Map of the World has proved itself a useful tool for humanitarian assistance, said Stanfill. The tool provides content that enables first responders to identify safest access to hospitals and best supply and evacuation routes. During EC-15, NGA technologists demonstrated how mission partners layer street maps with overlays of airfields and warehouses, and then add human geography data and even crowdsourced details.

"We can add intel straight from folks in the field to update actual conditions," said Dave Currence, an NGA analyst who led one of the MoW demonstrations.

## Overcoming challenges

While the thrust of EC-15 is interoperability, an equally critical task is to develop access control mechanisms that protect sensitive data while making content available to mission partners who need it. Identity and management tools control who can use resources – an authentication process – and what resources they can use and in what ways – an authorization function.

"Cross-domain is a big issue for working with international partners," said John Snevely, an EC-15 presenter representing the Undersecretary of Defense for Intelligence.

None of the solutions demonstrated through the EC will succeed without standards and compliance, said Stanfill. He believes NGA is positioned to assist.

"As the GEOINT functional manager, NGA's director, Robert Cardillo, can work with members of the NSG [National System for Geospatial Intelligence] and ASG [Allied System for Geospatial Intelligence] to encourage standards compliance," Stanfill said. (See "Team GEOINT" sidebar.)

Stanfill also said that under Cardillo's leadership, NGA is starting to change the mindset of the GEOINT community. He believes this new thinking will drive the tradecraft into the future.

"When community members realize 'I am no longer a specialized analyst, I am a member of the GEOINT team,' that will carry us to true fusion," Stanfill said. \*

## Team GEOINT

Before technologies and data can integrate, the transformative work of creating standards and policies is distinctly human.

Representatives from throughout the DOD, IC and close allied nations manage standards and governance through various National System for Geospatial Intelligence forums. The NSG, of which NGA is a member, constitutes the core of what NGA Director Robert Cardillo calls "Team GEOINT."

The NSG consists of more than 30 national members and the four nations with which the United States shares a multilateral agreement for intelligence cooperation — United Kingdom, Canada, New Zealand and Australia, which together form the Allied System for Geospatial Intelligence. In addition to the NSG and ASG, several organizations participate in the GEOINT community as NSG partners, including members of industry and academia, professional organizations and foreign nations with which the United States has bilateral agreements.

Director Cardillo leads the NSG as the GEOINT functional manager, a duty separate and distinct from management of NGA.

"A lot of people confuse mission management and functional management," said Charlie Schilling, deputy chief of the NSG Capabilities and Integration office within NGA's Office of Geospatial Intelligence Management. "Mission management is the tactical, day-to-day work; functional management is the strategic, planning work."

The use of universally accepted and agreed-upon standards ensures that NSG system components do what they are required to do and are integrated in ways that allow GEOINT to be exchanged between them, according to Jeff Bell, GEOINT standards expert who represents NGA in several NSG and GEOINT enterprise-wide standards working groups, including the Open Geospatial Consortium and the Defense Geospatial Information Standards Working Group. Standards also ensure that GEOINT data are in forms that can be understood by varied systems and users.

In June 2015, the NSG issued a directive on standards assessment, according to Mary Willmon, a member of the NSG policy team. The directive established a formal assessment program for standards pertaining to IT, GEOINT data and services, and interoperability.

The process is far from easy, said Angel Douglas, who focuses on the international aspects of the task. For example, she said metadata tagging is complex because nations work within different security domains, use different terminology and follow different technical standards.

Ronnie Stanfill, manager of Enterprise Challenge 15, said EC participants discovered several years ago that 80 percent of the GEOINT systems tested were compliant with standards, but only 20 percent of them were interoperable. The reason, he said, was that the standards themselves were incompatible.

The discovery prompted Thomas Ferguson, then-principal deputy undersecretary of defense for intelligence, to issue a memorandum in 2011 stipulating that full program funding for systems depends on verification of compliance with NSG GEOINT data standards.

But the real incentive to comply, according to Willmon, is that "people understand that they won't be interoperable without them. They'll be left out." \*



Photo by Senior Airman Christopher S. Muncy



# The GENESIS of GEOINT

By Regina Galvin, Office of Corporate Communications

## September 11, 2001

**8:46 a.m.** – Hijackers aboard American Airlines Flight 11 crash the plane into floors 93-99 of the North Tower of the World Trade Center in New York City.

**9:03 a.m.** – Hijackers aboard United Airlines Flight 175 crash the plane into the World Trade Center's South Tower.

**9:37 a.m.** – Hijackers aboard American Airlines Flight 77 crash the plane into the western façade of the Pentagon in Washington, D.C.

**10:07 a.m.** – Hijackers aboard United Airlines Flight 93 crash the plane into a field in Somerset County, Pennsylvania.

## September 13, 2001

Without ceremony or fanfare, overshadowed by the terrorist attacks two days before, retired Air Force Lt. Gen. James Clapper became the director of the National Imagery and Mapping Agency. While the catalyst for organizational change had already

been established with the findings of the Report of the Independent Commission of the National Imagery and Mapping Agency in early 2000, in the months and years that followed, Clapper led the transformation and established the National Geospatial-Intelligence Agency. No reflection on the transformation of GEOINT would be complete without the perspective of the man who coined the term and shaped the future of geospatial intelligence.





*With the hindsight of nine years, in his office in McLean, Virginia, now Director of National Intelligence Clapper reflected on the events irrevocably impacted by 9/11. In his own words:*

I took over two days after 9/11. I think the entire IC was under pressure. Not to the extent that say, CIA [was], but nevertheless I recall that Afghanistan was not exactly on our top 10 hit parade for foundation data — so we were behind the power curve.

We were really scuffling to do what we now call GEOINT products for Afghanistan. And [we] bought up every bit of commercial imagery that we could. We were really [hustling] there for about 90 days. I think it was around the first of the year 2002, I took the

top 40 or so leaders of [NIMA] and we went down to Camp Peary for an offsite.

The question I posed was, “Do you think we’ve been singing Amazing Grace at the wake of NPIC [National Photographic Interpretation Center] and DMA [Defense Mapping Agency] long enough?”

We saw the advantages, on an anecdotal basis, of the melding of mapping, charting, geodesy on one hand and imagery analysis on the other and melding them into a single product. There’d been some work done on a pilot program in the analysis area on doing that, which showed great promise.

So everybody bought into it. And I said if that’s the case, it’s GEOINT and we’ve got to change the name of the agency. All of that was hatched in that offsite, I think about Jan. 2002, after

the hectic, high-pressure time there of the last few months of 2001.

Everyone saw the merit of [the transformation]. When I came to NIMA, I had in hand the NIMA Commission Report, which really laid out the original intent of the founding fathers and mothers when NIMA was created. [NIMA] never really lived up to that because the first five years of existence, it was simply DMA and NPIC under one tent but they were separate. Even in the production organization, they were separate. The NIMA commission critique was that NIMA had not lived up to its intended expectation.

So that’s what I walked in with — that’s what needed to happen — so we pushed. I left almost five years later, and GEOINT pretty much gelled. It’s certainly matured since then, but that’s how it got started. ✨

| SHOW THE WAY |

# NATIONAL 9/11 PENTAGON MEMORIAL

**“WHAT SEPARATES US FROM THE ANIMALS, WHAT SEPARATES US FROM THE CHAOS, IS OUR ABILITY TO MOURN PEOPLE WE’VE NEVER MET.”**

— AUTHOR DAVID LEVITHAN IN HIS BOOK “LOVE IS THE HIGHER LAW.”

# ONE HUNDRED YEARS REMOVED

## A Map of World War I Europe by the U.S. Army General Staff, 1914

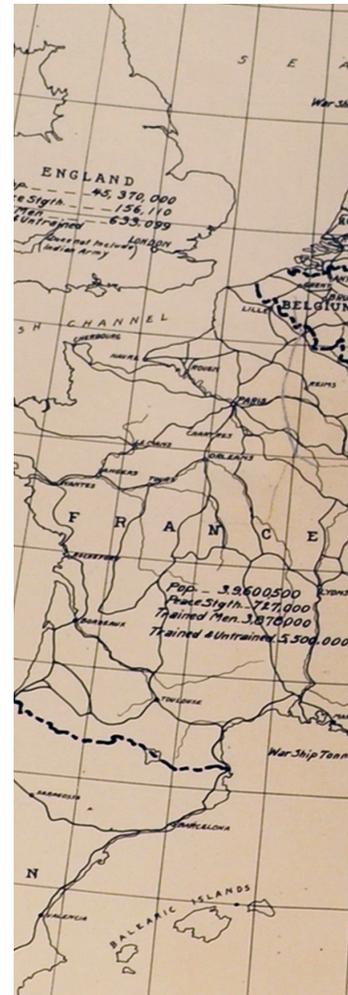
By Gary E. Weir, Ph.D., NGA Historian

*KNOW THE EARTH: The last issue's back cover featured a map prepared by the War College Division of the U.S. Army General Staff. Read on to learn the historical context of the map's use.*

Today, this map of Europe only appears in textbooks or historical archives. Many of the countries and empires represented no longer exist, perishing in one the most violent and destructive conflicts in human history.

After the assassination of the Archduke Franz Ferdinand in Sarajevo, June 28, 1914, the U.S. Army authorized a geospatial rendition of a likely European war, which provided the most fundamental data on the military potential on the battlefield and at sea, of each of the participants. As a result of the terrorist act against the Austro-Hungarian throne, the United States needed to prepare itself for the possibility of the outbreak of war within Europe among the two primary alliances. This map displays the political boundaries of Europe in 1914 as well as the continental river system. In addition, the data provided on the map answered some fundamental questions about each country for the Army planners. The general population as well as the peacetime strength of the professional army appeared at the top of the data list for each country. For example, France had an army of 727,000. The French navy accounted for 876,135 tons of warships, while the dominant British Royal Navy accounted for over 1.2 million tons. By comparison to a relatively small army in the United Kingdom, the French could count on 3.88 million trained men who would respond to a call for army mobilization, increasing the standing army numbers to 5.5 million trained and untrained men. While this is impressive, we need to remember that the effects of trench warfare and sophisticated weaponry over the course of four years would cost the French one-third of their male population.

With a population of 125.64 million and 1.2 million under arms in peacetime, many European military leaders treated Russia as the greatest threat in a possible war. Trained and untrained, the Russian army could place a force in the field that the U.S. Army could only guess. The mobilization of the Russian army by the Tsar actually led Germany to initiate its own mobilization in 1914. The Germans felt the need to knock out France before turning to meet the huge army of Tsar Nicholas II. The Russians, even though they were ill-equipped and ill-trained, could field more than Germany, who could call upon over 4 million fighters after a general mobilization and a trained and untrained total of roughly 7 million.



The imperial ambitions of the Europeans also brought resources from far-off lands into play. The British supplemented their forces with components of their Indian army and the French drafted natives from their colonies as soldiers. This was truly a world war.

If nothing else, this map provides a strong depiction of just how dramatically World War I changed the political configuration of Europe, and illustrates the scope and potential horror of the impending conflict as seen by the United States in 1914. \*



## KNOW THE EARTH

**ANSWER:** The woman who influenced Iraqi boundaries was Gertrude Bell. She was the first woman to graduate with a degree in history from Oxford University. She brought her expertise in near eastern history, language and culture into British army intelligence in the early years of World War I. A colleague of T.E. Lawrence, later Lawrence of Arabia, Bell found work as a highly valued, resident regional expert during and after the conflict.

