

trajectory

THE OFFICIAL MAGAZINE OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION



- > 2018 USGIF Scholarship Winners
- > Perspective: Dr. May Yuan, UT Dallas

Eyes *Wide Open*

Thanks to the **Five Eyes intelligence alliance** among the United States, Canada, Australia, New Zealand, and the United Kingdom, geospatial intelligence is a truly global affair

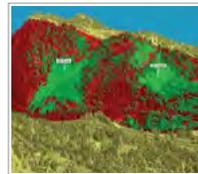
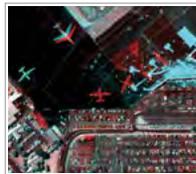


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Thanks to the Five Eyes intelligence alliance among the U.S., Canada, Australia, New Zealand, and the U.K., geospatial intelligence is a truly global affair

By Matt Alderton

PHOTO BY MASTER CORPORAL MATHIEU GAUDREAU



The Unclassified Remote-sensing Situational Awareness (URSA) system was deployed with the Canadian-led Combined Task Force 150 team at Naval Support Activity in Manama, Bahrain, in December 2016.

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Read full-length profiles on the recipients of USGIF's 2018 Ken Miller and RGi scholarships.

WEEKLY UPDATES

Visit us online for weekly GEDINT community news round-ups, blog posts, and more!

TRJ-056

Funding Academic Excellence

Fall is one of the most exciting times around USGIF. As our staff is hard at work planning USGIF's autumn programming, such as our annual series of events in St. Louis and GEOINT Community Week in Northern Virginia, our



RIT Ph.D. student Sanghui Han received USGIF's first K. Stuart Shea Endowed Scholarship onstage at GEOINT 2018.

annual scholarship winners head off to their respective campuses to continue their GEOINT-related studies. While we're proud to provide myriad opportunities for education, training, professional development, and networking, the annual scholarship cycle certainly has a special place in our hearts.

Among our 2018 scholarship winners are budding environmental scientists, machine learning experts, geophysicists, intelligence analysts, data scientists, GIS specialists, marine biologists, national security gurus, and more. In recent years, the USGIF Scholarship program has expanded to include new awards thanks to the generosity of USGIF Organizational Members and individuals.

In 2016, USGIF introduced the first-ever Ken Miller Scholarship for Advanced Remote Sensing Applications in partnership with USGIF Organizational Member Riverside Research. This year's winner—the third individual to receive this award—is Joshua Turner, a former U.S. Air Force geospatial analyst and NASA DEVELOP program participant.

At GEOINT 2018, USGIF presented the first K. Stuart Shea Endowed Scholarship to Sanghui Han, a former U.S. Army intelligence officer pursuing her Ph.D. in imaging science at Rochester Institute of Technology. This \$15,000 annual scholarship, named for one of the founders of USGIF and the first executive chairman of the Foundation, is made possible thanks to an anonymous individual and members of USGIF's Board of Directors.

This year, we proudly introduce the first recipient of the RGi Scholarship for Geospatial and Engineering, made possible by USGIF Organizational Member Reinventing Geospatial, Inc. The inaugural recipient is David Runneals, a geographic information science major at Northwest Missouri State University.

In 2018, USGIF presented \$141,000 in scholarships, and our scholarship program has generated more than \$1.2 million in awards since it began. This would not be possible without the support of USGIF Members. If you or your

organization is interested in funding or helping to fund an award, please reach out to us to begin the conversation. In the meantime, please read more about this year's exceptionally qualified awardees on page 18.

Also in this issue, you'll find two articles on the Five Eyes intelligence partnership among the U.S., the U.K., Canada, Australia, and New Zealand. In September, USGIF had the unique opportunity to host a GEOINTeraction Tuesday event featuring GEOINT liaison officers based at the National Geospatial-Intelligence Agency. We recap their Q&A session on page 4. And this issue's cover story, penned by *trajectory* stalwart Matt Alderton, starts on page 10, taking a deep dive into the Five Eyes alliance, exploring each country's efforts to foster closer collaboration and better common security.

Thank you, as always, for your dedication to and support of USGIF. None of our programs would be possible without our members, attendees, sponsors, supporters, and partners. I look forward to seeing you soon around our offices and/or at our upcoming GEOINT Community Week events. I encourage you to consider participating in USGIF's 2018 EdGEOcation Giving Campaign to support our burgeoning K-12 engagement efforts. Learn more about the campaign at usgif.org/donate.

As we head into the 2018 holiday season, on behalf of our entire team, I send the best to you and your families, and wish you all a healthy, happy, and prosperous 2019.



KEITH J. MASBACK | CEO, USGIF
@geointer

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From left to right, Vricon's Isaac Zaworski, USGIF's Keith Masback, Australia's Gordon Muir, the U.K.'s Simon Wynn, New Zealand's Andy Francis, and Canadian Lt. Col. Kevin Ng.

Sharing GEOINT Data & Services

GEOINT liaison officers based at the National Geospatial-Intelligence Agency (NGA) participated in a Q&A Sept. 11 during USGIF's GEOINteraction Tuesday event. The participants—representing the U.K., Canada, Australia, and New Zealand—were interviewed by Isaac Zaworski, vice president at Vricon, which hosted the event.

The liaison officers highlighted the mission of the Allied System for Geospatial Intelligence (ASG) and how it relates to the U.S. National System for Geospatial Intelligence.

"We are senior liaison staff within NGA, but our liaison is really to the GEOINT mission within the U.S.," said Simon Wynn, senior liaison officer for the U.K. "We are not embeds or exchange officers ... We make sure that in terms of our mission we understand the U.S. GEOINT enterprise, we can integrate into the U.S. GEOINT enterprise, and we can support the Five Eyes GEOINT mission."

Five Eyes refers to the intelligence alliance among the U.S., U.K., Canada, Australia, and New Zealand to share responsive and timely intelligence to meet individual and collective security needs.

 To read more about the Five Eyes and GEOINT, see our cover story on page 10.

Lt. Col. Kevin Ng, senior Canadian forces intelligence liaison officer, highlighted the nascent ASG Five-Year Campaign Plan, which will run from 2018 to 2023 and be updated on an annual basis. He shared the plan's four lines of operation:

- 1. Mission management:** A framework that enables Five Eyes partners for mission sharing.
- 2. Accelerating the GEOINT cycle:** Expanding in areas such as structured observation, automation, and artificial intelligence technology.
- 3. Managing GEOINT sources:** Assessing new, commercial sources and identifying how to acquire them and make the data accessible for warfighters.
- 4. Transforming the workforce:** Overcoming cultural and institutional challenges to integrate Five Eyes workforces into a coherent enterprise.

Wynn emphasized the collaborative nature of the campaign plan.

"When you look at the advantages of the ASG campaign plan, it's about aligning those lines of effort where it suits national interests but also where it suits Five Eyes collaboration," he said. "A lot of stuff we procure is along national lines but suits international interest."

Agility on the commercial side enables the allied mission and drives the countries to be even more collaborative, said Gordon Muir, senior liaison officer for North America with the Australian Geospatial-Intelligence Organisation.

"We need ongoing engagement with commercial vendors to consider alternative models for providing data—it might cost a bit more to buy products, but if you can share it, that's very quickly annulled," Muir said.

The nascent **ASG Five-Year Campaign Plan** will run from 2018 to 2023 and be updated on an annual basis.

TRAINING

The Foundation Partners with Boundless

USGIF has partnered with Organizational Member Boundless to collaborate on GEOINT Community educational initiatives as well as to offer open-source resources to colleges and universities under the Foundation's Collegiate Accreditation Program.



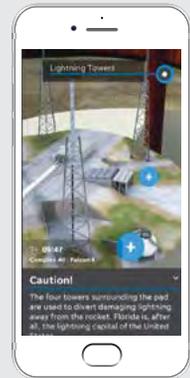
Boundless will provide an educational package that includes training materials and technical support for the four online-only, USGIF-accredited GEOINT programs: Northeastern University, Pennsylvania State University, Universidade Nova de Lisboa's NOVA Information Management School, and the University of Southern California.

Additionally, Boundless will provide all 16 USGIF-accredited colleges and universities with access to Boundless data and training guides to complement Boundless software. Through this partnership, students and faculty will be able to apply open-source GIS resources for instruction and research.

PROCRASTINATION TOOLS

321 Launch

This app, presented by *USA Today*, offers a new way to experience rocket launches around the world. During live launches, an augmented reality hologram mimics the activity of the real rocket using telemetry to predict its trajectory and speed. Live video coverage and commentary are built in. Users can also explore a launch simulator that explains how rockets are assembled, how facilities prepare for launch, and what happens along the spacecraft's flight, from separation to re-entry to the landing of a booster rocket.



321launchapp.com



Keith Barber (left) and Nick Buck speak to young professionals at Planet's office in Washington, D.C.

YPG

Acquisition 101 for Young Professionals

USGIF's Young Professionals Group (YPG) revived its popular Acquisition 101 series in August with an interactive discussion at Planet's office in Washington, D.C. Consultant Nick Buck and Keith Barber, who leads Planet's federal group, shared insights from their combined experiences in military, government, and industry. The discussion focused on debunking acquisition myths and provided history and information on federal acquisition regulation, agile acquisition, market research, and more. Attendees were invited to complete a survey to share what topics they would like to see highlighted in future Acquisition 101 presentations.



To stay informed about future Acquisition 101 installments and other YPG events, contact YPG@usgif.org to be added to the group's email list.

Gas Buddy

Gas Buddy is a long-distance road tripper's best friend.

The app helps motorists save money by locating nearby gas stations with the lowest prices using crowdsourced data from a community of 70 million users. By downloading, users are able to report local gas prices to help others save. Search filters also identify important amenities such as restrooms, car washes,



food, and more. Don't hit the road without it!

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Roadside America

From the world's largest chili pepper to the Shoe Museum, Roadside America is a guide to the weird and wacky wonders hidden along the nation's highways. Categories include architecture, history, museums, comically large sights, comically small sights, theme parks, tourist destinations, spooky spots, and more.

Visitor reports, photos, and maps inform travelers while choosing their next pit stop.

roadsideamerica.com/mobile





Children visit USGIF's build-your-own-satellite station during STEAM Family Day at the Steven F. Udvar-Hazy Center.

STEM

A Busy Summer for USGIF and K-12 Activities

USGIF recently formed a partnership with Seneca Ridge Middle School in Sterling, Va., as part of the Loudoun County School-Business Partnership program. This program promotes collaboration between Loudoun County Public Schools and local businesses to prepare K-12 students for future careers. USGIF has planned several middle school lessons and activities for the 2018–2019 academic year that span geometry, history, and physical education classes.

In June, USGIF volunteers exhibited at Altamira's 2018 STEM Showcase: Celebrating Fearless Women in STEM event in Dayton, Ohio. The event promoted STEM careers to the next generation of female professionals. The USGIF volunteers provided tutorials on satellites and Earth imagery.

The Steven F. Udvar-Hazy Center in Chantilly, Va., hosted its first STEAM Family Day in July. USGIF hosted a build-your-own satellite station at which children engineered model satellites using household products.

In September, USGIF participated in NGA Family Day, bringing its new Portable Planet interactive map for families to enjoy.

HOMELAND SECURITY

Geospatial Intelligence & Community Resilience

USGIF recently released a new report titled "Building Resilient Communities Through Geospatial Intelligence."

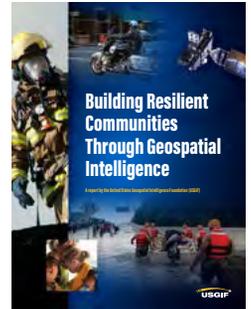
Resilient communities withstand and resist unfavorable change imposed by emergencies in a manner that minimizes loss and hastens an expedient and full recovery. This may be construed as encompassing the full life cycle of emergency management. Resilient communities must assess risk and plan for adverse events, take affirmative steps to mitigate threats, respond appropriately when the crisis is at hand, and efficiently deploy resources for recovery.

"This report articulates a powerful case for the opportunity afforded by the expansion of geospatial intelligence technologies outside of traditional military and intelligence applications,"

said USGIF CEO Keith J. Masback. "The team that assembled

this document understands the potential for immediate positive impact for emergency planners and first responders, and clearly articulates their thinking in this compilation of compelling articles."

GEOINT has emerged as a uniquely valuable tool for disaster management, demonstrating tangible benefits toward enhancing capabilities and infrastructure in the advent of more frequent, increasingly catastrophic disasters.



To download a free PDF of the report, visit usgif.org/education/GEOINTCommunityResilience.



More than 60 GEOINT academics gathered in September at USGIF headquarters in Herndon, Va.

PROFESSIONAL DEVELOPMENT

USGIF Hosts Annual GEOAcademic Summit

In September, USGIF hosted its GEOAcademic Summit at its headquarters in Herndon, Va., to engage representatives from its academic programs in conversations with government and industry. The GEOAcademic Summit is a two-day event gathering individuals from USGIF's 16 accredited colleges and universities to collaborate on a variety of the Foundation's professional development initiatives.

Geospatial intelligence technologies and applications are rapidly proliferating, becoming more readily available, strengthening overall resilience, and enabling the next generation of public safety professionals. The report includes articles on critical infrastructure protection, emergency communications, climate change, case studies, lessons from the military and the developing world, and much more.



Visit usgif.org/education/K-12/PortablePlanet to learn more!

Students participate in activities on USGIF's new "Portable Planet," a giant map of North America.



K-12

USGIF Introduces Interactive, Educational Map Program

USGIF created a large-format map of North America that is available for schools and organizations to rent for the purpose of informing and inspiring students.

USGIF's Portable Planet is a 35-by-26-foot map designed for children and teachers to walk on and explore its many features. Additionally, USGIF created cross-disciplinary, interactive activities for educators to conduct on the map. The lessons not only teach geography, mapping, and GEOINT basics, but also allow students to practice skills in critical thinking, spatial analysis, teamwork, and more.

"Many students shared their favorite activity of the day was the map," said Sandra Janack, a fifth-grade social studies teacher at Shorecrest Preparatory School in St. Petersburg, Fla., whose students attended GEOINT 2018. "It was fun to watch the students moving around the map—estimating, collaborating, and sharing their thinking to find locations to solve puzzles. Running around the map with the purpose of finding locations was so much more engaging for the students than using a paper map at their desks."



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 GOVERNANCE

New USGIF Educational Committee Structure

This summer, the Foundation enhanced its educational and academic committee structure with the formation of an Academic Advisory Board (AAB) and an Academic Planning Committee (APC).

The newly restructured AAB includes non-educators with expertise in the GEOINT Community and is intended to inform university faculty and K-12 teachers of industry best practices.

The APC includes a variety of faculty and GEOINT academic program leaders and plays a vital role in developing new curricula and expected student competencies, setting performance standards, and expanding GEOINT research.

Under the APC are three subcommittees: the Accreditation Subcommittee; the Scholarship Subcommittee; and the newly formed K-12 Subcommittee, which was created to promote geographic literacy and GEOINT awareness and will also develop educational materials and curriculum for classroom use.



Tampa area students attended a workshop offered by Hexagon Geospatial at GEOINT 2018.

 SOFTWARE

Students from USGIF-Accredited Programs Win Hexagon Competition

At USGIF’s GEOINT 2018 Symposium in April, a select group of college students attended a workshop offered by Hexagon Geospatial featuring the company’s Hexagon Smart M.App platform. The students created an Incident Analyzer View, an interactive map displaying specific incident data, while applying critical thinking and analysis skills. Hexagon Geospatial then challenged the students to create their own map and test their skills with commercial geospatial software.

The two winners of this competition were Carolynne Hultquist, a doctoral candidate studying geography and social data analytics at Pennsylvania State University, and Kevin Mercy, who is earning a bachelor’s degree in archaeology and a master’s degree in GIS at the University of Southern California. Hultquist focused her map on crowdsourced radiation measurements in Fukushima, Japan, while Mercy mapped militarized conflict trends in Somalia.



USGIF CEO Keith Masback and USGIF Director of Academic Programs Dr. Camelia Kantor present a certificate of accreditation to Micah Brachman of the University of Maryland College Park.

 ACCREDITATION

USGIF Welcomes Three New University GEOINT Programs

USGIF recently accredited three new university GEOINT programs as part of its Collegiate Accreditation Program. These schools include North Carolina Central University (NCCU), the University of Maryland (UMD) College Park, and the University of North Carolina Wilmington (UNCW), bringing the total of USGIF-accredited colleges and universities to 16.

“It’s particularly meaningful to add these three diverse accredited GEOINT Certificate programs, each with unique strengths, at this point in the evolution of USGIF,” said Foundation CEO Keith J.

Masback. “As we approach our 15th anniversary as an organization, we’re focused on our strategic vision, and the complementary nature of these strong programs aligns perfectly with that vision.”

NCCU offers both undergraduate and graduate GEOINT certificates. It is the second Historically Black College or University USGIF has accredited, and three NCCU faculty members have earned USGIF Professional GEOINT Certification.

UMD provides its graduate GEOINT certificate on-campus and online. Additionally, the university is located near Washington, D.C., offering courses related to defense and intelligence as well as close proximity to federal internship opportunities.

UNCW’s GEOINT certificate is offered through an undergraduate minor in geospatial technologies as well as a graduate certificate in geographic sciences with a focus on coastal sciences and sustainability. The university is the first USGIF-accredited institution with an ocean and coastal GEOINT focus.





United States Geospatial Intelligence Foundation

**NOW
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2019 USGIF Scholarship Program

2018 Scholarship Winners



USGIF is dedicated to supporting promising high school, undergraduate, and graduate students studying geospatial intelligence core disciplines such as geography and GIS, remote sensing, geospatial database management and data visualization and/or related disciplines.

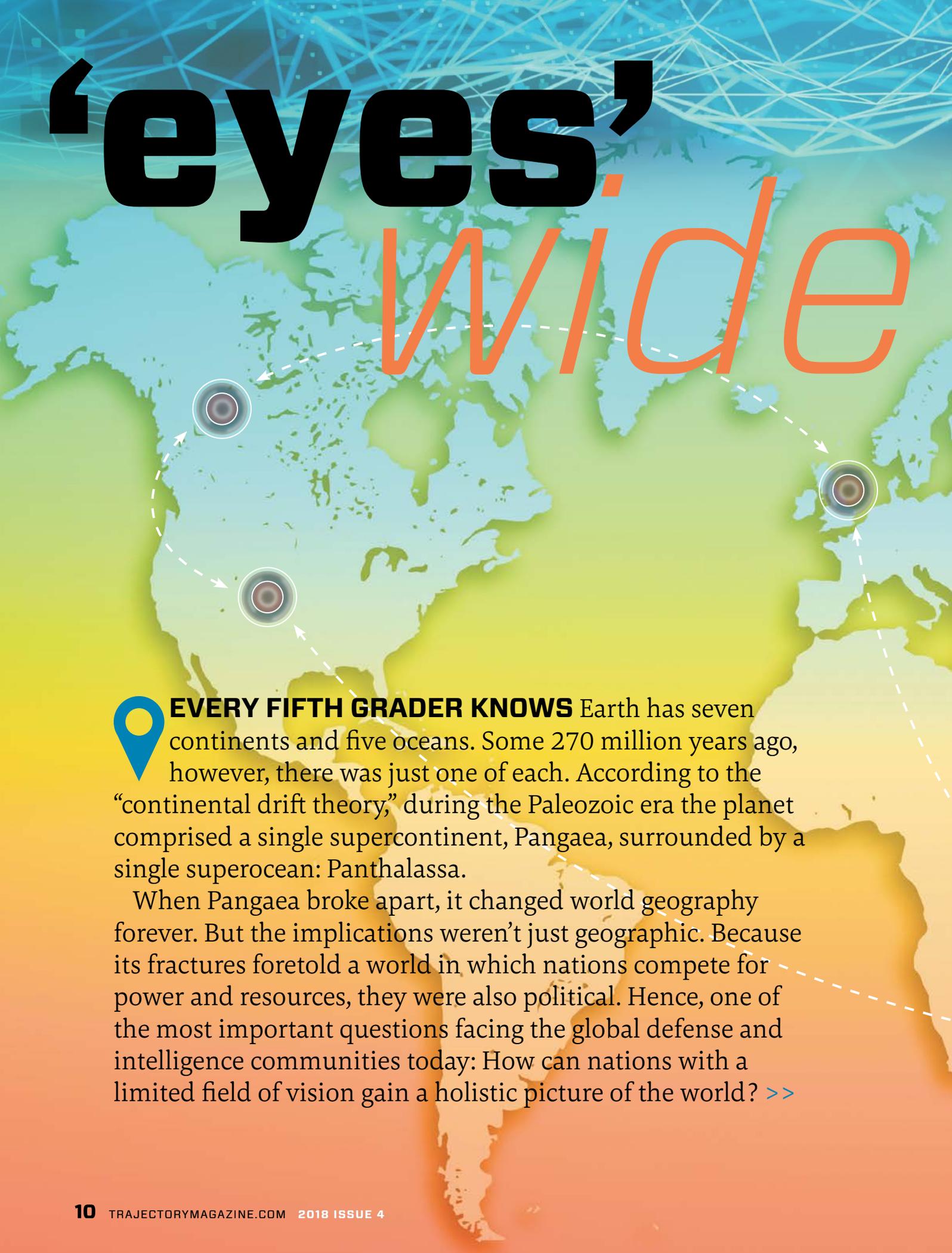
USGIF has awarded more than **\$1 Million** in scholarships since the program began.

Learn More and apply at usgif.org

K. Stuart Shea Scholarship application due: February 28
All other applications due: May 15



'eyes' wide



EVERY FIFTH GRADER KNOWS Earth has seven continents and five oceans. Some 270 million years ago, however, there was just one of each. According to the “continental drift theory,” during the Paleozoic era the planet comprised a single supercontinent, Pangaea, surrounded by a single superocean: Panthalassa.

When Pangaea broke apart, it changed world geography forever. But the implications weren't just geographic. Because its fractures foretold a world in which nations compete for power and resources, they were also political. Hence, one of the most important questions facing the global defense and intelligence communities today: How can nations with a limited field of vision gain a holistic picture of the world? >>



open

Thanks to the Five Eyes intelligence alliance among the United States, Canada, Australia, New Zealand, and the United Kingdom, geospatial intelligence is a truly global affair

BY MATT ALDERTON

The answer is teamwork. And thanks to the Allied System for Geospatial Intelligence (ASG), which for nearly a decade has seeded collaboration and cooperation among the United States and its closest allies, “Team GEOINT” enjoys a strategic cohesion that yields tangible benefits for each of its members: the U.S., Canada, Australia, New Zealand, and the United Kingdom—known collectively as the “Five Eyes” (FVEY). Their intelligence alliance is the genesis of a new kind of supercontinent united by common interests rather than shared soil.

STRENGTH IN NUMBERS

After the American Revolution, the U.S. and the U.K. went from enemies to fast friends. Their relationship became especially close during World War II. Created in 1943 by a secret pact known as the British-U.S. Communication Intelligence Agreement, their partnership bore fruit so critical to the Allied forces’ victory that it was formalized after the war as the UKUSA Agreement. As the agreement evolved, Canada became an official treaty partner in 1948, followed by Australia and New Zealand in 1956.

The term “Five Eyes” became verbal shorthand for “AUS/CAN/NZ/UK/US EYES ONLY,” which was stamped on all top-secret documents shared among Commonwealth allies.

And yet, the alliance is much more than a rubber stamp. It’s a deep and loyal friendship, according to Gary Dunow, chief of the International Support Team for Europe and Canada at the National Geospatial-Intelligence Agency (NGA).

“I’ve got a couple of friends I’ve known for almost 30 years ... If I need to call them at 2 o’clock in the morning—no matter what the topic is—I know those two guys are going to answer,” said Dunow, who’s based in London. “That’s how I think of the Five Eyes. They’re partners around the world who will always answer when the U.S. needs them, and we’ll do the same for them.”

The allies’ friendship comes naturally, added Fred Kemp, who recently retired from his position as NGA’s director of international affairs. “The fact that we have a common language—and, in many cases, a common history together—clearly unites our Five Eyes nations,” he said. “We see the world very similarly.”

But necessity, in addition to a common worldview, explains why FVEY continues to endure.

“This is as much pragmatic as anything else,” said Air Vice Marshal Sean Corbett of the U.K.’s Royal Air Force (RAF). In January, Corbett completed a 27-month rotation as the U.S. Defense Intelligence Agency’s (DIA) first deputy director for Commonwealth integration (DDCI)—the first foreign national deputy director of any U.S. intelligence agency.



Air Vice-Marshal Sean Corbett of the Royal Air Force, who recently completed a rotation as the U.S. Defense Intelligence Agency’s first deputy director for Commonwealth integration, sits with colleagues at a briefing for Chairman of the Joint Chiefs of Staff Gen. Joseph F. Dunford, Jr.

PHOTO COURTESY OF DIA PUBLIC AFFAIRS

“The world we live in right now is a very dangerous place and the U.S. can’t do everything,” continued Corbett, whose replacement at DIA is Maj. Gen. John Howard of New Zealand. “We can’t be everywhere, all the time.”

Dunow agrees. “Our intelligence challenges are global and unending,” he said. “We need to apply as many resources as we can to problems like counterterrorism, counterproliferation, and global warming.”

By providing resource assistance to one another, the partners improve their own intelligence capabilities.

“When you’re conducting intelligence and analysis, you need diversity in order to get to the best possible answer,” Dunow continued. “We look at things through our culture, our geographic location, and our national security paradigm differently than Canada, Australia, New Zealand, or the U.K. Their location, history, culture, and national security concerns all add value to the way [the Five Eyes] look at problems as a whole.”

SOLVING GEOINT PUZZLES

Escape rooms are live interactive puzzles intended to be solved via groupthink. Participants are locked in a themed room with a fictional mission—for example, defuse a ticking time bomb—and must solve a series of clues in order to complete it successfully. Generally, no one person can solve all the clues, and the only way to “escape” the room is to work together. That’s how FVEY works: In order to solve GEOINT puzzles, each partner must bring its own unique competencies to bear. The U.S., for example, benefits from each of its partners’ contributions, each of which is flavored by different contexts, capacities, and capabilities.

THE UNITED KINGDOM-

GEOINT has a long history in the U.K. dating back to at least World War II, when the British turned the war’s tide with their superior air reconnaissance and photographic

interpretation. Developed during covert aerial operations by the country's Secret Intelligence Service, those capabilities were originally housed in RAF's Photographic Development Unit, which after the war became known as the Joint Air Reconnaissance Intelligence Centre (JARIC). For decades, JARIC managed British imagery needs, while a separate entity, the Defence Geographic Centre (DGC) at Feltham, led foundation GEOINT. In 2012, both were subsumed under a new command known as the Joint Forces Intelligence Group, whose Defence Intelligence Fusion Centre (DIFC) became the U.K.'s principal GEOINT provider. In fact, DIFC was initially known as the Defense Geospatial Intelligence Fusion Center but dropped "Geospatial" from its name in 2014 to reflect and inculcate the group's multi-INT nature.

"In the U.S., [former Director of National Intelligence] Jim Clapper saw the benefits of bringing mapping and imagery agencies together into a coherent whole when he shaped the modern NGA. We've been following a similar pathway here in the U.K.," explained Mark Ashwell, a retired RAF air commodore and former director of intelligence capability, strategy, and policy with the British Ministry of Defence (MoD). "Because of our smaller size and scale, however, there's a different construct here in the U.K. Whereas NGA exists in its own right, there was not a direct equivalent of a U.K. geospatial intelligence organization; instead, geospatial intelligence has always lived alongside strategic intelligence in the Defence Intelligence organization."

That organization is currently in the midst of an ongoing transformation—in 2016, the National Centre for Geospatial Intelligence (NCGI) was formed and replaced DIFC as the functional manager of GEOINT in the U.K.

"Over the past two years, Chief of Defence Intelligence Air Marshal Phil Osborn has led Defence Intelligence through a significant transformation program," explained Brig. Ben Kite, head of NCGI. "During this process, the critical value that GEOINT provides to the U.K. was fully recognized and the requirement for a national capability was agreed. NCGI combines the former JARIC, DGC Feltham, No.1 Aeronautical Information Documents Unit, and 42 Engineer Regiment (Geographic) under a 2-star led organization, [overseen] by Air Vice Marshal Ian Valleley and managed daily by myself. It assumed the authority for GEOINT in the U.K., a major step forward for the U.K.'s GEOINT community."

According to Kite, NCGI is organized into three functional areas: Analysis, Foundation, and Deployable. "The organization combines the expertise of 1,200 military and civilian imagery analysts, geographers, and geospatial analysts in a mutually supporting structure," he added.

Ashwell said further evidence of British GEOINT's evolution exists in the U.K.'s Single Intelligence Enterprise initiative, through which MoD is attempting to create shared architectures and processes to unite disparate intelligence organizations and disciplines.

"The concept is to ... bring all of the INTs together and use them as a fused entity to provide solutions and decision support to the people who are wrestling with the macro-problems of the time," said Ashwell, who likened the Single Intelligence Enterprise to the Intelligence Community Information Technology Enterprise and Joint Intelligence Enterprise initiatives in the U.S.

"We're bringing a lot to bear in terms of the construct of massive data exploitation and innovative enhanced visualizations of data, as well as cognitive inter-relational databases."

—BRIG. BEN KITE, NATIONAL CENTRE FOR GEOSPATIAL INTELLIGENCE, U.K.

"Access to an expanding number of cross-domain data sets will provide the breadth and depth of information needed to allow NCGI analysts to provide accurate and timely foundation and intelligence products," Kite said. "The integration of all the national GEOINT capabilities, along with our partners' capabilities, will give the NCGI the competitive edge to meet current and future challenges."

Multi-INT fusion will help the U.K. extract maximal intelligence impact from minimal intelligence resources. This "more with less" spirit is well-suited to contemporary big data challenges, which will be another British competency benefiting FVEY partners going forward, Ashwell predicted. "There are lots of people in the U.K. looking at manipulation of data," he said, citing as examples U.K. companies such as Daden and BAE Systems Applied Intelligence. "We're bringing a lot to bear in terms of the construct of massive data exploitation and innovative enhanced visualizations of data, as well as cognitive inter-relational databases."

Even as it develops new centers of excellence, the U.K. continues to leverage long-established talents.

"The U.K., in particular, has a long legacy with hydrographic work because of its naval history," Dunow said.

And finally, there's its location—adjacent to some of the world's largest and most important economies. "The British history in Europe is different than the U.S. history in Europe," Kemp said. "Having that lens is incredibly important to us."

Panelists from the Allied System for Geospatial Intelligence discussed the evolution of GEOINT in their respective nations at the GEOINT 2017 Symposium.



-AUSTRALIA AND NEW ZEALAND-

What the U.K. is to Europe, Australia and New Zealand are to the Asia Pacific.

“New Zealanders, for example, certainly enjoy a unique perspective of the Antarctic that we don’t have because they’re closer to it,” Kemp said.

Tom Mayberry, NGA’s international support team chief for Asia Pacific, added, “We work very closely with our mission partners [in Australia and New Zealand] on GEOINT issues throughout the region. Some common threats we’re worried about, for example, are China and North Korea.”

Although it’s the smallest of the FVEY partners, New Zealand nonetheless makes important GEOINT contributions, according to Mayberry, who is based in Canberra, Australia. “New Zealand is a little bit more conservative—it’s a smaller effort—but they contribute significantly and regularly outpunch their weight from a GEOINT perspective in the region,” he said.

New Zealand’s GEOINT functional leader is GEOINT New Zealand (GNZ), which was originally the Hydrographic Office of the Royal New Zealand Navy and is now part of Defence Intelligence within the New Zealand Defence Force (NZDF).

“The real genesis of GNZ as it stands today occurred in 2002 with the standing up of the Joint Geospatial Support Facility, which was established to support NZDF across all three environmental domains,” explained GNZ Director Lt. Col. Damon Taylor. “In 2008, the organization changed its name again to the Geospatial Intelligence Organisation to reflect the fact that its role was now wider than purely the provision of foundation geospatial support—but also included an analytical intelligence output.”

In 2012, a government review of intelligence structures within New Zealand suggested the formation of a single geospatial intelligence organization to support both NZDF

and the wider New Zealand government. And so, GNZ was born.

“GNZ—similar to NGA—has a mandate to support both the military as well as the wider government. To do this, we have a robust governance model that helps ensure we deliver what is required by all our stakeholders,” Taylor said. “The biggest difference between us and our partner agencies within the FVEY is our size ... But our size is also an advantage. When you are only one or two analysts deep in some areas you need to make sure you hire the best people you can get—and we do. Our size also makes us very agile; we can change focus onto new areas relatively quickly or take part in new initiatives without having to jump through large layers of bureaucracy.”

Owing to its roots, GNZ maintains a core hydrographic and maritime competence and therefore plays a lead role in many disaster relief missions. In 2015, for instance, relief agencies leveraged GNZ’s damage assessment reports to target support in the aftermath of Severe Tropical Cyclone Pam, which killed 24 people in the Pacific island nation of Vanuatu.

“When there is a human disaster in the Pacific, [New Zealand brings] capabilities and perspective to those nations that are affected, just as [the U.S. does] when there are issues in the Caribbean,” Kemp said.

Echoed Taylor, “Given our physical location on the globe—Henry Kissinger described New Zealand as ‘a dagger pointed at the heart of Antarctica’—we view our immediate area of interest as the Southwest Pacific.”

Australia’s larger size means the country offers even more resources in the region.

Australia is on the upswing,” Mayberry said. “I see them taking on a strong leadership role in terms of [execution] of GEOINT in the Asia Pacific region at the FVEY level and beyond.”

Australia’s “upswing” within the FVEY community is thanks in part to a national GEOINT evolution currently underway. In 2000, the Australian Department of Defence established the Defence Imagery and Geospatial Organisation (DIGO), which was modeled after the U.S. National Imagery and Mapping Agency (NIMA)—NGA’s antecedent. Like NIMA, DIGO was an amalgamation of imagery and mapping agencies.

When Clapper coined the term “geospatial intelligence” in 2003, Australia eventually followed suit; like NIMA became NGA, DIGO in 2013 became the Australian Geospatial-Intelligence Organisation (AGO).

“When we were in Afghanistan and Iraq, we worked very closely with U.S. Special Operations Command, and we saw firsthand the utility of really granular geospatially enabled targeting,” said retired Australian Army Officer Chris Hawkes, now an intelligence and investigations consultant at Point Duty, an Australian company that specializes in GEOINT. “I think that led to a realization ... about how important

*Australia
Department of
Defence Lance
Corporal Emily
Goeman of the
Combined Team
Uruzgan Geospatial
Intelligence Cell
prepares imagery
in her role as
a geospatial
technician.*



PHOTO COURTESY OF COMMONWEALTH OF AUSTRALIA, DEPARTMENT OF DEFENCE

geospatial capability is and how lightweight we'd been on it."

In 2017, Australia further championed GEOINT when it gave AGO oversight of the Australian Hydrographic Office, which previously reported to the Royal Australian Navy. Additionally, Mayberry said AGO has hired so many new employees it had to lease a second facility to house them all.

One notable employee illustrates how AGO is scaling up its capabilities. "NGA is evolving into new types of [trade-craft], including structured observation management and modeling," Mayberry said. "AGO has followed suit to the point where it is actually paying for [an NGA employee] to be in its footprint ... for a three-year tour to assist AGO in standing up a modeling and structured observation management capability."

NGA has also loaned Australia a senior manager to help it establish a new Office of National Intelligence modeled after the U.S. Office of the Director of National Intelligence. "She's embedded in the Department of the Prime Minister and Cabinet to assist with the standup of this office," Mayberry said. He added yet another example of Australia's growing intelligence profile is Defence Project 799, through which Australia will invest AU\$500 million to acquire regional commercial satellite imagery in support of GEOINT missions for itself and FVEY partners.

Even as its capabilities grow, however, what remain most valuable to the FVEY community are Australia's connections.

"I see Australia getting bigger and bigger, and potentially taking on a role working with other countries in the region through a multilateral approach—even beyond FVEY," Mayberry said. "They've got some very strong, historic relationships with other countries in theater, and we hope to leverage that."

-CANADA-

Canada's GEOINT capabilities are particularly robust, according to Canadian Army Lt. Col. Kevin Ng, senior liaison officer to NGA from the Canadian Department of National Defence (DND).

"The landscape of GEOINT within the government of Canada is very broad," explained Ng, who said Canada's GEOINT enterprise includes diverse stakeholders like the Royal Canadian Air Force, which oversees space-based defense capabilities; Defense Research and Development Canada; Natural Resources Canada, whose Canada Centre for Mapping and Earth Observation specializes in geomatics; and the Canadian Space Agency. "There are many partners involved, but [DND is] the key player leading GEOINT policy and driving GEOINT capabilities forward."

The history of the Canadian Forces Intelligence Group closely mirrors that of its FVEY counterparts: For decades, the Canadian Armed Forces had separate imagery and mapping organizations—the Canadian Forces Joint Imagery Centre and the Canadian Forces Mapping and Charting Establishment, respectively—that were ultimately combined into a single formation, J2 Geomatics, in the early 2000s. In 2003, that formation became the Directorate of Geospatial Intelligence, which in 2013 became the Canadian Forces Intelligence Group, encompassing not only GEOINT, but also HUMINT, counterintelligence, and meteorological units.



PHOTO COURTESY OF DIA PUBLIC AFFAIRS

"The Canadian trajectory was very much an evolutionary process," said Ng, adding Canada's GEOINT progression has culminated in an all-source approach to intelligence problems in theaters like Iraq and Afghanistan, where the Canadian Armed Forces is known for forward-deployed, all-source intelligence centers.

While its all-source approach gives Canada a big bite, the reality is that at just under 70,000 troops, the Canadian Armed Forces is relatively small. To be effective, it must play to its core strengths, the most significant of which is maritime domain awareness.

"The maritime domain awareness capability is a niche area Canada has developed," explained Ng, who said Canada's maritime mastery stems from the fact that it has three coasts—including one in the Arctic, which was the basis for launching Canada's first commercial Earth observation satellite, RADARSAT-1, in 1995. "The primary Canadian interest in [RADARSAT-1] was surveillance of the Arctic and monitoring our coastline. Because there obviously are a lot of other applications, however, industry and government partners got together and identified the potential for us to exploit RADARSAT-1 for near real-time ship detection."

With the launch of RADARSAT-2 in 2007, and two associated ground stations for data processing, exploitation, and dissemination in 2012, Canadian Armed Forces evolved its capabilities even further.

"Back in 1998, it took us hours to process RADARSAT-1 imagery for ship detection purposes. Now we've reduced that time lag down to about 15 minutes or less," continued Ng, who also highlighted Canada's ability to automatically combine radar and Automatic Identification System (AIS) technology for the purpose of identifying "dark" targets (ships not emitting AIS signals).

Canada brought that capability to bear for its coalition partners in 2016 as part of multinational counterterrorism efforts in the Middle East, where Canadian Armed Forces' Unclassified Remote-sensing Situational Awareness (URSA) mobile ground station made its operational debut in Bahrain. URSA's near real-time ship detection capability provides a maritime operating picture for Canadian, U.S., and allied commanders by directly downloading imagery from commercial satellites—including RADARSAT-2—as they pass over a deployable ground station.

In the future, Canada hopes to add similar value to FVEY partners operating in other, dryer domains. "We're not just looking at maritime contacts in an automated fashion;

The corridor outside the Five Eyes Coordination Cell at U.S. Defense Intelligence Agency headquarters.



“A fully operationalized global GEOINT enterprise will fortify reliability and availability of GEOINT, ensuring mission-readiness in times of war, crisis, and peace.”

—DUSTIN GARD-WEISS, ODNI

we’re going to be looking at land targets as well,” Ng said. Canada’s forthcoming RADARSAT Constellation mission, for example, is scheduled to put three new Earth-observation satellites on orbit in November, providing daily revisits of Canada’s vast territory and maritime approaches, as well as daily access to 90 percent of the Earth’s surface.

NEXT STOP: CLOSER COLLABORATION

The Commonwealth allies have much to gain from leveraging one another’s assets and expertise. Still, collaboration doesn’t always come easy.

One of the biggest hurdles facing FVEY is technology, as partners must have complementary systems even as they have disparate budgets and requirements.

“As you try to improve the speed at which you make decisions, technology is a key enabler of that. So, interoperability is a big deal,” said Kemp, who stressed the importance of investing in technology that facilitates information sharing. “We shouldn’t make resource decisions in isolation. If we’re going to modernize a particular approach, we need to take into consideration what effect that modernization will have on the people we’re partnering with.”

Added former NGA Associate Director for Enterprise Dustin Gard-Weiss, who recently joined the Office of the Director of National Intelligence (ODNI) as associate deputy director of national intelligence for enterprise capacity, “An enduring challenge is to share consequential geospatial intelligence, data, and analytics ... through seamless operations across the National and Allied Systems for Geospatial Intelligence. Technology, long a barrier to interoperability, has advanced sufficiently to enable us to work in ways we have always envisioned and desired. We are seizing opportunities to increase interoperability through analytic modernization and professionalization initiatives.”

The goal of one such initiative is managing the complexity of GEOINT analytic data and collection operations among Commonwealth partners with a shared approach to artificial intelligence and machine learning.

“Together, we are embracing and harnessing the power of GEOINT algorithms and models while adopting a risk-aware mindset and approach to machine learning, computer vision, and artificial intelligence,” Gard-Weiss continued.

Across this and other initiatives, data security is of particular concern. “Classification is always an issue,” Kemp continued. “We need to ensure that we have the proper identity management capabilities in place, and that we’re sharing the right information with the right partner, at the right time, and for the right purpose.”

Policy can complicate that task. “Our policy community is very forward-leaning. It’s also very inclusive, which means there are a lot of different equities that are considered when we draft and promulgate policy,” Dunow said.

Even things as minor as language and workflows can pose major challenges, according to Corbett, who said FVEY must develop shared terminology and compatible systems architecture that facilitate the cross-flow of information.

Perhaps the greatest challenge is organizational culture and buy-in. “To me, the biggest challenge is getting it into the DNA of the analyst and others that it’s a good thing to work at the FVEY level,” Corbett said. “Not just because somebody higher up is telling you to do so, but because you gain benefits from it—because some of the FVEY partners may have that missing piece of the jigsaw puzzle you need.”

In the GEOINT realm, the ASG offers a framework through which FVEY can discuss these challenges and collaborate on solutions. One of its most fruitful mechanisms is the liaison role.

“In addition to having exchanges throughout the year on different topics and technical areas, our FVEY partners send folks to work in our facilities and we do the same in their locations,” Dunow said. “When you sit, work, and go to lunch together that relationship gets stronger.”

At DIA, the DDCI post is an effort to achieve the same international synergy with all-source intelligence that the ASG promotes with GEOINT.

“We’ve all fought together and sometimes died together. But the closer you get to the beltway, the harder it becomes to work together,” said Corbett. “I was brought in specifically to address that for defense intelligence by optimizing FVEY integration within DIA.”

Corbett’s efforts included encouraging analysts and technical staff to confer directly with their FVEY counterparts to achieve mutual understanding of one another’s intelligence products; conducting outreach and training with intelligence analysts to familiarize them with FVEY capabilities, benefits, and workflows; and defining requirements for releasable intelligence products so they could be shared optimally.

As a result of Corbett’s efforts, DIA has more than doubled the amount of intelligence products made available to FVEY partners: from 17 percent of releasable intelligence shared in 2015 to 54 percent presently.

Improvements in multinational intelligence sharing aren’t just numbers; on battlefields in Afghanistan, storm-ravaged islands in the Pacific, and in countless other theaters, they’re strategic advantages and lives saved. Which is why the next frontier in FVEY collaboration will be putting even more “eyes” on the shared picture.

The ultimate goal is creating a bigger, broader ASG—a global system for geospatial intelligence instead of merely an allied system.

“We seek to better understand our partners’ needs and unique strengths, and to harness GEOINT capabilities—wherever they reside—to the highest priority missions,” Gard-Weiss concluded. “A fully operationalized global GEOINT enterprise will fortify reliability and availability of GEOINT, ensuring mission-readiness in times of war, crisis, and peace. Together, we will achieve the full potential of the global GEOINT enterprise for those we serve.” 🌐

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USGIF offers scholarships annually to outstanding doctoral candidates, graduate students, undergraduate students, and graduating high school seniors. Accompanying these scholarships are two awards funded entirely by USGIF Organizational Members: The first-ever Reinventing Geospatial Inc. (RGI) Scholarship for Geospatial and Engineering, a \$10,000 scholarship awarded to an undergraduate student pursuing engineering and geospatial disciplines who demonstrates financial need; and the third Ken Miller Scholarship for Advanced Remote Sensing Applications sponsored by Riverside Research, which awards \$10,000 to a graduate student studying remote sensing who plans to enter the defense intelligence workforce.

RGI SCHOLARSHIP FOR GEOSPATIAL AND ENGINEERING



David Runneals

Northwest Missouri State University
Geographic Information Science

Runneals credits both his formal and informal education for his present success. He discovered his passion for GIS in 2008 through his 4-H club. He currently studies GIS with an emphasis in emergency and disaster management and is interested in using geospatial technologies to enhance

disaster response. He believes GIS can help save lives through improved coordination and more informed decision-making.

KEN MILLER SCHOLARSHIP FOR ADVANCED REMOTE SENSING APPLICATIONS



Joshua Michael Turner

North Carolina State University
Geographic Information Science and Technology

Turner served as a geospatial analyst for the United States Air Force for 15 years and completed his bachelor's degree in intelligence studies from American Military University. He participated in a 10-week rapid feasibility project using geospatial capabilities to solve real-world environmental issues

through the NASA DEVELOP program. His goal is to use his education and experience to transform succinct, algorithm-derived geospatial information into complete, actionable military intelligence.



SPOTLIGHTS Read extended profiles on Runneals and Turner online at trajectorymagazine.com/spotlights.



Christopher Olayinka Ilori

Simon Fraser University
Geography

Ilori's research focuses on satellite-derived bathymetry for nearshore waters. He received his bachelor of science in geography from Obafemi Awolowo University in Nigeria. He also holds a post-

graduate diploma in geographical information science from the University of Nottingham in the U.K. and a master's degree in sustainable environmental management from the University of Greenwich. He has worked in the areas of GIS and climate change in the U.K. and Japan, and is currently a remote sensing analyst with TCarta Marine in Denver, Colo.



Scott Pezanowski

Pennsylvania State University
Information Science and Technology

Pezanowski was previously the geospatial technology lead at the GeoVISTA Center and an assistant research professor of geography at Penn State. He has also held

positions at Esri and MapQuest. Pezanowski is applying machine learning and other data science techniques to detect descriptions of animals moving through geographic space found in text sources. Pezanowski holds a master's degree in geography from the University of South Carolina and a bachelor's degree in geography from Penn State.

GRADUATE



Jacob Fuson

University of Wisconsin-Madison
Geographic Information Systems

Fuson holds master's degrees from Florida State and Pennsylvania State University. He is a full-time graduate student at the University of Wisconsin in the GIS and

Web Map Program. His research interests include generative adversarial neural networks, recursive neural tensor networks, and quantum computing.



Cesar Jhonatan Garrido Lecca Rivera

University of Redlands
Geographic Information Systems

Rivera holds a bachelor's degree in computer science from the Peruvian University of Applied Sciences. He is developing an integrated GIS framework for public health

assessment in collaboration with Esri. Based on the CDC's CASPER method, the framework allows health agencies to optimize the collection of community health needs for emergency preparedness and response. Rivera plans to apply machine learning techniques for the second phase of his project.



Travis Meyer

Pennsylvania State University
Geographic Information Systems

Meyer's graduate research is focused on using object-based image analysis and LiDAR data for automated extraction of coastal features and vegetation. Meyer is >>

DOCTORATE



Katherine Cavanaugh

University of California, Los Angeles
Geography

Cavanaugh received her bachelor's degree

in environmental studies with concentrations in applied physics and remote sensing from Gettysburg College in 2016. Post-graduation, she conducted various geospatial Earth science projects at NASA's Jet Propulsion Laboratory, where she developed research interests in coastal ecology. For her graduate work, Cavanaugh is studying the dynamics of large kelp ecosystems using both satellite and UAV imagery.

studies with minors in geography and geographic information science. For her doctoral dissertation, she aims to understand how changes in climate can affect fire regimes, post-fire regeneration, and future forest disturbances. Guz plans to combine field work and geospatial modeling to conduct research on forest disturbances in the Rocky Mountains and the Swiss Alps.



Carolynne Hultquist
Pennsylvania State University
Geography

Hultquist is studying geography and social

data analytics specializing in fusing sources of geographic information to better understand complex environments. She has conducted research in energy, complexity theory, machine learning, and the use of geospatial technologies during hazards. The focus of her current research is to use computational methods for spatiotemporal analysis and modeling the effects of natural disasters on humans.



Jaclyn Guz
Clark University
Geography

Guz holds a bachelor's degree from Texas A&M University in environmental

GRADUATE

also enrolled in Penn State's graduate GEOINT and Remote Sensing certificate programs. His geospatial interests include social media analytics, custom tool development, feature extraction, image processing, and elevation modeling. Meyer served nine years in the military as an enlisted Marine and later a Naval officer. He currently works as a cartographer for USGS at the National Geospatial Technical Operations Center in Lakewood, Colo.



Andrew Ryan
George Mason University
Geoinformatics and Geospatial Intelligence
Ryan graduated with a bachelor's

degree in geography from Virginia Tech in 2015, after which he completed an internship with the U.S. State Department's Office of the Geographer. He entered George Mason's graduate program in 2016 and began working as a geospatial analyst with Radiant Solutions. Currently, Andrew is back at the Office of the Geographer as a cartographer and is finishing up his master's degree while he outlines his future education. Andrew's research interests include cartography and geo-visualization, spatial data mining, Python, and machine learning.



Sarah Spalding
University of Texas at Austin
Global Policy Studies
Spalding received her bachelor's degree in

government and politics with a minor in GIS from the University of Maryland, College Park. Prior to attending graduate school, she was an unconventional weapons and technology researcher/GIS analyst and then a geospatial data management consultant for the U.S. Department of Homeland Security. In her master's studies, she is specializing in security, law, and diplomacy. Spalding is interested in using GIS to better implement policy and support national security efforts.

UNDERGRADUATE



Jake T. Burstein
University of South Carolina
Geophysics
Burstein's passion is using marine

geophysics and GIS for seafloor mapping. This field uses acoustic echo-sounding technology to study the seafloor surface and subsurface, and enables scientists to discover the ocean's secrets, such as deep-sea coral reefs, mid-ocean ridges, or sunken vessels. GIS is vital for marine geophysicists to accurately plot, integrate, and spatially analyze multiple datasets.



Milovan Dakic
Indiana State University
Political Science and Geographic Information Science

Dakic is in his third year of Air Force ROTC and hopes to become an intelligence officer. He is interested in foreign languages and cultures, and recently finished his first year studying Persian. He believes the cultural and human aspects of geography can provide an additional way to conduct analyses and extract valuable geospatial intelligence, and enjoys examining the link between traditionally non-geographic concepts and their locations.



Margaret Hackney
Mercyhurst University
Intelligence Studies and Political Science

In addition to a double major, Hackney is also seeking a minor in religious studies. She has also applied her technical and cultural knowledge in three intelligence analyst internships with the Department of Defense and one with the Department of State. In her analytic roles, she leverages geospatial methods to assess national security challenges. Hackney hopes to use GEOINT to better understand conflicts, threats, and operating environments.



Haley Kathryn King
George Mason University
Geography and Geographic Information Science

King is passionate about GEOINT and plans to enter George Mason's accelerated master's degree program in geoinformatics and geospatial intelligence. As a GMU Ambassador, King serves as "The Face of Mason," supporting a variety of institutional and community service needs. She is also a member of Mason Mappers, a club that helps advance the tradecraft of mapping and geospatial analysis. King is a geospatial analyst intern with Dewberry Engineers & Consultants.



Candice Lee
University of Georgia
International Affairs

Lee is knowledgeable in international affairs, Korean, GIS, and global affairs. Her focuses include security, nuclear nonproliferation, and East Asian regional affairs. Lee is enrolled in the Air Force ROTC program and intends to commission upon graduation as an intelligence officer. She has interned with the NASA DEVELOP program and is a Richard B. Russell Security Leadership Program scholar.



Pearl Leff
Macaulay Honors College at Hunter College & Lander College for Women
Geography and Computer Science

Leff is passionate about using computer science to enhance GIS. Her exposure to GIS through her research in the use of machine learning to classify hyperspectral imagery as well as her experience writing software for geospatial companies has led to her fascination with satellites and remote sensing. She is also interested in GEOINT applications in the Middle East.



Claire Mercer
Ohio State University
Geography

Mercer specializes in spatial analysis. She aspires to work in national security after interning for the U.S. Defense Department and State Department. Mercer was a student assistant for the 2018 Esri User Conference and plans to intern with the National Geospatial-Intelligence Agency (NGA) as a visualization specialist in summer 2019. Her interests include interactive web-mapping, 3D modeling, and remote sensing.



Rachel Pierstorff
University of Denver
Geography and Applied Computing

Pierstorff focuses her studies and research on the geospatial dynamics of cities. By pursuing double majors as well as double minors in urban and international studies, she blends the critical-thinking skills of the social sciences with the technical knowledge and analysis of geospatial technology and computer science. She plans to apply her GIS and problem-solving abilities to improve the efficiency, self-sufficiency and security of urban areas.

GRADUATING HIGH SCHOOL SENIORS



Alexander Chrvla
Towson High School in Towson, Md.; now attending the University of Maryland Washington
Geography

Chrvla has applied GIS to regional transportation, urban development, and environmental issues, including creating a proposal for a new interstate highway. He's always held an interest in current events and geography, and dreams of a career as an analyst at NSA.



Srijay Kasturi
South Lakes High School in Reston, Va.; now attending the University of Maryland
Computer Science
Kasturi became interested in indoor

GIS applications when he started to explore the challenges faced by the blind community through his science fair projects. He is studying computer science so he can learn how to build systems to assist the visually impaired in understanding their surroundings with the primary motivator being to bring context to those who have difficulty gathering information themselves.



Madyson Larson
Xenia High School in Xenia, Ohio; now attending the University of Cincinnati
Chemistry

After she discovered a passion for chemistry, Larson's grandfather expanded her STEM horizons when he introduced her to geospatial intelligence. After many lessons and research, Larson was delighted to realize she could combine her love for chemistry with GEOINT. She is interested in using her chemistry studies in support of GEOINT in areas such as environmental issues and characterizing nuclear weapons.



Christopher Lee
Dripping Springs High School in Dripping Springs, Texas; now attending the University of Texas at Dallas
Computational and Applied Mathematics

Lee learned about the influence geospatial sciences have in the real world through his AP Human Geography class, which depended heavily on the use of rendered GIS data. He dreams of developing a scalable, efficient method to create a 3D reconstruction of the world by combining existing geophysics and geospatial analysis techniques with computer vision and machine learning.



Keelin O'Hara
Albermarle High School in Charlottesville, Va.; now attending the University of Maryland Washington
Geography

O'Hara studied GIS in high school through a dual enrollment program with James Madison University. Two of her final projects included an analysis on the effects of climate change on coral reefs, and observing urbanization using land classification data. O'Hara plans to focus her studies on either human or environmental geography and to pursue a GIS certificate.



Adam Wallace Potter
Oak Park River Forest High School in River Forest, Ill.; now attending Massachusetts Institute of Technology
Mechanical Engineering

In addition to mechanical engineering, Potter plans to minor in computer science. In high school he developed skills that can be applied to rovers, satellites, and large-scale data analysis through his work with his school's VEX Robotics team and through personal projects involving computer vision and robotics.



Brandon Staple
Longmont High School in Longmont, Colo.; now attending the University of Colorado Denver
Computer Science

Staple's computer science interest is in deep machine learning networks. He has interned at Google and the National Security Agency. His goal is to employ advanced artificial intelligence techniques to enhance the collaboration between analysts and computer systems.



Maxwell Thorpe
David H. Hickman High School in Columbia, Mo.; now attending the University of Wisconsin-Madison
Cartography

Thorpe is interested in digital analysis and data management. He enjoys working with numbers, charts, and maps to present data in a clear manner. Thorpe has completed an internship with the Center for Geospatial Intelligence at the University of Missouri, is currently working for the Boone County Assessor as a GIS intern, and also completed an independent study project involving GIS.

To date USGIF has awarded more than **\$1.2 million** in scholarships.

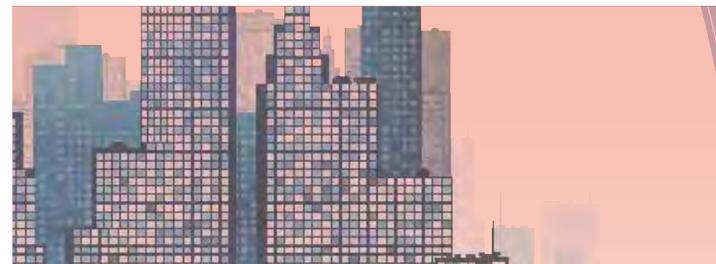




IMAGE COURTESY OF JACOBS

Jacobs: Embracing the Digital Revolution

Q&A with Darren Kraabel, senior vice president of mission systems

Q Why did Jacobs elect to become a USGIF Strategic Partner in 2018?

Jacobs has long utilized GIS data and technologies to enhance intelligence operations for our clients. We decided to become a USGIF Strategic Partner due to the importance of GIS solutions in the digital revolution we are experiencing in every industry Jacobs serves. As a global company providing solutions across oil and gas, transportation, buildings and infrastructure, pharmaceuticals, mining, construction, and other industries, we help clients unlock new value with smart technology solutions that increase productivity, improve reliability and availability, extend service life, and enhance safety and sustainability. We're doing this through our Jacobs Connected

Enterprise (JCE) solutions strategy. And GIS technologies and data analytics are at the core of many JCE solutions.

Q What is Jacobs' role in this "digital revolution?"

We deliver transformative solutions for diverse clients, combining industry experience and technology-agnostic digital savvy to unlock big data analytics, predictive operating intelligence, and security insights for a more connected, sustainable world. As with every industrial revolution in the past, market leaders today face a choice: to embrace the revolution and be a disrupter in their industry or ignore the revolution and wait to be disrupted. Market leaders who choose the latter will inevitably be pushed out of the marketplace. Many of the industries

we serve are risk averse and are slow to adopt new technologies. Yet our clients recognize they must harness the power of digital technologies to avoid being disrupted. We're helping them understand and deploy digital technologies that are mature enough to be implemented without introducing unacceptable risk to their operations.

Q What kind of GIS solutions does Jacobs offer?

In many cases, our clients simply want to know where their assets are located so they can optimize



Darren Kraabel

“Market leaders who choose [to ignore the digital revolution] will inevitably be pushed out of the marketplace. Our clients recognize they must harness the power of digital technologies to avoid being disrupted.”

— DARREN KRAABEL, JACOBS

their operations. This is particularly true in the construction industry where we are tagging and tracking people, equipment, and materials to optimize productivity and reduce project risk. In other cases, our clients are leveraging geo-tagged asset management solutions to reduce the cost of ownership of their heavy process and manufacturing facilities. Our infrastructure clients are considering cities of the future and intelligent transportation networks. And our petrochemical clients are seeking to analyze large GIS data sets to optimize production processes and enhance capital expenditure investment decisions. These types of solutions are pretty novel in industries like construction. Bringing those technologies to bear shows our clients how to do things in new ways, and they love it.

Q Can you share more about Jacobs Connected Enterprise (JCE)?

It's important to note that JCE is not a specific product or platform. JCE is our answer to the Industrial Internet of Things (IIoT). It's the way we harness the power of digital technologies to solve global challenges in every industry we serve, and then deliver those solutions as a systems integrator. JCE solutions incorporate digital technologies to collect data from a wide variety of sensors or sources, move that data across a network to a central repository where it can be analyzed to derive insight, and protect the data and the infrastructure that is now network-connected. We refer to that as: “Connect to Collect, Analyze, and Protect.” While there is often a hardware component

to our JCE solutions, the real value is derived from the data analytics.

Q How has Jacobs transformed internally to help clients embrace the digital revolution?

Jacobs has spent the past few years transforming our culture to change the way we think about our role in helping clients improve their performance. If we're telling clients to use particular GIS tagging and tracking tools, then when we're doing construction projects ourselves, we need to be using those tools. We've also shifted our mindset from being a services company toward being a solutions company. That may sound like a subtle change, but it has had a profound impact on how we serve our clients. It changes the way we look at our talent. Perhaps most importantly, it changes the way our clients value Jacobs as their partner.

Q How has this transformation changed the way you hire new geospatial talent?

Perhaps the most fundamental change has been our focus on attracting, developing, and retaining data analytics talent. Where Jacobs may have historically focused on finding the best engineering and project delivery personnel, we are now equally focused on finding people who can analyze data. And GIS data analysts are at the forefront of that focus. We need people who can analyze data in the context of the problems our clients face. We need analysts who understand the transportation industry and the petrochemical industry and the pharmaceutical industry. It goes back to the fundamental differentiator for Jacobs: We are blending digital technology expertise with industry domain expertise to collect and analyze data faster and in the right context.

NT Concepts: Innovation and Expertise

Q&A with Gavin Greene, vice president of business development

Q How would you describe the company culture at NT Concepts?

We are committed to using innovation

and expertise to help our national security clients solve their most critical challenges. Every employee operates with a mission-first mentality. For us, it's about moving the needle for our clients. We do what's right for today's mission and ensure our customers are ready for the challenges and opportunities ahead. NT Concepts is celebrating its 20th anniversary this year. We are incredibly proud of our shared success—it is a testament to the hard work of our leadership and employees, our history of delivery performance, and the strength of our customer relationships.

Q Who are your primary customers, and what are their most significant challenges?

Our largest customer is the National Background Investigation Bureau (NBIB), where we provide support services for more than 2 million background investigations each year. We work with the National Geospatial-Intelligence Agency (NGA) on several critical multi-INT visualization programs. We have prime contracts delivering enterprise IT and advanced analytics for multiple defense and intelligence agencies including prime AI/ML contracts. Each customer brings unique mission challenges, yet they all share the same underlying problems: data volume, legacy technology, and security.

We have a methodology called Marketplace Next focused on bringing commercial technologies to the federal government. There are four stages:

- **Explore:** We relentlessly pursue best-fit commercial tech.
- **Examine:** We measure return on investment and find the risk-versus-reward for potential deployment of the technology.
- **Exchange:** We do continuous collaboration to ensure mission fit.
- **Accelerate:** We “excel at accelerating” time to operational status for the government.

Q What advice do you have for companies looking to land their first contract with the federal government?

First, establish who you are and where you want to play. The magnitude of selling to the



Gavin Greene

IMAGE COURTESY OF NT CONCEPTS



“You need to understand the government’s playbook: the policies, regulations, and authorizations that must be checked off to successfully deliver. It’s important to develop relationships with trusted government contractors such as NT Concepts.”

— GAVIN GREENE, NT CONCEPTS

biggest buyers in the world can quickly overwhelm. Do your market research and target the agencies whose missions align with your business strategy. More importantly, get out there and get involved. Build networks. Join organizations such as USGIF, AFCEA, or other transaction authority consortiums.

Getting into the government space can be challenging. You need to understand the government’s playbook: the policies, regulations, and authorizations that must be checked off to successfully deliver. It’s important to develop relationships with trusted government contractors such as NT Concepts, who have the clearances, integration expertise, and ability to scale technology to meet their needs.

Q How do you stay sharp across a broad suite of offerings?

We constantly challenge each other to think bigger, answer client needs, and stand in the future. We go that extra mile to deliver solutions others can’t. For example, we’re a premier partner to the largest commercially-available GEOINT data providers in the world. Recently, we delivered a visualization solution that provides access to terabytes of data from a well-known technology that our client could not access before—now they can enhance their data and gain new insights.

For the Defense Information Systems Agency, we’re building a first-of-its-kind prototype for an enterprise case management system for background investigations. Because of our NBIB support, we are uniquely qualified to develop this system. We understand the complexities of a wide range of missions, and we know what is required to speed up security clearance processing times, bring down backlog, and scale to meet future mission needs.

Q How are you incorporating artificial intelligence into your solutions?

For the Intelligence Community, we’re standing up solutions for object detection, identification, and motion tracking in imagery and video. For complex data sets, we build custom jobs for data preparation, training,

and inference. We use AI with sensor and Internet of Things data to help automate onboard prognostics and improve efficiency of logistics pipelines. We recently won a prime contract integrating AI for a large, commercial systems integrator, which will provide better performance for their multibillion-dollar platform. This is just the start. As the technology evolves, so will our expertise.

Q What excites NT Concepts most about the future of GEOINT?

GEOINT analysts today have a more data-driven view of the world than ever before, and “pattern of life” has become a key condition. However, machine learning has yet to become a foundational methodology for GEOINT. We believe that is about to change. We have seen NGA and the military express interest in employing machine learning to advance their capabilities, fund technology demonstrators, and even develop training datasets. We are excited to be part of this revolution.

Individual Member Spotlight: Endless Opportunities

Spatial Networks’ Director of Strategic Alliances and Partnerships Amy Aylor on nonlinear career paths, the pace of government, and the future of data analysis

Amy Aylor entered the GEOINT profession through roles at Lockheed Martin supporting contract work for the National Reconnaissance Office (NRO) and the National Geospatial-Intelligence Agency (NGA). In 2007, Aylor moved to the federal government



Amy Aylor



IMAGE COURTESY OF SPATIAL NETWORKS

as a program management officer at NGA. After eight years at NGA and two with the Office of the Director of National Intelligence (ODNI), she sought another change. This time, Aylor wanted to work with a smaller organization. In March, she began her new role as director of strategic alliances and partnerships at Spatial Networks, a GEOINT company based in St. Petersburg, Fla.

Q What is your advice for aspiring GEOINT professionals?

The opportunities are endless. If something is a passion of yours, follow the passion because you never know where it's going to lead. I never knew what was out there until I gave myself the opportunity to try something different. It requires stepping outside your comfort zone. Being here at Spatial Networks is totally different for me. At larger organizations there's a sense of security. [GEOINT] is bigger than most people realize.

Q What lessons can you share with regard to working for the federal government?

On the industry side, we often don't understand there are mandated processes and procedures the government has to follow. We're used to doing things fast, fast, fast. The government just doesn't work this way. There are approval processes and stages that must be followed to turn ideas into reality. In industry, we have great ideas. We're brought on board to be innovative and to think outside of the box, but there's a certain sequence of events we often have to abide by to get us and our customers to the end goal.

Q In seeking out and managing commercial partnerships, what GEOINT technology have you seen to be most in demand throughout 2018?

There is definitely a large demand for signal analytics, machine learning, and automated or assisted intelligence.

With the advent of big data, many users of data in and out of government are looking for technologies to help extract knowledge without needing to add analysts. One concern I have is that organizations may forget that they still need to have diverse types of data to efficiently apply AI and ML tools.

Q How has USGIF membership helped your career development?

I've attended several USGIF GEOINT Symposia and GEOINteraction Tuesday events. Hearing what else is out there gives me the opportunity to look at other small businesses and to see all the cool stuff they're doing. In the thick of it at NGA, I was often dealing with the large systems integrators, not the small businesses. Going to USGIF gatherings, you see there's so much talent in so many other places. I wouldn't have realized there was a place [in the GEOINT Community] for a company like Spatial Networks otherwise. It gives you a diversity of thought to have a variety of organizations in the room. 🌐

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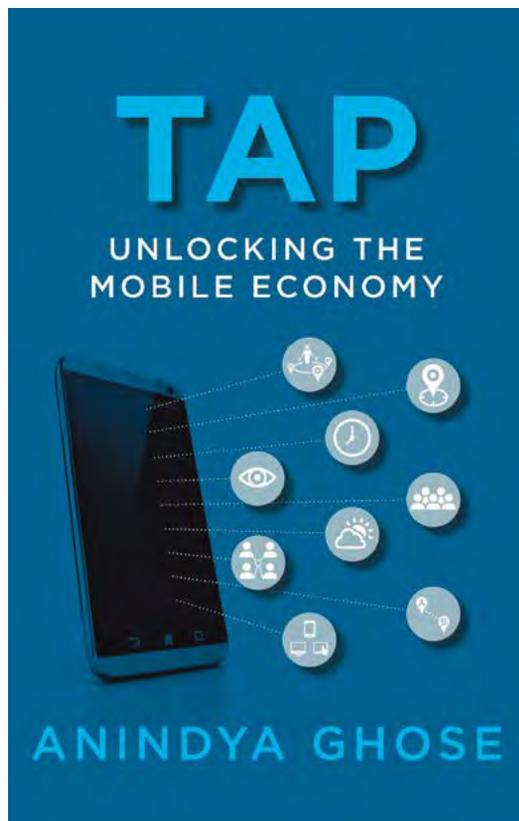
- AI and machine learning
- Collection and constellation planning
- Remote sensing and OPIR
- Optics and photonics
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Tap: Unlocking the Mobile Economy

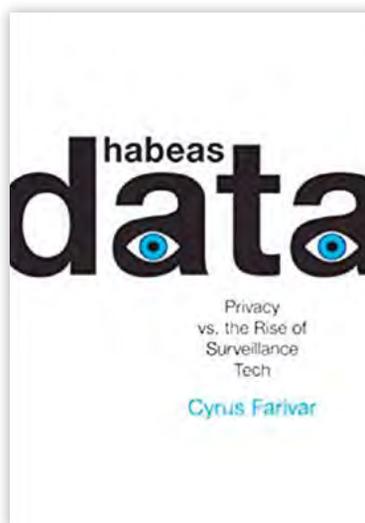
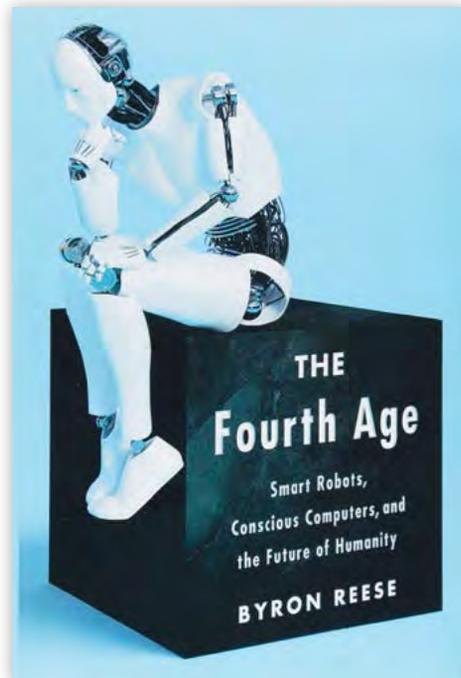
By Anindya Ghose

The mobile economy is valued at more than \$3 trillion, and in the age of artificial intelligence and the Internet of Things, that number will surely rise. *Tap* is a comprehensive analysis of the economic and behavioral factors that influence consumer behavior, such as time, crowd size, and weather, and how companies can use mobile data to improve the consumer experience based on those factors. From this perspective, the smartphone isn't a conduit for surveillance, but a personal concierge that allows businesses to better serve customers.

The Fourth Age: Smart Robots, Conscious Computers, and the Future of Humanity

By Byron Reese

The Fourth Age argues that technology has reshaped life on Earth three times in the past. First, fire led to language. Then, 90,000 years later, agriculture led to cities and war. Finally, the invention of the wheel combined with the development of written language led to the nation-state: the backbone of global society and economy. Reese, CEO of research publication at Gigaom, posits artificial intelligence and robotics represent an equally transformative shift for humanity. His analysis is more philosophical than technological, addressing questions of reality, humanity, and the mind.



Habeas Data: Privacy vs. the Rise of Surveillance Tech

By Cyrus Farivar

This text, written by *Ars Technica's* senior tech policy reporter, explores 10 historic court decisions that shape current privacy legislation in the U.S. with regard to the extensive capabilities of modern digital technology. The juxtaposition reveals a dizzying gap of loopholes that organizations lean on to collect intimate information about specific individuals, from banking data to online whereabouts to personal messages. What does history tell us about the future of digital privacy?

USGIF EVENTS CALENDAR

NOVEMBER 10-16

GEOINT Community Week
Northern Virginia

NOVEMBER 17

GEOGala
McLean, Va.

JANUARY 7

GEOINT Community Job Fair
Fairfax, Va.

JUNE 2-5

GEOINT 2019 Symposium
San Antonio, Texas

USGIF announced the addition of **AL DI LEONARDO** and **PATTY MIMS** to the Foundation's Board of Directors. Di Leonardo is an experienced intelligence and special operations officer, and Mims is currently director of Global National Government at Esri.

Northrop Grumman Chairman and CEO **WES BUSH** announced he will step down as CEO effective Jan. 1, 2019. The firm's board of directors has chosen **KATHY WARDEN**, president and COO, to succeed him.

Planet appointed **NATHAN DICKERMAN**, former VP of worldwide sales & operations at AppDirect, as the company's new chief commercial officer.

STACEY DIXON, deputy director at IARPA was appointed to succeed **JASON MATHENY** as the agency's new director.

Maxar's DigitalGlobe hired **MIKE EDWARDS**, a former executive at Northrop Grumman, as vice president and senior adviser for defense programs.

Octo Consulting announced the hires of **SIMON GODWIN** as VP of federal civilian programs and **CRAIG SUMMERS** as VP focusing on commerce accounts.

OGSystems announced the promotion of **AARISH GOKALDAS** and **LORINDA AYLING** to chief growth officer and chief services officer, respectively.

The board of directors of General Dynamics elected **CHRISTOPHER MARZILLI** executive vice president of the company's Information Technology and Mission Systems segments, effective Jan. 1, 2019. Marzilli will succeed **S. DANIEL JOHNSON**, who plans to retire at the end of this calendar year.

Continental Mapping Consultants hired former NGA Senior Executive **CHUCK MCGAUGH** as senior director for its defense & intelligence sector.

Spatial Networks announced the addition of **BRIAN MONHEISER** as executive vice president for government solutions—global, responsible for delivering Spatial Networks' products to the U.S. government, NATO, the United Nations, and beyond.

Maxar Technologies appointed **BIGGS PORTER** executive vice president and chief financial officer.

Maxar's MDA named **MICHAEL RACK** president of its newly created commercial division. He'll oversee operations and growth for all commercial product lines.

Accenture selected **BRYAN RICH**, former senior vice president of analytics strategy at Novetta Solutions, as the new managing director of analytics and artificial intelligence solutions for the company's federal services arm.



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- On-premises, cloud, and scalable deployments available
- Support for 1 cm image and 7.5 cm digital surface models, refreshed daily

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perspective

LEADING HOLISTIC GIS EDUCATION

Dr. May Yuan of UT Dallas on research, innovation, and the future of GIS

Dr. May Yuan is the Ashbel Smith Professor of Geospatial Information Sciences in the School of Economic, Political, and Policy Sciences at the University of Texas (UT) at Dallas as well as a member of USGIF's Academic Committee.

Q Your CV includes many diverse research areas. What are some highlights?

GIS is a great platform not just for looking at the natural processes and human activities but also the societal impact. That's why I've had opportunities to look at a wide range of topics, from wildfires to severe weather to patterns of life. The core of my research aims at innovations in methodology—how to think through spatial problems and how to look at spatiotemporal behaviors and interactions of different elements across human and ecological systems. My research group assesses current environments, analyzes relationship, interaction, risk, and impact in space and time, and predicts future scenarios. We seek novel ways to enrich GIS methodology from concepts across disciplines. For example, I collaborated with the Naval Research Laboratory for a project funded by the Department of Homeland Security on spatial risk prediction of suicide bombings applying concepts from ecological species prediction models.

Q What are you researching now?

I'm working to identify the site and situational characteristics of places most likely to have traffic accidents by time of day and day of the week using a machine learning approach. We segment the street and cut every 100 meters, then for every 100 meters cut to every hour. And based on two years of traffic accident data from 2015 to 2016 in the city of Dallas, we analyze that the risk for individual space-time units. We apply the concept of "near-repeat" from criminology to seek cascading effects of traffic accidents in which a preceding accident within an hour and 200 meters might contribute to subsequent traffic accidents. Using machine learning we estimate what the spatial risk will be for a given street segment on a certain day of the week at a given hour.

The purpose is to come up with better routing decisions for emergency vehicles to ensure they can reach the destination safely and avoid accidents that will further delay their arrival. In the long run this could also be used for other purposes. Nowadays so many people use Google or Waze to find



Dr. May Yuan after a Vapor 55 drone survey using a PhaseOne iXU 150 camera to develop a high-resolution 3D model of Fort Martin Scott in Fredericksburg, Texas.

the shortest, fastest, or most scenic route. With spatial risk modeling in place, one could also request the safest route.

In addition to the traffic risk project, my group is using our campus as a laboratory for smart city research. We are building a comprehensive 3D model of our campus with detailed data on building interior structure, use, and capacity. We are developing algorithms and apps for indoor-outdoor navigation, location-based services for events and parking, and ground-level air quality modeling.

Q What are your thoughts on the future of GIS?

GIS is far beyond a system perspective now. It encompasses multiple sources and platforms to seek computational advances in transforming geospatial data to produce knowledge of our world and intelligence to inform decisions. From an education perspective, we need to incorporate more spatial thinking, quantitative and computational methods, and geographic knowledge epistemology into GIS learning. We shouldn't focus on teaching students how to use a particular software. We should help students think through spatial problems and

know how to develop algorithms and solutions to solve problems. This is quite different from a lot of the current GIS curricula that focus on point-and-click exercises.

Q How do organizations like USGIF contribute to the profession?

In my role on USGIF's Academic Committee, we aim to assist with the accreditation review process and to help enrich the GEOINT curriculum. I hope that through the committee's efforts we will help a lot of USGIF-accredited programs further enhance their strengths and also improve learning elements that might be lacking. Members of the Academic Committee have played key roles in the development of the GEOINT Essential Body of Knowledge, GEOINT professional certification, and GEOINT education discussions. Many alumni from our member institutions work at various government agencies and in industry. USGIF is a key driver for GEOINT workforce development. 🌐

Visit trajectorymagazine.com/perspective to read an extended version of this interview.



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- Sponsors STEM events and judges science fairs
- Develops and delivers geospatial learning materials
- And much more

The United States Geospatial Intelligence Foundation (USGIF) is a 501(c)(3) nonprofit educational foundation dedicated to promoting the geospatial intelligence tradecraft and developing a stronger GEOINT Community with government, industry, academia, professional organizations, and individuals.



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“You can’t hit what you can’t see.”

- Muhammad Ali

This is especially true in critical infrastructure protection and urban security initiatives. Over the past two years, we have acquired the best aerial survey firms, uniting the most experienced airborne mapping professionals in the nation under the Geomni brand. Our hubs operate a comprehensive selection of the latest Oblique aerial cameras, sensors and LiDAR scanners. In addition to drones, we own over 100 manned fixed-wing aircraft enabling deployment to any site in the USA, within hours, to acquire your customized data. Even more important, our massive cloud-based library of high-resolution imagery is available through our easy to use web App, API or our ArcGIS plug-in. Let us help you complete your mission of protection and security.



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