

» CRITICAL INFRASTRUCTURE » COMPETITIVE ORIENTEERING » USGIF INDIVIDUAL MEMBERSHIP

2016 ISSUE 1

trajectory

THE OFFICIAL MAGAZINE

OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

A GLOBAL INTELLIGENCE ENTERPRISE

THE INTELLIGENCE AND
DEFENSE COMMUNITIES
OVERHAUL IT ARCHITECTURE
TO EMBRACE DATA SHARING



Big Data Savant

Dozens of Special Ops missions in Iraq, Bosnia, and Kosovo give Mark Giaconia a unique perspective on Big Data Analytics.

Q: How does having *been there* influence your work?

I understand risk... because I lived it. That helps me anticipate which questions these massive data sets have to answer. One of my biggest motivators is getting the right data into the mix.

Q: In retrospect, what challenges stand out?

Not being able to share data with coalition partners was a huge frustration. That made it hard to collaborate — and cranked up the risk.

Q: How are you solving that problem today?

It's all about using open source intelligence: blending multi-spectral imagery with unconventional data. I just developed an application that turned a livestream of tweets into geospatial intel.

Q: What USG mission are you serving?

I blend data to provide answers for intelligence analysts and military planners. My goal is to innovate *every day* and stay ahead of whatever GEOINT they need.





A crew from New Jersey's Public Service Enterprise Group works to restore power after Hurricane Sandy.

PHOTO COURTESY OF PSE&G

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Farewell and thank you to Dr. Max Baber.

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Correction

The "Carrying on the Tradecraft" article in the Q4 2015 issue of *trajectory* incorrectly stated USGIF scholarship winner Crystal English is a certified crime and intelligence analyst for the California Department of Justice (DOJ). English is certified by the California DOJ as a crime and intelligence analyst, but is not employed there. We regret the error.

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WEB EXCLUSIVE

Growing UAS use improves critical infrastructure evaluation.



2016 STATE OF GEOINT REPORT

Download the PDF to read about tradecraft trends and predictions.



INTELLIGENCE INTEGRATION

Cover story bonus material: additional resources on IC ITE, JIE, and more.

REFLECTING AND LOOKING AHEAD

Welcome to the first issue of *trajectory* for 2016. I hope you enjoyed the holiday season and had some time to reflect and reset for the New Year. Just prior to digging out from "Snowzilla," USGIF finished leading the effort to produce our second annual State of GEOINT Report. The report offers the opportunity to both reflect on trends of the past year and reset goals to help address issues we face as a GEOINT Community.

The 2016 report includes 40 authors from government, industry, and academia contributing 14 insightful articles on myriad topics including analysis, deep learning, and collaborative intelligence. The State of GEOINT Report is meant to be a conversation starter. It is an avenue for the GEOINT Community to raise questions, call attention to issues, and share perspectives on where our Community is headed. I encourage you to visit USGIF.org to download this year's report and also to share it broadly with your colleagues.

The diverse perspectives shared in the report are representative of the wide-ranging topics we cover in *trajectory*, at our events, on the web, and via social media. As we manage the final edits to each issue, I appreciate the topics we've covered, and lament the tremendous number we've yet to go after. In this issue, Matt Alderton tackles the topic of critical infrastructure protection, highlighting the role of GEOINT in effectively planning for and executing that important mission. Managing Editor Kristin Quinn takes on the difficult task of defining how the defense and intelligence communities are reshaping information technology to facilitate data sharing with IC ITE, JIE, DI2E, and more. Her comprehensive examination chronicles the success of these efforts to date and paints a picture of what lies ahead. We asked Kristin to do this with regard to commercial imagery in our very first issue. She nailed it then, and I think she's done it again here. While fact checking this article, one senior official remarked it was the most clear and concise articulation of the path forward they had seen. I look forward to your thoughts and comments on both of these features.

Speaking of difficult tasks, I'd be remiss if I didn't mention Dr. Max Baber has moved on from USGIF, with an eye toward returning to teaching, after six successful years leading our academic programs. When I joined USGIF, it struck me that we lacked a dedicated staffer with requisite bona fides to engage effectively with academia and GEOINT-related organizations

in the academic world. We hired Max to further fulfill our mission as an educational foundation. Under Max's stewardship we accredited nine collegiate GEOINT programs, bringing the total number to 12—with many more in the pipeline. Additionally, Max managed the selection process for almost \$1 million in scholarship awards. He helped grow a small, pre-symposium gathering into the content-rich and very popular GEOINT Foreword. Max's efforts have opened the door for the GEOINT Community to work more closely with academics, and in many cases changed minds about the work we do as a Community. We all owe Max our sincere appreciation for his dedication to the GEOINT mission.

Max's efforts will directly impact our profession for many years to come as students who have attained our GEOINT Certificate move into the workforce. Further, this year's GEOINT Foreword is shaping up to be another phenomenal gathering preceding the May GEOINT 2016 Symposium in Orlando. We hope to see you at GEOINT 2016 where we'll gather to learn and grow professionally, network with colleagues, visit more than 275 exhibiting organizations, and engage in meaningful discussions about this year's theme: "The GEOINT Revolution."

Of course we hope to see you at one of our other events early this year, which will include GEOINTeraction Tuesday, a data analytics workshop, and a GEOINT Symposium preview with NGA leadership. We also look forward to the ongoing growth of USGIF as a professional association, as we will soon eclipse 1,000 individual members.

I look forward to seeing you in our halls or at one of our events sometime soon. Best wishes for a productive and innovative 2016.



KEITH J. MASBACK | CEO, USGIF
@geointer



DR. MAX BABER,
USGIF's former director
of academic programs,
speaks on a panel during
GEOINT Foreword at the
GEOINT 2015 Symposium.

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HERA SYSTEMS

NEWS UPDATES AND HIGHLIGHTS

HERA SYSTEMS plans to launch its first satellites in October 2016.



IMAGE COURTESY OF HERA SYSTEMS

HERA SYSTEMS TO LAUNCH FIRST SATELLITES

Hera Systems revealed plans to launch its first satellites, which will capture high-resolution earth images and video in near-real time. The constellation will be able to collect fresh one-meter and high-resolution imagery and video of any location on the globe.

The company also plans to offer its imagery products with analytics and derived information, easily accessible on-demand via mobile applications. Hera Systems secured its initial round of investment funding and plans to begin launches in October 2016.

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NASA's Lunar Reconnaissance Orbiter spacecraft has generated more than

4 billion

measurements since it launched in 2009.

NASA TO LAUNCH WILDFIRE DETECTION SATELLITE NETWORK



IMAGE COURTESY OF NASA

NASA plans to launch a new satellite network to make it easier to predict and fight wildfires. Named FireSat, the network will encircle the globe with 200 satellites equipped with temperature sensors. The sensors will be able to detect fires 35-50 feet wide within 15 minutes of inception. NASA aims for the network to be operational by June 2018.



FAA REQUIRING CONSUMER UAV REGISTRATIONS

The Federal Aviation Administration (FAA) now requires all consumer unmanned aerial vehicles (UAVs) be registered. The decision is the result of a U.S. Department of Transportation task force created in October to develop recommendations for a UAV registration process. In November, the task force released a report suggesting UAV operators fill out an online or app-based registration form in order to receive an electronic certificate and personal registration number. Registration costs \$5 and does not apply to systems weighing less than 0.55 pounds. Current UAV owners were given until Feb. 19 to complete the process. Visit registermyuas.faa.gov to learn more.

UNIVERSITY OF REDLANDS RECEIVES NSF GRANT

Researchers at the University of Redlands in Redlands, Calif., received a National Science Foundation (NSF) grant totaling nearly \$700,000—the university's largest NSF award to date. The grant began Nov. 1 and supports a two-year pilot program to develop and test spatial science, technology, engineering, and mathematics plus computing (STEM+C) activities in K-5 classrooms.

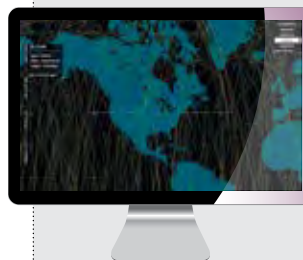


PROCRASTINATION TOOLS

INTRO TO GEOGRAPHY WORLD EDITION

In partnership with Rand McNally Education, educational app builder Montessorium created a new app to help children ages six to eight learn geography. Supporting seven different languages, the app teaches the names, locations, shapes, and flags of countries around the world via challenges, puzzles, and drawing exercises.

montessorium.com/app/intro-to-geography-world-edition-2



LINE OF SIGHT

Want to see which satellites are passing overhead right now? Open-source mapping startup Mapzen pinpoints current satellites in orbit and maps their trajectory. Users hover their mouse

over each satellite to learn its name and purpose. PatricioGonzalezVivo.github.io/LineOfSight

OPENGEOFICTION

Based on the OpenStreetMap software platform, OpenGeofiction is a collaborative platform to create fictional maps. Build cities, create a country, or develop neighborhoods and let one's imagination do the work! opengeofiction.net



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The Lunar Reconnaissance Orbiter has mapped more than



of the moon's surface.

2015 GEOINT COMMUNITY WEEK

Around 1,000 people attended events during USGIF's 2015 GEOINT Community Week Nov. 16–20 in Northern Virginia and beyond.

The week of events began with USGIF's first **Small Satellite Workshop**, a two-day event hosted by the Foundation's SmallSat Working Group in collaboration with the National Geospatial-Intelligence Agency (NGA) at NGA Campus East in Springfield, Va. The first day was unclassified while the second day included classified sessions. (Read a full recap of this event on page 8).

"By all accounts, the first-ever USGIF Small Satellite Workshop was a huge success," said Rob Zitz, co-chair of USGIF's SmallSat Working Group and senior vice president and chief systems architect of Leidos' national security sector. "All participants—government, industry, and academia—left with a far deeper appreciation of how low-cost, yet highly capable satellites will contribute to our national security."

Later in the week, USGIF hosted its annual **NGA Tech Showcase East** also at NGA Campus East.

USGIF's **Geospatial & Remote Sensing Law Working Group** held its first event with a workshop focused on legal matters critical to the GEOINT Community.

"I was very pleased with both the turnout at the program and the quality of the presentations," said Kevin Pomfret, co-chair of USGIF's Geospatial & Remote Sensing Law Working Group as well as executive director of the Centre for Spatial Law and Policy and partner at Williams Mullen. "We also accomplished our goal of drawing from both industry and government so that we can begin to build a community of lawyers that face similar issues involving the collection, use, storage, and distribution of geospatial information."

The American Geographical Society held its annual **Geography 2050** event Nov. 19–20 at Columbia University in New York City. This year's conference focused on "Exploring Our Future in an Urbanized World." USGIF CEO Keith Masback moderated a plenary session on the future role of cities in the geo-strategic landscape. Additionally, USGIF Chairman of the Board The Honorable Jeffrey K. Harris led an industry panel discussion on urban change.

USGIF also participated in George Mason University's "GIS and Health" event on **GIS Day**, and the Foundation's **Young Professionals Group** held an informal networking event in Arlington, Va.



USGIF FILE PHOTO

LAWYERS FROM BOTH industry and government gathered at USGIF's Geospatial & Remote Sensing Law Workshop to discuss legal matters related to the GEOINT Community.

FUSING BIG DATA

NGA's Ernest Reith speaks at GEOINTeraction Tuesday

USGIF's GEOINTeraction Tuesday was hosted by a USGIF Member Organization for the first time in November. Approximately 150 people attended. Held at VRICON's office in McLean, Va., the event kicked off with a ribbon cutting, marking the opening of the company's new headquarters.

Attendees also had the opportunity to network and hear from Dr. Ernest Reith, deputy



USGIF FILE PHOTO

director of IT services at the National Geospatial-Intelligence Agency (NGA).

Reith's speech focused on data fusion. He said the visualization aspect of data fusion, where imagery and 3D merge, provides NGA good representation and context in order to make critical decisions.

"We're on the cusp of the legendary dog catching the car—the car being Big Data," Reith said. "One piece of that is IC ITE (the Intelligence Community Information Technology Enterprise). Every time [DNI] James Clapper talks about IC ITE, it's about integration, which goes back to data fusion." (Read more about IC ITE in our cover story on page 14).

Reith also spoke about NGA's newly released Commercial GEOINT Strategy and how the agency's unclassified GEOINT Pathfinder project will contribute more data for fusion.

GEOGALA 2015

USGIF's tenth annual GEOGala was held Nov. 14 at the Hilton McLean Tysons Corner in McLean, Va. This black-tie event brings together more than 400 Intelligence Community leaders, USGIF members, and guests for an evening of networking, delicious food, and dancing.

USGIF FILE PHOTOS



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EMBRACING SMALLSATS

The National Geospatial-Intelligence Agency (NGA) no longer intends merely to admire the potential of commercial small satellites; it is moving forward with plans to harness the next generation of commercial remote sensing.

In November, USGIF and NGA co-hosted a Small Satellite Workshop at NGA Campus East as part of USGIF's 2015 GEOINT Community Week. The first day was unclassified, while the second day included classified sessions. NGA Director Robert Cardillo kicked off the unclassified session with a keynote speech.

According to Cardillo, the challenges before his agency and the Intelligence Community as a whole are how to best take advantage of new commercial potential, reduce barriers to space, and create better insights and warning. He cited "optic" or the perception of how commercial SmallSats will add value, as one of his primary objectives.

"Our value proposition going forward will still include [high] resolution, but the temporal aspect has grown exponentially," Cardillo said.

He urged the audience to think in terms of "activity resolution," which he described as "the sum of spatial facts as understood through time and projected into the future to create insight and understanding."

Cardillo also said the opportunities ahead will add to the technologies NGA already leverages today, giving a nod to national technical means as well as the agency's existing commercial partners, especially EnhancedView contract holder DigitalGlobe.

The director also discussed NGA's new Commercial GEOINT Strategy, which outlines how the agency will embrace new commercial GEOINT products by March 2018 via four "lanes": know, explore and experiment, acquire and deliver, adopt and institutionalize. Cardillo added he anticipates the agency will do little acquiring of SmallSats and instead mostly partner with SmallSat providers.

Chirag Parikh, director of space policy with the White House National Security Council, spoke at USGIF's Small Satellite Workshop, where he commended NGA for embracing commercial space products. Innovative technology paired with investment equals inevitability, he said. "I'm so happy to hear NGA is investing fiscally and culturally in this."

Parikh added that new space venture capitalists have been looking for government commitment to commercial products, and cited NGA's Commercial GEOINT Strategy as a concrete commitment that will influence investment.

Parikh also announced at the workshop he would soon leave the White House to take a leadership position with NGA.

RESILIENCY & LAUNCH

Parikh and several other experts also described the threat to space systems as inevitable.

"You don't see the Navy making the case for why it needs to protect an aircraft carrier," Parikh said. "The same approach is needed for space."

SmallSats inherently provide resiliency because it is much more difficult for an adversary to take out hundreds of satellites as opposed to one large satellite, in addition to the fact that SmallSats are relatively quick and inexpensive to replace.

However, the next generation of commercial remote sensing will not make it into space without next generation launch systems, according to experts on a morning panel titled "The Burning Platform."

Tom Webber, director of the Space and Strategic Systems Directorate for the Army Space and Missile Defense Command, said timely, affordable access to satellite launches is still inadequate.

"The timelines, even if you can afford the launch, are completely unacceptable for the tactical Army mission," Webber said, noting the unrealistic 18-month wait times and \$50 million price tags.

Robbie Schingler, co-founder of Planet Labs, which has 101 satellites on orbit and aims to bring that total to 200 in the next 18 months, said launch is a global problem that hasn't been solved anywhere—except for perhaps China.

"We should think more strategically and allocate resources to create commercial launch capabilities in the U.S.," Schingler said.

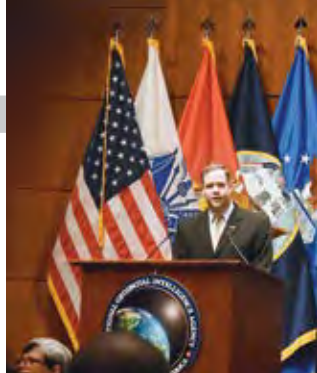
Jason Andrews, CEO of Spaceflight, said his company "works to put everyone on everyone else's launch vehicle."

"By making satellites smaller you make the price of launch smaller," Andrews said.

However, Andrews added, the community needs small, dedicated launch vehicles, and there are a lot of people working toward providing that capability.



PHOTOS COURTESY OF NGA



REP. JIM BRIDENSTINE, member of the House Armed Services Committee and the Science, Space, and Technology Committee, gave an afternoon keynote at USGIF's Small Satellite Workshop.

message. According to Bridenstine, access to launch isn't the only barrier to space with which experts should be concerned.

Bridenstine said recent advancements in space are positive and will make the world a better place, but warned: "The future generation needs to be able to benefit from capabilities in low Earth orbit."

He pointed to the Kessler Syndrome, a theory developed by NASA scientist Donald Kessler in the late '70s that debris is being created in low Earth orbit from collisions much faster than it is being removed by the atmosphere and gravity.

"The DoD doesn't want to be the FAA for space," Bridenstine said repeatedly. "The DoD needs to focus on fighting and winning in space instead of trying to determine if a piece of orbital debris is going to hit the International Space Station on a particular morning."

Bridenstine recommended regulation to address the growing problem of orbital debris. "If we do nothing, we will

DEALING WITH DEBRIS

Rep. Jim Bridenstine, member of the House Armed Services Committee and the Science, Space, and Technology Committee, gave an afternoon keynote with a hopeful yet sobering

regulate ourselves out of being able to use certain orbital regimes," he said.

The Congressman added that continuing to do nothing might also bring about regulation requiring satellites to be hardened, making them heavier and therefore more expensive to launch. When asked who he thought should be "the FAA for space," Bridenstine declared, "the FAA."

NEXT GENERATION ANALYSIS

Thought leaders in an afternoon panel also discussed how analytics would keep pace with the increasing amount of data coming down from space.

John Fenwick, Skybox Imaging operations manager for Google, said the number of analysts would not grow alongside the amount of data, making automated feature detection more necessary.

In another afternoon panel, Gary Dunow, NGA director of analysis, said more data would facilitate activity-based intelligence, predictive analytics and forecasting, and even competitive and opportunity analysis—the ability to test theories on data to support policy makers in ways not yet available. Dunow also cited "analysis-as-a-service" as a potential boon for SmallSat companies.

John Goolgasian, director of source at NGA, said analysis-as-a-service would augment, not substitute, analysis being conducted today.

"We want to ensure we retain core knowledge and that people understand what the machines are doing and how to develop algorithms," Goolgasian said.

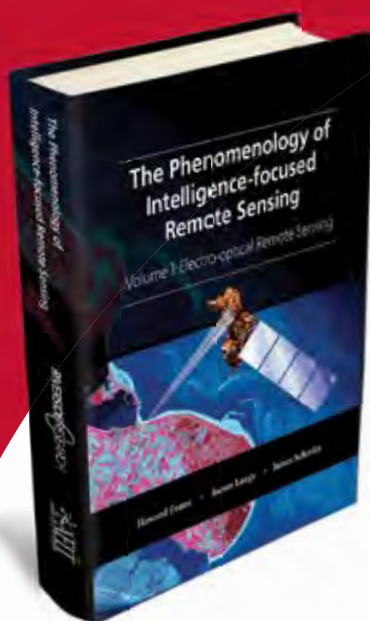
He also said the agency would soon release the first in a series of four Broad Agency Announcements to precede an RFP in summer 2016, all of which are to help NGA implement new solutions and bring next generation capabilities to bear.

According to Goolgasian, the agency will seek access to three things: high-resolution commercial imagery, high-revisit commercial imagery, and high sensor diversity. ■



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—Keith J. Masback, CEO, United States Geospatial Intelligence Foundation

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THE THINKING SPORT

GIS, spatiotemporal analysis, and critical thinking combine to help West Point's nationally recognized orienteering team shine

By Jim Hodges

WEST POINT'S orienteering team defeated the U.S. Naval Academy in a 150-70 win December 6 at Occoquan Regional Park in Lorton, Va.



PHOTO COURTESY OF WEST POINT

NICHOLAS IVES AND JETT DIPALMA appeared suddenly over the hill, their cleated athletic shoes swishing quickly through a thick layer of fallen leaves. They spied the orange and white cloth bag and transponder tied to a spindly young oak. First Ives, then DiPalma keyed into the transponder, sending a signal to a computer a half-mile away that they had reached control point 19, the last on the 7.1-kilometer “red” course.

Then they raced down the hill, slipping and sliding until they reached the finish point of the orienteering competition at Occoquan Regional Park near Marine Corps Base Quantico in Virginia. Both scored for the United States Military Academy at West Point in its 150-70 win December 6 over the U.S. Naval Academy—the first time the two academies had ever faced off in orienteering.

Col. Mark Read is a physical geography instructor at West Point in his

second stretch as officer in charge of the academy's orienteering team. During his first term, from 2002 to 2005, Read led the team in the beginning of its current 13-year run as U.S. Intercollegiate Orienteering Champions.

“We had some success before that, but there had been a couple of years when we [unfortunately] did not,” Read said. “There are certain sports that Army should dominate, and this is one of them.”

Orienteering is built on a geospatial foundation of place, direction, and time. At the beginning of the competition, athletes are handed paper maps of 5-meter

terrain contour with plotted control points. Using only a compass, athletes navigate a path from one control point to the next, which must be negotiated in order. The path, however, is up to the individual competitor, who must apply speed and mental acuity to make the fewest mistakes possible.

“I don’t get too caught up in winning,” said DiPalma, a third classman and intercollegiate orienteering champion in the M-20 (male under 20-years-old) division. “I want to run a perfect course. Win or lose, if I made a mistake, I’m a little upset with myself.”

|||||

“I DON’T GET TOO CAUGHT UP IN WINNING. I WANT TO RUN A PERFECT COURSE. WIN OR LOSE, IF I MADE A MISTAKE, I’M A LITTLE UPSET WITH MYSELF.”

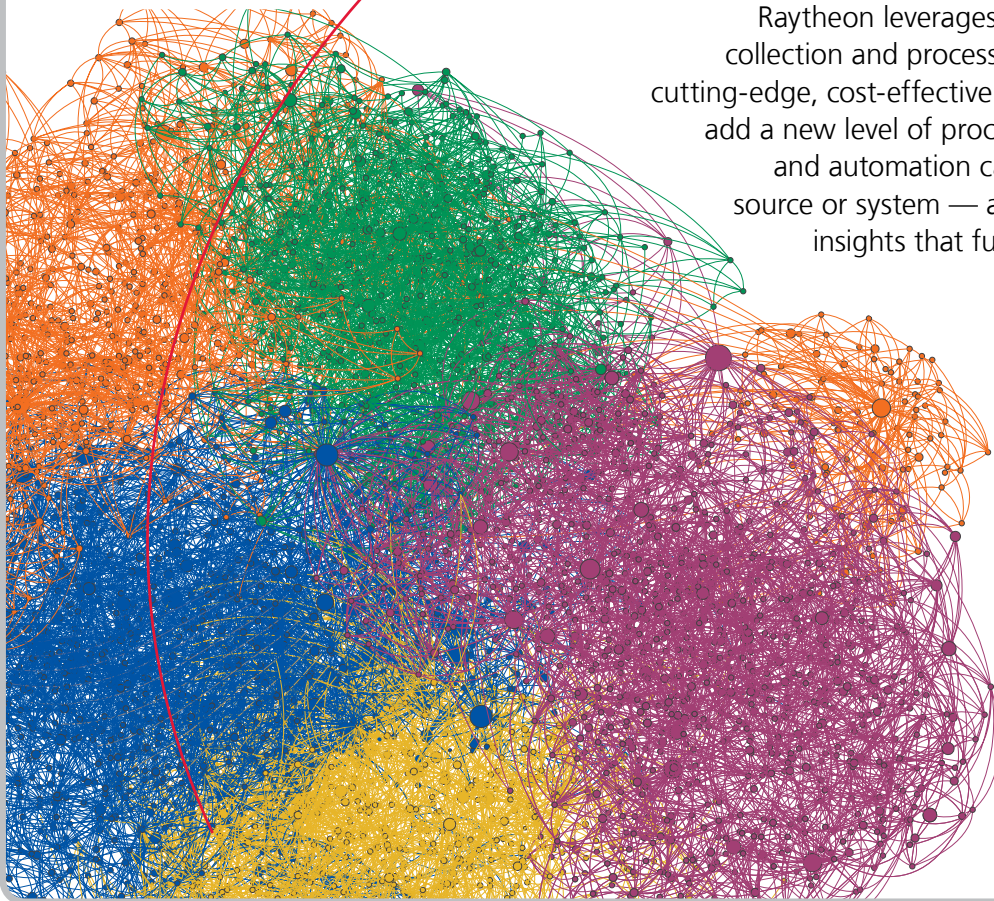
—Jett DiPalma, United States Military Academy at West Point third classman

|||||

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DiPalma is a GIS major at West Point who gravitated to the orienteering team after discovering he was good at land navigation during summer training. Rachel Wolfe, also a GIS major, took up orienteering for the opposite reason.

"I was really bad at land nav, and I thought I should be better at it," she said.

PRE- AND POST-RACE TRAINING

As GIS students, DiPalma and Wolfe helped create the training course maps the West Point orienteering team uses to train over the rugged terrain of the Hudson River Valley.

West Point orienteers also participate in a post-competition process created by retired Col. Mike Hendricks, who led the Orienteering Team in between Read's two terms. Now with the Alaska Division of Geological and Geospatial Surveys, Hendricks introduced biomechanics into orienteering while at West Point, where he taught GIS and conducted research in spatiotemporal analysis.

"We would record our track over the course every second [using a GPS watch]," said Lt. Hannah Culbert, a former West Point orienteer who is now an engineer assigned to the National Geospatial-Intelligence Agency. Culbert was the first woman from West Point to earn a spot on the U.S. Senior Foot

Orienteering Team, which represents the country at international orienteering competitions.

"You throw that track on your map to note time and place," Culbert said. "You can color code your speed and say, 'Here's a place where I hesitated. Here's where I was uncertain. Here's where I made a mistake, where I went someplace instead of where I was supposed to go.'"

A heart-rate layer, also captured by the watch, can be added as well.

"You can say, 'Oh yes, I made a huge mistake here where my heart rate spiked over 180. I know that's where I need to dial it back. I can't think spatially when my heart is at 180,'" Culbert added.

Mistakes can be limited by gaining control over racing heartbeats and other factors that may cloud judgment.

"It's about managing how fast you can go vs. the decision you need to make," DiPalma said. "When you can figure out what you did wrong, and what you can do better, it really helps you improve."

West Point's USGIF-accredited GIS program, which is part of the academy's Geography and Environmental Engineering Department, helps contribute toward the orienteers' success.

"All of the GIS instructors are willing to help me if I have a question on orienteering," DiPalma said. "We've been

"YOU CAN SAY, 'OH YES, I MADE A HUGE MISTAKE HERE WHERE MY HEART RATE SPIKED OVER 180. I KNOW THAT'S WHERE I NEED TO DIAL IT BACK.'"

—Lt. Hannah Culbert, former West Point orienteer and the first woman from West Point to earn a spot on the U.S. Senior Foot Orienteering Team

adopted by the GIS program and the geography program in general."

ARMY VS. NAVY

The GIS instructors also pushed for West Point to challenge the Naval Academy in orienteering as part of Army-Navy week 2015. The challenge was relayed through Dan O'Connor, a West Point cadet assigned to the Naval Academy for a semester.

The Naval Academy has neither a GIS academic program nor an orienteering team, so an email was sent to its mountaineering club, said O'Connor, who competed for West Point at Occoquan.

Jack Gasper, a second classman and aspiring Marine, was among the midshipmen who answered West Point's challenge. "I want to learn land navigation," he said. "We don't have it at the academy (save for a course taught in the last semester of the fourth year to future Marines)."

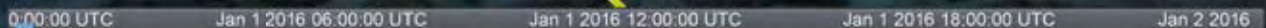
Gasper finished an advanced, 5.6-kilometer "green" course in 57 minutes and 21 seconds—close to the 10 minutes-per-kilometer threshold that marks a competitor ready for more difficult courses, according to Lt. Col. Victoria Campbell, a West Point grad who coaches the Armed Forces Orienteering Team.

"Orienteering is a thinking sport," Read said. "You can be the best marathon runner in the world, but if you can't think while you're out there ... it doesn't matter how fast you run if you're lost." ■■

IN COMPETITIVE ORIENTEERING, athletes must quickly navigate a path from one control point to the next using only a compass and a terrain contour map with plotted control points.




PHOTO BY CHARLES OKAL






BY KRISTIN QUINN

a global INTELLIGENCE *enterprise*



In 2005, soldiers in war-torn Iraq reported spending 90 percent of their time fighting for data and only 10 percent of their time fighting the enemy. To address this issue, Dr. Stephen Cambone, then under secretary of defense for intelligence, approached Gen. Keith Alexander, at the time the Army's deputy chief of staff for intelligence, and asked him to synchronize intelligence and operational data. As a result, Joint Intelligence Operations Center (JIOC)-Iraq was funded and fielded in about six months, according to Lynn Schnurr, former Army chief information officer for intelligence and now a vice president with General Dynamics Information Technology.

"There were stovepipes and the data was not being shared," Schnurr said. "We were hearing from commanders the data had so much latency—48 to 72 hours—that they couldn't do anything with it. We knew we had to develop a system that would not only get them the data in as near real-time as possible but that could make it available to decision-makers. It was a very early on achievement in showing how intelligence integration can and needs to be done."



The image features a silhouette of a person in profile, holding a tablet. The background is a light, warm-toned gradient with a complex network of circuit-like lines in black, white, and teal. The lines are of varying thicknesses and connect to small circles, resembling a printed circuit board or a data network. The person's silhouette is solid black, and they are positioned on the right side of the frame, looking at the tablet. The overall aesthetic is high-tech and modern.

THE INTELLIGENCE AND DEFENSE
COMMUNITIES OVERHAUL IT
TO EMBRACE DATA SHARING,
THE CLOUD, AND ENTERPRISE
BUSINESS PROCESSES.



A decade later, both the intelligence and defense communities are implementing massive information technology upgrades that will facilitate data sharing among analysts not only across intelligence agencies or services, but also between intelligence agencies and the armed services. Originally perceived by many as programs or contract vehicles, the Intelligence Community Information Technology Enterprise (IC ITE), the Department of Defense's (DoD) Joint Information Environment (JIE), and the Defense Intelligence Information Enterprise (DI2E)—the unifying construct that bridges IC ITE and JIE—are much more. They are large-scale initiatives with the common threads of upgrading IT infrastructure, sharing data and services, and redefining cultural and business processes to ultimately achieve unprecedented efficiencies and make integration a way of life for U.S. analysts.

"It is in the interest of national security to ensure that we enable the widest possible access to and the best possible use of data we possess," said Dr. Raymond Cook, chief information officer (CIO) for the Office of the Director of National Intelligence (ODNI). "We are at a point in time where we can achieve these goals with unprecedented efficiency and security controls."

All three initiatives—IC ITE, JIE, and DI2E, need to be interoperable for success, according to Cathy Johnston, director of digital transformation and operationalizing IC ITE with the Defense Intelligence Agency (DIA). As a combat support agency, DIA is critical in supporting the tactical edge, Johnston said.

"As we execute IC ITE we are in constant contact with USD(I) and the DoD CIO to make sure we remain

interoperable and standards get identified," Johnston said, adding that the ultimate goal is to support strategic, operational, and tactical users "from the White House to the 7th fleet."

While IC ITE is focused on integrating classified data repositories and workflow across the Intelligence Community (IC), JIE's mission is much larger in scope, centered on IT upgrades at the secret and unclassified levels for the entire DoD. JIE extends far beyond intelligence to include logistics, force application, operations, medical, and more.

DI2E leaders were pursuing goals of common DoD and IC specifications and capabilities before the emergence of IC ITE and JIE. DI2E's common framework of standards, processes, technologies, and reference implementations enable the sharing of data, web services, and applications across the defense intelligence community. Today, the Office of the Under Secretary of Defense for Intelligence USD(I) is leveraging DI2E governance and processes to ensure JIE and IC ITE can connect to meet defense intelligence needs.

"All of the different initiatives and environments are important," said Jack Jones, director of intelligence, surveillance, and reconnaissance (ISR) infrastructure with USD(I). "IC ITE, JIE, and DI2E all have to succeed."

LAYING THE FOUNDATION

For intelligence integration to come to fruition, a strong IT infrastructure must first be laid. The following outlines the foundational elements of IC ITE, JIE, and DI2E.

"IC ITE is an enabler for our analysts and users to do their jobs faster and better and easier than they were able

to in the past," said Doug McGovern, CIO and director of IT services with the National Geospatial-Intelligence Agency (NGA). "It's the foundation for which the community can operate at a faster pace and answer the key intelligence questions that face us today."

Under IC ITE, ODNI tasked specific intelligence agencies with fielding designated capabilities for the entire IC. NGA and DIA, charged to develop the IC Common Desktop, have to date delivered more than 56,000 new desktops across the two agencies. They are now in phase two of the effort, which will deploy the common desktop to the rest of the community. The new desktop provides a uniform interface and enables analysts at any agency to communicate and exchange information.

The cornerstone of JIE is standing up Joint Regional Security Stacks (JRSS). The JRSS, one of which is up and running at Joint Base San Antonio, will improve network security and increase the DoD's capacity for collecting, storing, and sharing Big Data among services and with the IC.

"These stacks have a large capacity for bringing in and processing Big Data," Johnston said. "If you can bring in Big Data and get it processed and made accessible to the community you will achieve better operational capabilities out to the COCOMS, military, and the IC."

Another JIE goal is the installation of a number of Multiprotocol Label Switching (MPLS) routers, several of which are already operational, said Roger Thorstenson, director of strategy and integration for the deputy CIO for information enterprise with the office of the DoD CIO. The new routers will reduce the chances of data being stalled or lost as a result of high volume or congestion.

***"It is in* the interest of national security to ensure that we enable the widest possible access to and the best possible use of data we possess."**

—Dr. Raymond Cook, CIO for the Office of the Director of National Intelligence (ODNI)

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"All efforts are underway today and most capabilities we anticipate will be in place by end of FY 2019," Thorstenson said.

The cloud is also a critical element of the new enterprise environments. Under IC ITE, the Central Intelligence Agency (CIA) has established IC Commercial Cloud Services (C2S) through Amazon. Meanwhile, the National Security Agency (NSA) has stood up an early implementation of the IC's classified Government Cloud, or GovCloud. The classified cloud will scale over time as more data sets, analytic tools, mission workflows, and users are added.

"We need to think more in terms of what I call 'cloud complementary,'" said Andrew Hallman, director of the CIA's new Digital Innovation Directorate. "We have within the IC thought of these as either/or ... But you may have, for example, an app in C2S that needs to leverage the data that's in GovCloud. We need to think of this as a holistic—almost a hybrid—cloud."

NGA was the first agency to share some of its core capabilities in C2S with its Geospatial Visualization Services and Map of the World, according to McGovern.

"That underlying, foundational information can be consumed by anybody on the network with the proper credentials," McGovern said.

Under JIE, the DoD has granted provisional authorization to several industry members allowing them to compete to provide DoD cloud services, according to Thorstenson.

"There's a lot of opportunity for industry to participate in putting in place cloud solutions to help meet the Department's computing and storage needs," Thorstenson said, adding interested industry members should seek provisional authorization.

In addition to GovCloud, NSA is tasked with oversight of the IC Applications Mall. In June, the agency launched the next-generation mall—an upgrade of the first version launched in 2013. As of December 2015, the mall had approximately 235 apps and 3,165 unique monthly users. The mall has two components: a hosting environment where agencies can upload and download apps; and a development environment that

allows the IC developer community to swap code. As of December, the developer environment had 6,500 users.

"[The mall] is about software reuse," said Michael McNamee, NSA's chief of system engineering. "If one organization develops software it's then made available to the rest of the community."

These efficiencies also extend to security, according to NSA Deputy CIO Sally Holcomb.

"If an agency has worked through software assurance, having someone else be able to use [that same software] to save on time and security is also a win," she said.

Similarly, the D12E community can access the D12E Developers Environment, which offers the ability to provision virtual machines to support development, integration, and testing. The environment currently hosts 280 collaborative projects across 60 programs and supports more than 3,100 users.

"The services can all come into the development environment and test their own capabilities to make sure they work with standards," Jones said. "And then they can establish technical protocols below the standards level to make sure things actually work."

D12E also offers a storefront for app exchange.

"So SOCOM can take the DCCS integration backbone, make it better using a new app—it still fits standards—post it on there, and someone else can come in and adopt that capability for free," Jones continued, offering an example. "There's no integration costs, no buying anything ... That's the goal. Adopt before we purchase anything."

AN ENTERPRISE APPROACH

This enterprise business model is a common thread shared by IC ITE, JIE, and D12E, according to Kevin Meiners, assistant director of national intelligence for acquisition, technology, and facilities with ODNI.

"The 'E' in IC ITE is critical to helping people understand what IC ITE is," Meiners said. "It's an enterprise look."

The three-legged stool of IC ITE is comprised of efficiency, integration, and security. To achieve efficiency will require IC ITE infrastructure and

services be managed and provided as a single enterprise. C2S is a prime example of this, according to Cook.

"[C2S is] an entirely new way of thinking about how IT is procured and used," Cook said. "It's service-based. So just as you would do in the unclassified, commercial world, we're saying to Amazon, 'you own and manage the cloud and we're going to pay you by the minute.' ... You pay for only what you use and you only buy what you need."

Such enterprise business processes require novel contracting and service provider approaches that allow the IC as a whole to directly leverage services provided by one agency. For example, NGA is only charged by the minute for its analysts' use of the CIA-acquired C2S rather than purchasing licenses for every one of its analysts or standing up its own, proprietary cloud. Not only does this model facilitate data sharing but also the sharing of efficiencies in the form of time and money.

"We're trying to translate those enterprise license agreements into our various contracts so no matter who you are in the IC you can log in and benefit from that service without having to have your own licensing agreement," Meiners said.

Kevin West, USD(I)'s deputy director for ISR infrastructure, said a major challenge to implementing D12E as a "globalized enterprise" is outdated security accreditation policies. Current security accreditation policies are written to accredit an entire system as opposed to an enterprise and need to be changed, he said.

"An enterprise approach is very different than a systems approach to doing accreditation," West said. "So we have to take a look at those things from a resource and accountability perspective because we manage almost everything programmatically that way. The [DoD] as a whole has begun to do that, but we still have a long way to go."

Thorstenson said DoD is looking to industry for help establishing JIE enterprise license agreements.

"Help us get in place hardware and software and service delivery initiatives that enable us to leverage the Department's buying power rather than doing things on an individual component basis," Thorstenson said.

FAST FACTS

THE INTELLIGENCE COMMUNITY INFORMATION TECHNOLOGY ENTERPRISE (IC ITE)

What: A strategy to further the Director of National Intelligence's vision of intelligence integration by changing the IC's IT operating model.

Led by: The Office of the Director of National Intelligence (ODNI) with intelligence agencies taking the lead on various IC ITE services:

- The Intelligence Community (IC) Common Desktop: The National Geospatial-Intelligence Agency (NGA) and the Defense Intelligence Agency (DIA)
- The IC Cloud: The Central Intelligence Agency (CIA) and the National Security Agency (NSA)
- The IC Applications Mall: NSA
- Network Requirement and Engineering Service: The National Reconnaissance Office (NRO)
- Information Transport Service: NSA
- Identity Authorization and Authentication: CIA and NSA
- Security Coordination Center: ODNI
- Enterprise Management: DIA

Who it affects: All analysts, intelligence officers, and operators in the U.S. Intelligence Community.

By the numbers:

- More than 56,000 new IC Desktops deployed at NGA and DIA
- 235 apps and 3,165 unique monthly users in the IC Applications Mall
- 6,500 users in the IC Applications Development community

THE JOINT INFORMATION ENVIRONMENT (JIE)

What: A framework to align and modernize the Department of Defense's (DoD) IT networks.

Led by: The Office of the DoD Chief Information Officer

Who it affects: The entire DoD, which includes more than 1.4 million active-duty men and women, 718,000 civilians, and 1.1 million National Guard and Reserve members using more than 7 million computers and IT devices.

Priority modernization areas:

- The optical carrier transport
- Multiprotocol Label Switching (MPLS) routers
- The Joint Regional Security Stacks (JRSS)
- The Joint Management System for the JRSS
- Cyber situational analytic capability for the JRSS

Some key accomplishments to date:

- One JRSS is up and functional at Joint Base San Antonio.
- A number of MPLS router installations have been completed.
- Several industry members have provisional authorizations in place to compete to provide cloud services.
- The NIPRNET Cloud Access Point became operational in December 2015 when the East Coast capability came online to complement the existing West Coast capability.

Looking ahead: The No. 1 priority of the DoD CIO is to continue the installation and activation of JRSS and MPLS routers as well as to put optical transport upgrades in place to meet modernization goals by the end of FY 2019.

THE DEFENSE INTELLIGENCE INFORMATION ENTERPRISE (DI2E)

What: The unifying construct that bridges IC ITE and JIE.

Led by: The Office of the Under Secretary of Defense for Intelligence

Programs and systems under the DI2E umbrella include:

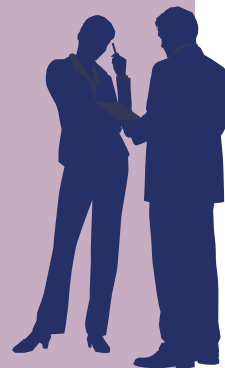
- The Distributed Common Ground/Surface System (DCGS) for the U.S. Air Force, Army, Navy, Marine Corps, Special Operations Forces, and Intelligence Community
- U.S. Battlefield Intelligence Collection & Exploitation System – Extended (US BICES-X)
- Combatant Command Intelligence Information Technology (CCMD Intel IT)

10 focus areas:

- Identity and access management
- Data tagging
- Content discovery and retrieval
- Cross domain
- Domain name services
- Time synchronization
- Collaboration tools
- Visualization capabilities
- Service Directory
- Cybersecurity

Some key accomplishments to date:

- Established the DI2E Developers Environment, an open development environment for the DI2E community that provides the ability to provision virtual machines to support development, integration, and testing. The environment currently hosts 280 collaborative projects across 60 programs and supports more than 3,100 users.
- Established the DI2E Storefront to enable smarter acquisition that promotes interoperability, software component ease of use, and cost savings. The storefront provides a catalog of DI2E architecture artifacts, DI2E technical profiles, reusable software components, and more.



An enterprise approach is *very different* than a systems approach to doing accreditation.

—Kevin West, USD(I) deputy director for ISR infrastructure

McGovern said industry should take note the IC would no longer “be doing business in the same old way.”

“Our acquisition contracts are being structured to support agile development efforts where we can very quickly build a little, test a little, operate a little, and then learn from that and be putting capabilities on the floor in days or weeks,” he said.

FREEING THE DATA

In addition to embracing enterprise business processes, the intelligence and defense communities are looking to industry to help create the standards

necessary to integrate data and the flexible solutions to unleash it.

Meiners is asking industry to “move up the stack,” describing new IT infrastructure such as common desktops and cloud environments as now being commodities.

“Those kinds of things are taken care of for us,” Meiners said. “Software-as-a-service is at the top of the stack. That’s what we need more of.”

Cook added the IC is also looking to industry to help provide the personnel at the top of the stack—the data scientists who know how to manipulate software-as-a-service for intelligence.

Hallman noted freeing data from apps as a major challenge facing IC ITE, but one necessary for scaling in a Big Data environment. He cited a need to re-engineer existing apps to free data and to be mindful of keeping data free from apps during acquisition and development.

“For the strongest competing intelligence officers of the future, industry will have to get used to the concept of apps that are not binding the data to those apps,” Hallman said. “Apps that can get meaning out of a variety of data as it’s generated. New data sets will appear faster than industry can produce the apps.”

In the IC of the future, he predicts intelligence officers will drive the evolution of industry much faster than they do now, fostering competition by determining the best of breed apps that offer the most value.

Johnston echoed Hallman, and said she seeks industry solutions to conjoin “unlike, unusual data sets in ways not combined before.” She added the result would be data that is IC-specific rather than tied to an agency or mission.

“When you collect data, you can’t possibly imagine all the potential applications for that data,” Johnston said.

Identifying the proper open standards is also key to data sharing, according to Jones.

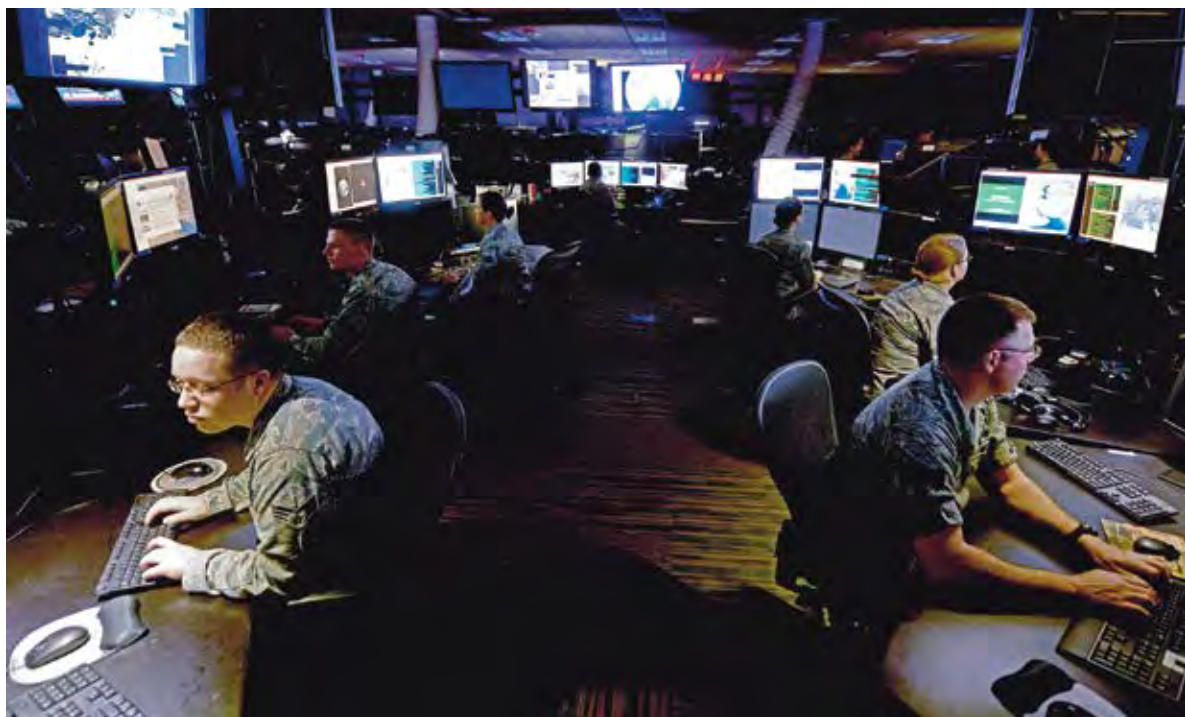
“Open standards are thrown around a lot, but if you don’t document what is actually happening and then test it, sometimes something that’s open standards doesn’t work with something else that’s also open standards,” Jones said.

Jones added that international partners are a growing part of the global ISR enterprise, calling for the U.S. to have “a global standard by which we integrate and share data with those partners as well.”

To help test and define standards, the DI2E camp invites industry to DI2E Plugfest, an annual demonstration of DI2E advancements.

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“We need industry’s help in identifying potential solutions that would fit well into an open systems architecture approach,” West said. “Plugfest is an opportunity for us to explain the approach to industry and for industry to demonstrate to the Department how they fit into and can help us in establishing the DI2E enterprise.”

The fourth annual Plugfest will be held in Fairfax, Va., in June.

ADOPTING INTEGRATION

As the foundations for IC ITE and JIE are being laid, the next step is to determine how mission users will leverage the new environments. FY 2016 is “the year of mission adoption,” for IC ITE according to Cook, who is building an adoption road map with all of the U.S. intelligence agencies.

That’s where the IC ITE Mission User Group (The MUG)—co-chaired by Hallman and Johnston—is paramount. The purpose of the MUG, which includes mission and thought leaders from across the IC, is to be the voice of mission as well as to determine and test what the new operating model for intelligence analysts will look like once IC ITE is fully implemented. The MUG ensures stovepipes are not being

recreated in the cloud and is empowered to rethink and optimize mission for an IC-whole business process, according to Johnston.

“The MUG led to the realization that laying technical infrastructure is an excellent and necessary first step, but is insufficient to meet mission user needs,” Johnston said. “We also need connectivity across search, discover, and geospatial mapping, for example.”

The MUG helps identify common needs and an executive agent to provide them to the entire IC. Since inception, it brought to light the need for basic geospatial services and designated NSA to provide them.

Another essential role of the MUG is to create a close-knit team of mission and IT experts.

“We can deliver [IT] services all day long, but without mission driving what those services really need to do they might miss the mark,” Cook said.

In some MUG sessions, mission users demonstrate their challenges on screen in front of IT experts.

“IT is for mission,” Meiners said. “Once you see a user doing their job and how difficult it sometimes can be, it really helps IT folks better understand what they need to do.”

Meiners added that the MUG, rather than making generalized policy recommendations, works to pinpoint a specific policy, interface control document, or other spec that might hinder data sharing.

In 2016, the MUG will take on real-world intelligence challenges to push IC ITE to its limits and determine where more services need to be stood up or existing services should be modified. Meiners and Cook are hopeful the challenges will help the analyst workforce realize the tangible benefits of integration.

Likewise, Thorstenson said demonstrable success would help boost the culture shift needed to drive adoption of JIE.

“The challenge is measuring and understanding success, especially when you look at the operational effects,” Thorstenson said. “It’s rather difficult to measure in the near term. You see those over a period of time, but it’s not something that’s immediately obvious.”

Thorstenson added the DoD CIO is collaborating with USD(I) to gain efficiencies and facilitate interoperability between IC ITE and JIE. Working to ensure the two architectures can connect is the DI2E Council—the DI2E governing body—a tiered, structured

OPERATORS

demonstrate the joint, national, and coalition interoperability of the Distributed Common Ground System.



PHOTO BY STAFF SGT. JOE LAWS

activity consisting of senior experts from across the DoD and IC.

The council is examining IC ITE and JIE to determine which elements need to work across both environments and help both communities take an “adopt, buy, create” acquisition approach and embrace enterprise services.

“We work with the DoD CIO folks leading JIE and the ODNI CIO leading IC ITE to work the technical solutions, to get the appropriate documentation, and then to the maximum extent possible reuse capabilities and make them available to the community as a whole,” West said.

But for JIE and IC ITE to align, the cloud architecture on both sides must be integrated technically at the interface level to enable data movement between the top secret IC ITE system and secret and unclassified DoD systems.

“When you get to a brigade level you have JWICS there, but when you get to the battalion level and below you see less and less instantiation of JWICS,” Schnurr said.

Adopting common standards for things such as identity access and management, content search and discovery, and cross-domain services will help facilitate IC to DoD data sharing, according to ODNI.

Jones said it’s also essential to ensure the Distributed Common Ground System (DCGS), the biggest weapon system within the DI2E framework, can interface with the IT standards set for IC ITE and integrate with JIE at the operational level.

“The part we express to our IC ITE friends is not to forget the Department’s intelligence folks—they especially have to be able to integrate with IC ITE but also with other warfighting domains,” Jones said.

Kim Singleton-Slater, NGA’s DI2E-JIE coordinator, said the agency is being mindful of maintaining this “delicate balance” and applying IC ITE lessons learned to JIE.

“We try to make sure we balance what’s happening in the TS environment so we can leverage it in the secret and unclassified environments because we have customers in all three domains,” she said.

For those still hesitant when it comes to such unprecedented data

sharing, Cook explains integration doesn’t mean “everyone gets access to all data.” Rather, he said, it prevents analysts from having to knock on the door of several agencies to obtain the data necessary to carry out their mission. Although it may seem counterintuitive to some, upgraded IT infrastructure actually offers better access control, identity management, and insider threat mitigation, making it easier—or at least less risky—to integrate.

“Everyone that has the need to know and the right credentials is allowed to see data that is tagged similarly,” Cook said.

ANALYTIC PROMISE

For the analytic utility of intelligence integration to materialize, subject matter experts unanimously agree culture, not technology, is the most significant obstacle. Both “server huggers”—IT specialists wary of the cloud—and analysts untrusting of data outside of their discipline or agency must get on board with the new paradigm.

NGA has demonstrated its commitment to integration and accelerated by two years its timeline to be “all in” to the IC ITE cloud environment, moving its target date up from end of calendar year 2019 to 2017.

“As we go deeper into deploying capabilities in the community environment, we find it’s not that hard,” McGovern said. “We find it’s actually quite enabling to start having the users involved in shaping what the future capabilities and services need to be.”

David Cacner, NGA’s director of the National System for Geospatial Intelligence (NSG) expeditionary activities, hopes the escalated timeline will boost the culture shifted needed to make intelligence integration a success.

“People are hesitant to change, and I think giving us a goal to work toward will help foster that change,” Cacner said, pointing to a targeting capability NGA recently stood up in C2S for the U.S. Air Force as a forward-leaning example.

“There was a lot of concern from the folks here who said, ‘Well, let’s just stand up a server in our data center,’ and the

answer was, ‘No, we’ve been told to go to the cloud, let’s push,’” Cacner recalled. “And we did that exactly. We delivered to the cloud within four months as the Air Force asked us to.”

This is an attitude IC and DoD leadership hopes will continue to spread.

“We are near a tipping point where culturally in the IC we have enough power users and mavens who are starting to explore the capabilities of IC ITE where they can be accelerators for the rest of the workforce,” Hallman said. “We still have a ways to go before the general user can know ‘I can exploit data this way using IC ITE tools.’”

Hallman added that as more young analysts comfortable with data and coding join the workforce, they would continue to drive IC ITE adoption.

Johnston called upon analysts to “put sweat equity in to help reinvent their own world,” encouraging them to break free of agency-specific constraints and to network across the IC. Were IC ITE a house, she said, the foundation has been laid, the frame is standing, and today’s analysts now have the opportunity to wander around inside and determine where the light switches, et cetera, will be located.

According to Jones, intelligence integration is essential to move the analytic community into the future.

“We have to get our arms around IT and communications or else there’s no way we can continue down the path we’re going,” Jones said. “We have to have some standard method for identifying data, for sharing—we can’t pay for multiple licenses multiple times. So all these ideas and the rationale for doing this makes sense.”

Looking ahead five years, leaders foresee a more globally dispersed and deployed, yet better connected community of defense and intelligence analysts than ever before. Johnston envisions innovation being shared across the defense and intelligence communities from a vast “data ocean.” Cook anticipates diverse analytic communities of experts studying the same intelligence issue will naturally materialize despite organizational units. In all, IC ITE, JIE, and DI2E stand to yield a more powerful intelligence capability for the entire nation and its allies. ■■



WEB RESOURCES

For additional information on IC ITE, JIE, DI2E, and more, visit trajectorymagazine.com.



DEFENDING THE NATION'S CRITICAL
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security & RESILIENCE

BY MATT ALDERTON

The National September 11 Memorial & Museum

is a solemn, sobering place. Located 70 feet below ground in Lower Manhattan, on the site of the former World Trade Center, it reverberates with memories of loss. Among the museum's most moving elements is the "In Memoriam" exhibit, which features portraits of the 2,996 men, women, and children who died in the 2001 terrorist attack. Also powerful are the enormous aluminum casts of the Twin Towers. Floating like ghosts in the buildings' original footprints, they're an overwhelming reminder of the attacks' strategic nature: Along with human lives, al-Qaeda targeted buildings and their associated structures, including several telephone switching hubs, a broadcast antenna, two electrical substations, a multimillion-dollar emergency command center, and two mass transit lines. When the towers fell, thousands of feet of roadway, water main, power lines, fiber optic cable, sewer pipes, and gas lines were among the rubble.

"The World Trade Center was such an integral part of the New York skyline that, of course, there was emotional value attached to it. But there was also server space there for processing financial transactions, and electric utility substations that

switched power for Lower Manhattan," explained Talbot Brooks, director of the Center for Interdisciplinary Geospatial Technologies at Delta State University and co-author of *GIS for Critical Infrastructure Protection*.

Though a price cannot be placed on human life, terrorists know they can inflict economically crippling damage and wreak havoc by targeting infrastructure as well. Consider what would happen if a disaster damaged or destroyed the nation's power grid, as depicted by the National Geographic Channel in its 2013 film *American Blackout*. A fictional account of what would happen after a terrorist attack on U.S. power infrastructure, the film paints a dark picture. Traffic signals would go out, causing crashes and gridlock. ATMs, banks, and credit cards would cease to function, crippling the economy. Pumps supplying cities with running water and flushing toilets would stop working, causing a public health crisis from dehydration and disease. Gas stations would lack the power needed to pump gas, leaving trucks unable to deliver food and medical supplies. Hospitals would be unable to treat patients, and emergency responders unable to answer 911 calls. The panic and chaos that would ensue is why governments must protect not only people during disasters, but also critical infrastructure.

“It’s not usually disasters themselves that are the big problem—manmade or natural, it’s what they do to infrastructure,” said Chris McIntosh, director of public safety industry solutions at Esri. “For example, a hurricane itself isn’t necessarily a big problem. The big problem is the loss of services to people... The acute effects of the actual disaster impact a fairly localized group of people, but the loss of critical infrastructure impacts a much larger population.”

Geospatial intelligence is the linchpin of incident planning, prevention, response, and recovery.

“Everything is somewhere—especially critical infrastructure,” continued McIntosh. “If an incident occurs in a location and you’re a decision-maker, the first thing you’ll ask yourself is: ‘How bad is it?’ You’re going to want to know: ‘What is in the affected area? And what could be impacted by the loss of that area?’... With its fusion of location and location analytics, geospatial technology allows you to answer those questions in near real time to identify initial actions quickly.”

THE CRITICALITY OF INFRASTRUCTURE

Infrastructure is to communities what the circulatory system is to the human body: a critical network supplying resources needed to function. In both cases, a lone clog in a single artery can cause a life-threatening heart attack.

“Critical infrastructure serves as the backbone of the nation’s economy, security, and way of life,” said Michael Donnelly, a geospatial data architect in the Department of Homeland Security (DHS) Geospatial Management Office (GMO). “It refers to basic, everyday needs and services—electricity, cell towers, or even bridges. By identifying such infrastructure as critical, we can prioritize its security and resilience.”

The U.S. government has designated 16 sectors of infrastructure as “critical” (see sidebar on page 29), meaning if they were to be degraded or prevented from operating there would be significant, if not catastrophic, impact on the populous. The 16 sectors—each of which has a designated federal agency as its functional lead—were established in 2013 by Presidential Policy Directive-21: Critical Infrastructure Security and Resilience.

Individually, each sector is massive. Collectively, the scope is mind-boggling. The transportation sector, for example, includes approximately 450 commercial airports, 361 seaports, nearly 4 million miles of roadway, approximately 600,000 bridges, some 400 tunnels, 25,000 miles of waterways, about 2.2 million miles of natural gas distribution pipelines, and more than 140,000 miles of active railroad. The food and agriculture sector consists of approximately 2.2 million farms, 900,000 restaurants, and more than 400,000 registered food manufacturing, processing, and storage facilities.

Threats aren’t just hypothetical. In April 2013, a team of unidentified gunmen assaulted Pacific Gas and Electric Company’s Metcalf transmission substation near San Jose, Calif. Although a blackout was avoided by rerouting power, the 19-minute attack mangled 17 electrical transformers and resulted in more than \$15 million worth of damage that took 27 days to repair.

A COMMON OPERATING PICTURE

Concerns about the vulnerability of critical infrastructure date back more than a century according to James Devine, senior advisor for science applications with the U.S. Geological Survey (USGS).

“When earthquake science began to develop around the turn of the 20th century, it was recognized almost immediately that when major events happen, infrastructure is a recipient of the damage. Not just an individual house or school, but a whole system,” Devine explained. “During the 1906 earthquake in San Francisco, for example, the rupture of gas lines created fires, which did much more damage than the shaking.”

It wasn’t until after 9/11 that the federal government deployed GEOINT as a foundational solution. In February 2002, the Bush administration created the Homeland Infrastructure Foundation Level Data (HIFLD) Subcommittee to facilitate improvements across multiple levels of government in the collection, processing, sharing, and protection of

geospatial domestic infrastructure data. The subcommittee includes representatives from the Office of the Assistant Secretary of Defense for Homeland Defense and Americas’ Security Affairs, the DHS National Protection & Programs Directorate Office of Infrastructure Protection, the National Geospatial-Intelligence Agency (NGA), and the USGS National Geospatial Program Office.

“Key individuals [in these offices] ... wanted to make sure everybody was working together to create foundation infrastructure information, instead of everybody recreating the same thing because

MULTIPLE CREWS from New Jersey’s Public Service Enterprise Group fix poles and downed lines to restore power after Hurricane Sandy.



PHOTO COURTESY OF PSE&G



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CYBER PROTECTION

As chaotic as an infrastructure failure could be, perhaps the scariest thing about them is they could be caused by just the click of a mouse, according to Michael Donnelly, a geospatial data architect with the Department of Homeland Security (DHS) Geospatial Management Office (GMO).

"The nation's infrastructure is more interdependent than ever before, and is at risk from a variety of hazards—including constant and sophisticated cyber threats," Donnelly said.

Those threats loom large, according to Robert Zitz, former deputy under secretary for preparedness with DHS and now a senior vice president with Leidos.

"The nexus between cyber and GEOINT in support of critical infrastructure protection is growing," Zitz said. "Protection is now both physical and cyber. They're woven together like a strand of DNA. Because if you look across all the sectors that make up critical infrastructure—water, power, food, transportation, and so on—the one thread that runs through all of them is the Internet. Every one of those sectors depends on the Internet, yet every one of them is also vulnerable because of it."

GEOINT helps DHS keep such risks at bay, according to Donnelly, referencing the DHS GMO's Geospatial Information Infrastructure (GII), a common geospatial enabling platform DHS uses to deploy data, tools, and apps that support critical infrastructure protection.

"One example of this GII capability is the Cyber Communications Common Operating Picture app," Donnelly said. "This app provides the National Cybersecurity and Communications Integration Center the ability to geospatially visualize, analyze, and report on threats and incidents to the nation's critical communications infrastructure ... The app can access hundreds of geospatial data layers, base maps, and imagery."

the infrastructure data DHS needs for homeland security is the same data needed for emergency preparedness and emergency response," said Booz Allen Hamilton Principal Justin Sherin, co-founder and program manager of the HIFLD Subcommittee, the goal of which was to create geospatial infrastructure data that could be shared not only among federal agencies, but also with state and local government as well as private sector partners.

Toward this effort, the HIFLD Subcommittee developed the Homeland Security Infrastructure Program (HSIP) data sets. Specifically, HSIP Gold, a unified geospatial data inventory assembled by NGA in partnership with DHS. First released in 2005 and updated with new data sets almost every year since, HSIP Gold contains more than 560 common geospatial data sets characterizing domestic infrastructure.

"The HSIP data sets are critical to the analysis and assessments conducted to support infrastructure security and resilience by providing a comprehensive common operating picture," Donnelly said.

HSIP is now leveraged for every natural and manmade disaster in which the federal government is involved, according to Sherin.

"There's nothing worse than going to a meeting and having two separate maps or reference points. That causes more confusion than coordination," Sherin said. "The HSIP product was monumental because it allows you to find [information] once and share it with everybody."

SEEING SUCCESS

The country has since seen the benefits of the common geospatial operating picture provided by HSIP and state and local equivalents. After Hurricane Sandy in 2012, GEOINT catalyzed efforts to protect critical infrastructure from future natural disasters—starting with facilities damaged by the storm, which have been eligible for mitigation grants to strengthen their resiliency.

In New Jersey, Public Service Enterprise Group (PSE&G), a gas and electric utility, has likewise used GEOINT to prepare for another event such as Hurricane Sandy.

"We had over 13 feet of storm surge at some substations," said Mike Weber, emergency preparedness manager at PSE&G, adding the utility lost 31 electrical substations to flooding during Sandy.

PSE&G leveraged GEOINT to identify approximately 100 mitigation actions it believes will keep electricity on in the event of another major storm.

"One of the bigger things we're doing is looking at critical infrastructure—which could include hospitals, police, fire, etc.—and seeing which circuits serve them, then developing a backup plan to ensure access to a second means of electricity for them so they don't end up going down," Weber said. "Because of resiliency and redundancy that we've built into our system, it's not going to be easy to take out power again."

Hurricane Sandy wasn't the only 2012 storm to illustrate GEOINT's role in infrastructure protection. In Fairfax County, Va., GEOINT helped local government respond to a historic derecho that left more than half the county without power during a June heat wave.

"It was critical for us to have visibility of our physical assets in Fairfax County so we could figure out where the impacts were to the community," said Fairfax County Chief Information Officer Wanda Gibson, who leads the county's GIS efforts. "We could determine where we needed to set up cooling centers, for example, and see where our senior centers were in case they needed assistance."

The county used geospatial data to visualize where the power was down, where roads were blocked, the locations of citizens with special needs, and which government buildings—including schools and courts—were operational.

When GEOINT is applied to critical infrastructure, livelihoods are saved just as often as lives, according to Dr. Joseph Fontanella, director of the U.S. Army Geospatial Center.

"In 2012, there was a record drought in the middle part of the country, so water levels along the Mississippi River were historically low. At the bottom of the river were exposed rock pinnacles that were impacting commerce throughout the Mississippi Valley," Fontanella said. "We developed some products and did some geospatial analysis that enabled

THE 16 SECTORS OF CRITICAL INFRASTRUCTURE

The Department of Homeland Security designates the following 16 sectors as critical infrastructure:

- Chemical
- Commercial facilities
- Communications
- Critical manufacturing
- Dams
- Defense industrial base
- Emergency services
- Energy
- Financial services
- Food and agriculture
- Government facilities
- Health care and public health
- Information technology
- Nuclear reactors, materials, and waste
- Transportation systems
- Water and wastewater systems

[the U.S. Army Corps of Engineers] to brief the White House and the Department of Defense on mitigation strategies, and they ended up demolishing some of these pinnacles to remove them as obstacles.”

PREVENTABLE FAILURES

For every example of how GEOINT has helped governments protect and monitor critical infrastructure, there is an example of how it wasn't used to do so. During Virginia's derecho, for example, Verizon experienced equipment failure that left nearly 2.3 million Virginians without 911 emergency services, but the company didn't even know about the outage until Fairfax County called to report it.

Yet another example is the 2010 explosion of a broken PG&E natural gas pipeline in San Bruno, Calif., which killed eight people.

“You see critical infrastructure failing with sometimes pretty extreme consequences on a regular basis,” Brooks said. “The gas explosion in San Bruno is an example of catastrophic critical infrastructure failure...It was a failure of intelligence to understand the gas pipeline system, its condition, and its relation to residential neighborhoods.”

These and other failures are evidence of gaps GEOINT is well positioned to help fill. Before it can do so, however, systemic challenges must be addressed, according to Brooks.

“We in the critical infrastructure and emergency response sectors have the fundamental problem that we do not share data well at all,” he said. “The electric utility company doesn't go to the gas company or the telephone company and say, ‘Here, have all the GIS data for our entire gas distribution system.’ Instead, they keep it and say it's proprietary.”

From a business standpoint, this might make sense. But it's senseless when one considers the implications for critical infrastructure protection. Because power lines often share trenches with water, sewer, gas, and cable lines, a threat to one utility is often a threat to all. Even in the most vulnerable places like New York City, where infrastructure is packed tightly together, public and private data are widely segregated.

“We have a very good working relationship with our utility, but we do not ourselves have their data set in our possession,” said NYC Office of Emergency Management Assistant Commissioner for Strategic Data James McConnell, who also serves as director of New York City's GIS Division. “The fact that we don't have it is not necessarily hindering our response, but having that level of detail would be very useful for looking at how various infrastructures interrelate and where there might be ways to increase resiliency or realize efficiencies.”

Although HSIP was designed to eliminate them, it likewise struggles with silos, according to NGA Branch Chief and Program Manager Todd Bolen, who said security concerns limit the federal government's ability to share geospatial information with state and local partners despite a strong desire to do so.

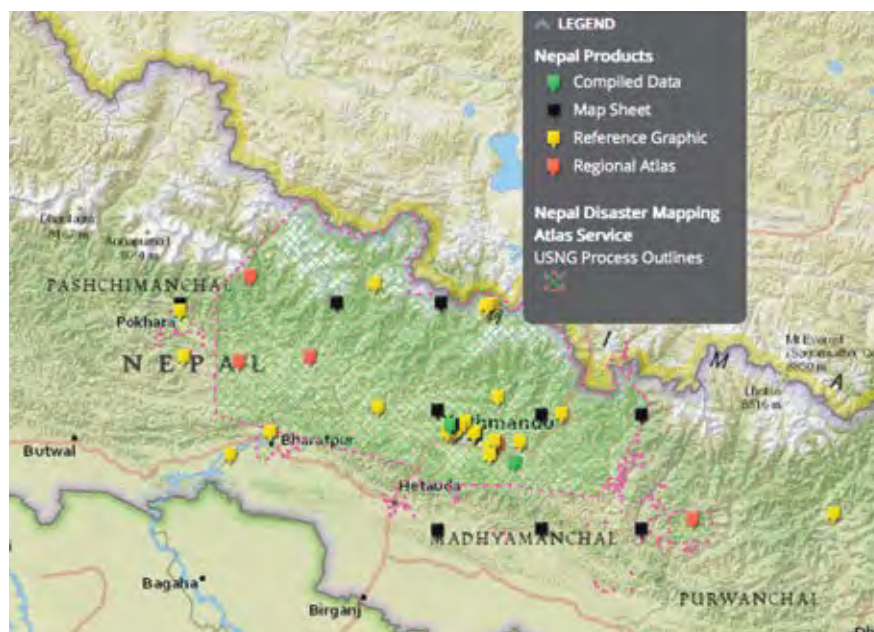
“In the post-9/11 timeframe, all levels of government are averse to sharing a significant amount of information about our critical infrastructure,” Bolen said. “Where we have key water storage facilities, for instance, is a sensitive issue,

so providing that information in an open forum on the [Internet] is a non-starter. In the digital age, however ... those old policies seem anachronistic. There's no reason to have protections on some of the data we protected at the highest levels in the past, but those policies remain in place.”



NGA DAMAGE ASSESSMENT graphics—such as this one of Joplin, Mo., following the May 22, 2011, tornado—are used for response and recovery efforts.

FOLLOWING the devastating earthquake that shook Nepal April 25, 2015, the National Geospatial-Intelligence Agency stood up a public website using Esri's ArcGIS platform to share valuable maps, imagery, and data overlays with first responders.



Another obstacle is education, according to McIntosh. On the one hand, he said, geospatial technology has advanced such that almost anyone in the critical infrastructure ecosystem could be a GEOINT user and consumer. On the other hand, only few are aware of the technology and how it can be applied.

"Right now, many people don't know what's possible," explained McIntosh, who believes geospatial technology should be a component of the Emergency Management Accreditation Program. "Technology is a fast-moving train, and it's outpacing the education policies and procedures of the emergency management community."

Utilities are a prime example, according to Weber. "I don't know if the utility industry knows the abilities geospatial technology can offer," he said.

Stakeholders at even the highest levels struggle to stay current.

"At DHS, our challenge is moving fast enough to keep pace with evolving threats to our critical infrastructure, and the development of new technology," Donnelly said.

TOWARD A HIGHER INFRASTRUCTURE IQ

In response to shortcomings, stakeholders are devising GEOINT solutions to strengthen critical infrastructure protection.

HIFLD is leading the way with the next generation of HSIP. In 2014, the working group became a subcommittee of the Federal Geographic Data Committee (FGDC), whose oversight has prompted a wave of improvements, according to Donnelly.

"HIFLD is now positioned to better coordinate across the federal government on improving HSIP's data holdings," he said. "[The HIFLD Subcommittee] is working to enable common operating data sets like HSIP to be more available to the entire homeland security enterprise."

HIFLD is working with data owners across the federal government to validate information and also looking at ways to improve the HSIP data set by enhancing metadata, building data tags to improve data discoverability, and building a dynamic online delivery mechanism to provide data updates to the user in real time. Simultaneously, the group is engaging commercial providers to license data to more users and conducting data layer reviews to determine which data can be made more widely available.

"States and locals see the value of HSIP data, but in many cases we can't share it with them because either it's licensed only to federal users or it's official use only, which limits its utility," Bolen said. "We've increased our

licensing to now include state users as a step toward broadening access."

NGA is also transitioning administrative authority for HIFLD and HSIP to DHS, which is expected to further break down data silos.

"We're currently in a three-year transition plan with DHS, which will [be completed] by the end of FY18," Bolen said. "State and local support will be more effectively enabled once the majority of the program sits on the DHS side of the table."

State and local governments are doing their part, too, according to Brooks, who said cities such as Tampa, Minneapolis, and Char-

lotte, among others, are leveraging the Geospatial Information and Technology Association's (GITA) Geospatially Enabling Community Collaboration (GECCo) initiative to improve data sharing around critical infrastructure protection—particularly with the private sector, whose data is absent from HSIP even though it owns 80 percent of critical infrastructure in the U.S.

"Organizations like GITA and USGIF have a critical future role to play as neutral facilitators to the private sector," said Brooks, who is also president of GITA.

Both proactively and reactively, emergency managers and governments must make it a priority to leverage GEOINT for critical infrastructure protection, especially in the face of ISIS and other terrorist threats. As the Twin Towers' aluminum casts portend, a well-orchestrated attack on U.S. infrastructure could cause just as many tremors as a high-magnitude earthquake—tremors that could leave the nation without power, water, fuel, or food for an extended period of time and cause cascading catastrophe. Fortunately, ongoing efforts in GEOINT hold great promise for planners and first responders to both prevent and significantly mitigate future damage to critical infrastructure, be it from natural or manmade disasters. ■



WEB EXCLUSIVE
Read how UAVs are improving critical infrastructure evaluation at trajectorymagazine.com.

IMAGE COURTESY OF NGA



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FOUNDATION RESTRUCTURES MEMBERSHIP IN RESPONSE TO EXPANDING GEOINT COMMUNITY

In June 2015, USGIF revamped its membership program to better align with member needs and the expanding GEOINT Community. The Foundation revised its Strategic, Associate, and Sustaining Partner Organizational Membership levels to show more value and engagement as well as added Small Business and Academic Partner levels. Additionally, USGIF launched a new Individual Membership, offering more benefits at an affordable price.

USGIF's new Individual Membership offerings include options for government/military, academia, young professionals, law enforcement/first responders, and industry. The annual cost of membership is \$35 for all membership levels except industry, whose annual cost is \$99. USGIF is also offering discounts on three- or five-year memberships in addition to lifetime memberships.



Trajectory spoke with Bill Alder III, USGIF's membership development manager, and Jeff Ley, USGIF's vice president of business development and exhibitions, to learn more about the Foundation's new Individual Membership program.

What is new with USGIF's Individual Membership program?

Bill: We have totally changed our Individual Membership program, eliminating the old levels of membership and instating many new versions at better price points. The new

membership program offers greater benefits at a lower cost. We strive to get more people involved as USGIF continues to evolve into the professional association for GEOINT practitioners. We want to enable individuals to become a part of the Foundation, become a part of our mission, and become an active member of the larger GEOINT Community.

Who should become a USGIF Individual Member?

Bill: At the core of USGIF to date, we've supported the national security, intelligence, defense, and homeland security communities, but the Foundation's mission goes beyond that. Anyone who uses, produces, or develops geospatial technology to the betterment of their respective community or industry is invited to become a USGIF Individual Member. USGIF is a thought leader in the geospatial intelligence space, and our members stay far ahead of trends and abreast of the latest tools, technologies, and concepts in the GEOINT Community.



What are the benefits to becoming a USGIF Individual Member?

Jeff: Benefits include access to the greater GEOINT Community by way of USGIF's volunteer committees and working groups. You'll get exposure to a number of topics as well as the organizations and individuals working with those technologies and trends. You get to be at the forefront of technological

< ATTENDEES TOUR the exhibit hall at USGIF's GEOINT 2015 Symposium. USGIF Individual Members receive significant discounts to USGIF events, among many other benefits.

change and discussions among the influencing members of our Community that represent the GEOINT tradecraft.

New Individual Members receive a USGIF lapel pin, a welcome letter, and a membership card. The membership card will grant members access to USGIF's new Affinity Program, through which members receive discounts with Westway Development Services, EZGovOpps, Miller's Office Products, Dell, and Walker's Grille and Embassy Suites in Springfield, Va.—in close proximity to the National Geospatial-Intelligence Agency's Campus East.

Additional membership benefits include significant discounts at USGIF events, access to members-only events, a subscription to *trajectory* magazine, early notification of USGIF events and

activities, and the ability to submit proposals for presentation at USGIF events.

How do I manage my relationship with the Foundation?

Bill: As part of the USGIF membership restructure, USGIF has implemented a new tool called USGIF Connect to help Individual Members manage their engagement with USGIF. All members may log in to USGIF Connect at connect.usgif.org and update their member information at any time, register for USGIF events, renew membership, and manage email preferences.

Why is USGIF's new Individual Membership important to the GEOINT Community?

Jeff: During the past decade, USGIF member needs have changed and the

Foundation has changed along with them to offer new networking events, business opportunities, professional development, and working groups and committees. GEOINT Community members have also asked for more ways to engage with the Foundation. Doctors have the American Medical Association, lawyers have the American Bar Association; geospatial intelligence practitioners deserve and need a similar community—USGIF—which they can join as individuals to enhance personal networks and further professional development.

With the coming launch of USGIF's Universal GEOINT Credentialing program, there has never been a more appropriate time for the Foundation to offer a relatively inexpensive Individual Membership with added benefits for all. ■■



Visit usgif.org/membership or contact membership@usgif.org to learn more about USGIF's revamped Membership Program.

WHY "I AM USGIF" Individual Member Testimonials



Stewart Bruce
*GIS Program Coordinator,
The Center for Environment
and Society, Washington
College*

"USGIF Individual Membership means I am part of a community of professionals dedicated to promoting the GEOINT tradecraft. It also means I need to do my best to contribute back to that community, especially by promoting GEOINT to my numerous college student interns, to not only educate them in the tradecraft, but also to help them make their own connections for possible future careers in GEOINT."



Dr. Suzanne Sincavage
CEO, IDIQ Inc.

"USGIF membership offers me the incredible opportunity to participate in working groups that provide a venue to collaborate with industry, government, academia, and non-profits to solve real problems in real time. The benefits of receiving invitations to participate in symposia, roundtables, and other members-only events have supported my business by helping me understand what I need to do to support the Intelligence Community."



John W. Desmarais, Sr.
*Director of Operations,
Civil Air Patrol, U.S. Air
Force Auxiliary*

"The main benefit [of USGIF Individual Membership], to me personally, is educational opportunities. Civil Air Patrol collects imagery in support of other federal, state, and local agencies responding to emergencies, and it is helpful to know how our products are going to be used in order to deliver the best product possible. By doing so, we aid responders that need timely and accurate information."



Bruce Molnia
*Former Senior Science
Advisor, National Civil
Applications Program,
United States Geological
Survey*

"USGIF is my window to a much broader cross-section of the GEOINT Community than I have access to through my normal day-to-day activities. USGIF provides me a forum to quickly learn what is happening in GEOINT at the corporate, academic, agency, and individual levels. This is a relationship I hope to cultivate through the remainder of my GEOINT career."



Charlotte Shabarekh
*Advanced Analytics Division
Director, Aptima Inc.*

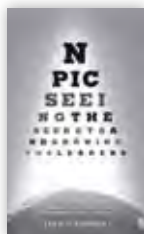
"As a research scientist in the field of advanced analytics, it is critical for me to stay informed of trends, emergent technologies, and evolving trade-craft in the GEOINT Community. USGIF provides a forum to connect me with other researchers and organizations to foster collaboration and further the common goal of advancing analytic tradecraft."



Gabe Chang
Federal CTO Architect, IBM

"With the ongoing great relationship with the constituency of the [National System for Geospatial Intelligence], USGIF membership allows additional access to our agency partners and clients via another informative channel. Benefits to me personally include educational workshops, networking with mission and business partners at relevant events, awareness of innovation in the tradecraft through collaboration, and continued insight into our nation's upcoming challenges through active participation."

READING LIST + USGIF EVENTS CALENDAR



**NPIC:
SEEING THE
SECRETS AND
GROWING THE
LEADERS**

By Jack
O'Connor

In this book, author Jack O'Connor shares the history of the National Photographic Interpretation Center (NPIC). O'Connor, who was formerly the National Geospatial-Intelligence Agency's chief learning officer, chronicles how NPIC, a little-known CIA office, discovered most of the Cold War strategic secrets of the Soviet Union and produced many future Intelligence Community leaders.



**MAP:
EXPLORING
THE WORLD**

By Victoria
Clarke
Selected

by an international panel of curators, academics, and collectors, this book brings together a collection of 300 stunning maps from around the world. From the birth of cartography to today's digital maps, the book covers a unique arrangement of geographic interpretations from different time periods.



**TRANSIT
MAPS OF
THE WORLD:
EXPANDED
AND
UPDATED**

**EDITION OF THE WORLD'S FIRST
COLLECTION OF EVERY URBAN
TRAIN MAP ON EARTH**

By Mark Ovenden

Originally published in 2007, this book's claim to fame is the first and only comprehensive collection of historical and current maps of every rapid-transit system on Earth. The expanded edition, released in 2015, includes 250 revised city maps and 36 additional pages of rare and historic maps, diagrams, and photographs.

MARCH

8

GEOINTeraction
Tuesday

10

GEOINT 2016
Preview with NGA
Location TBD

28

Data Analytics
Workshop
Herndon, Va.

MAY

15-18

GEOINT 2016
Symposium
Orlando, Fla.

PEER INTEL

The Intelligence Advanced Research Projects Activity (IARPA) named **Stacey Dixon** deputy director. Dixon previously oversaw geospatial research and development at the National Geospatial-Intelligence Agency (NGA).

Anne Altman, general manager of IBM's U.S. federal and government industries announced her retirement in January.

Sam Gordy, integrated systems group president at Leidos, will succeed Altman. Gordy brings to IBM analytics, cybersecurity, and enterprise information systems expertise.

In December, UrtheCast announced **Wade Larson** as its new CEO in addition to his roles as president and COO. Larson is a co-founder of UrtheCast and has more than 20 years of experience in the space sector.

The Honorable Michael G. Vickers was appointed to BAE Systems' board of directors for a three-year term as of Dec. 1. Vickers recently served as the Under Secretary of Defense for Intelligence from 2011 to April 2015.


Former NGA Director **Letitia Long** was named chairperson of the Intelligence and National Security Alliance's board of directors. She is also a member of the USGIF Board of

Directors. Long was the fifth director of NGA.

Ambassador R. James Woolsey Jr., a national security and energy specialist, was elected chancellor of the Institute of World Politics. Woolsey previously served in the U.S. government in five capacities, including director of the Central Intelligence Agency from 1993 to 1995.

USGIF board member and former CEO of GeoEye, **Matthew O'Connell**, was named CEO of OneWeb. The company is planning a 900-system constellation of low-orbiting satellites to provide worldwide broadband Internet. In January, O'Connell oversaw the final details of OneWeb's joint venture agreement with Airbus Defense and Space to create OneWeb Satellites.

Boundless expanded its leadership team with three new appointments. In December, the company announced **Andrew Dearing** as acting CEO. In January, it selected **Brian Monheiser** and **Dave Gibbon** to join its management team. Monheiser will lead Boundless' U.S. federal sales initiatives, while Gibbon is the new director of global commercial sales.



2016 STATE OF GEOINT REPORT

USGIF

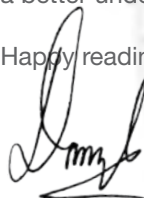
Download the 2016 State of GEOINT Report at usgif.org

Each year, USGIF assembles a variety of GEOINT subject matter experts, practitioners, and thought leaders to create the annual State of GEOINT report.

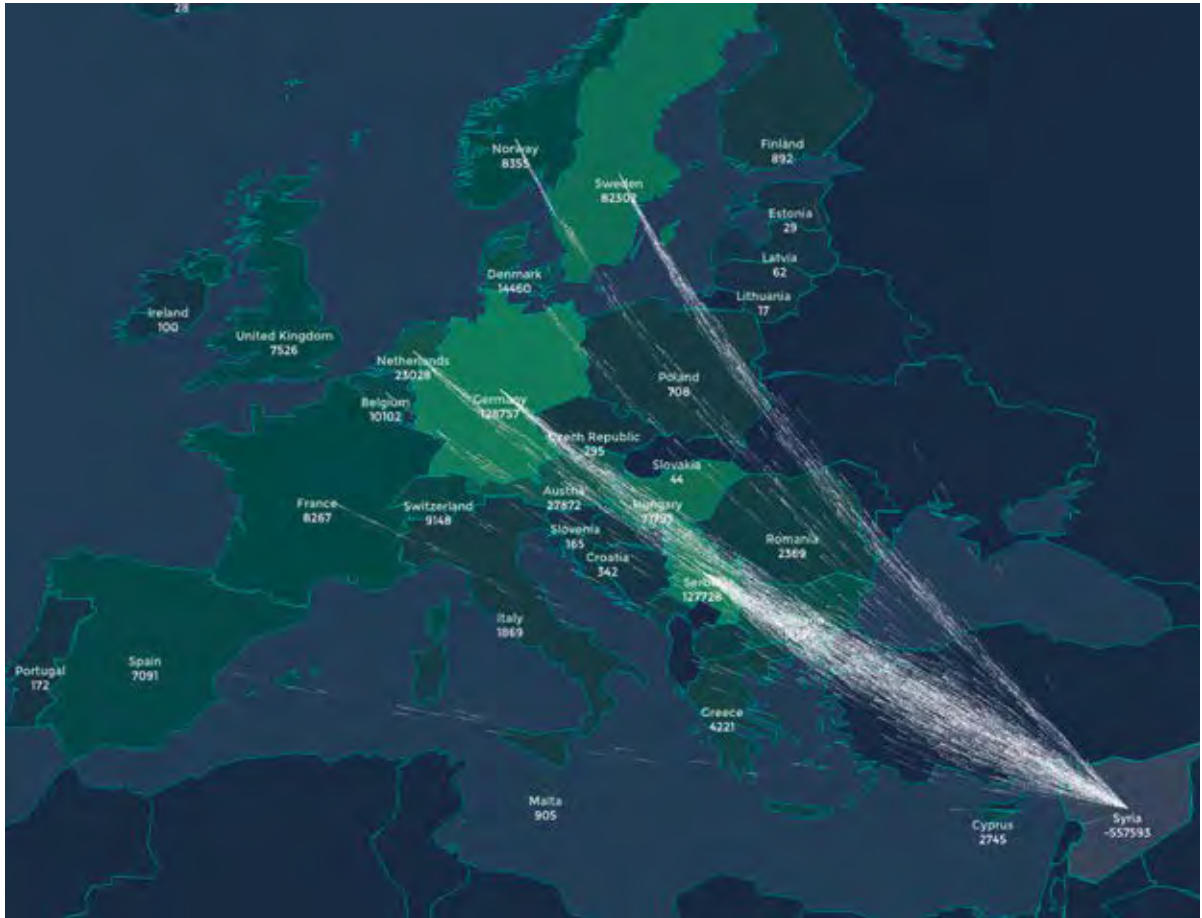
This year's State of GEOINT report highlights a number of pressing issues for the defense, intelligence, and homeland security communities: the arrival of small satellites as a recognized and viable collection platform; the proliferation of open-source data; the impact of volunteered geographic information; the need to revamp training to match the use of new and open sources; and the growing demand for improved government procurement processes.

Researchers, analysts, government officials, business development professionals, and students and academics alike will learn from this eclectic, hard-hitting report to gain a better understanding of their tradecraft and profession.

Happy reading,



Dr. Darryl Murdock,
USGIF Vice President of Professional Development



The Great Migration



VISIT

lucify.com/the-flow-towards-europe to study the interactive map and other related visualizations. To view an interactive map on the cost of displacement, visit lucify.com/the-cost-of-displacement.

According to the United Nations (UN), more than 12 million people—including 5.6 million children—have fled Syria to escape the horrors of the country's ongoing civil war and invasion by ISIS. Worldwide, the UN reports an unprecedented 59.5 million people are displaced by crisis. The flow of refugees toward Europe from Syria and other war-torn nations has caused the continent's greatest refugee crisis since World War II. Finland-based Lucify, which creates interactive data visualizations to help organizations analyze and communicate important data, recently tackled the refugee migration to Europe. Using UN data from 2012 through December 2015, its interactive map offers a time-lapse view of refugee migration and country-by-country statistics. The above image shows Syrian refugees streaming toward Europe.

Between April 2011 and November 2015, more than 800,000 Syrians have sought asylum in Europe. When viewing worldwide data, the map reveals that among European countries Germany has experienced the greatest influx of refugees, taking in nearly 600,000 since 2012.

The background of the entire page is a map. The top-left portion shows a dark map with a white street grid and a blue line representing a river or coastline. The bottom-left and right portions show a map with a color-coded overlay in shades of green, yellow, and orange, likely representing a risk or intelligence analysis. A large white diamond shape is centered on the page, containing the main text.

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