

# trajectory

THE OFFICIAL MAGAZINE OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

## the sky's *the limit*

From agriculture and energy to construction and communications, airborne imagery is taking off in myriad industries—and lifting GEOINT to new heights.

- Humanitarian Aid in Mozambique
- GEOINT 2019 Symposium Highlights
- Q&A with Esri's Patty Mims





**SAVE THE DATE**

# **Geospatial Gateway Forum Oct. 7-9 · St. Louis**



**Geospatial Gateway Forum (formerly Tech Showcase West) is a multi-day event offering the unique opportunity to see the innovative work happening in the St. Louis region.**

**The event will feature a career fair, young professionals event, networking reception, classified and unclassified workshops, and a K-12 STEM event.**

**[usgif.org](http://usgif.org)**

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2019 ISSUE 3



IMAGE COURTESY OF NEARMAP

An aerial view of Facebook headquarters in June.

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Captured with a Leica Geosystems airborne sensor, this image of the Port of Los Angeles is available in the HxGN Content Program, a cloud platform for high-quality orthorectified aerial imagery. Image courtesy of Hexagon Geosystems

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### GOT GEOINT?

Check out our latest blog posts on topics such as ethical GEOINT, quantum computing policy, and more.

# An Ever-Strengthening Community



Young professionals gather to listen to a panel discussion on “Advancing Your Career in Technology” at the YPG Lounge in the GEOINT 2019 Exhibit Hall.

From left to right, Army Staff Sergeant Aljune Lerio, Katie McGaughey, and Ben Foster participate in a special opening presentation at GEOINT 2019.



**WATCHING THE BUILDING** of a community around ever-advancing tradecraft is one of the many joys of being involved with USGIF programs. The Foundation’s annual gathering at the GEOINT Symposium reaffirms many of the important characteristics of our community and reveals many hidden strengths.

The YPG (Young Professionals Group) Lounge at the Symposium is one such strength. The exhibit floor has many competing demands for attention and requires participants to allocate their time wisely. The late-afternoon YPG mentoring sessions are always a highlight for me. Geospatial practitioners gather to discuss the issues of the day and create a dialogue in which the mentors serve as facilitators for the rich content that is continuously teed up by the participants. One such session at GEOINT 2019 was conducted without a microphone; young professionals gathered in a tight circle, intently discussing world politics and ideas as to how GEOINT mission contributions could help mitigate global challenges in this geopolitically unsettling time.

A conversation led by “digital natives” during the GEOINT 2019 general session reaffirmed that the incoming generation of geospatial practitioners will not suffer unnecessary bureaucratic peccadillos and are willing to exhibit leadership—both technical and programmatic—to achieve superior mission outcomes. The speed of technology coupled with the ingenuity and innovation of journeyman experts is essential to our community. I am encouraged to know that Ben Foster, Army Staff Sergeant Aljune Lerio, and Katie McGaughey are advancing the tradecraft.

In the GEOINT 2019 exhibit hall, the Innovation Corner offered “speed-geeking” in the form of mission-focused lightning talks. I benefitted from witnessing the passion with which Liz Lyon (@geographerliz) advances the importance of human geography with her team. Liz’s impressive social media following is yet another measure of our community’s strength.

The Honorable Sue Gordon, PDDNI, had lunch with an exceptional cohort at GEOINT 2019—the 30 USGIF Young Professional Golden Ticket winners. Sue’s ability to simultaneously teach, mentor, and instill passion has earned her a reputation as a superstar leader that is richly deserved. Her ability to foster group collaboration around the tabled topics and then to evaluate the discussion was described by one participant as “magical.” Watching NGA Director Vice Adm. Robert Sharp deftly



Liz Lyon, NGA



At left, PDDNI Sue Gordon. Below, NGA Director Vice Adm. Robert Sharp speaks with GEOINT 2019 Golden Ticket Winners.



handle sharp-edged inquiries from Golden Ticket winners also nicely reflected our community's passion to share and mentor while challenging and encouraging.

The K-12 generation of potential geospatial practitioners visited GEOINT 2019 and engaged with YPG leaders and USGIF's Portable Planet map of North America. One San Antonio area Boy Scout in a group led by Golden Ticket guide Caitlin Marsh of Ball Aerospace visited the National Reconnaissance Office (NRO) booth. While explaining the HEXAGON film return process, an NRO employee asked the Scout how fast a satellite moves on orbit. Without hesitation, the scout replied, "17,000 miles per hour." The group was blown away as the Scout's proud mother looked on, reported Caitlin.

And, at this year's Symposium, GEOINTers donated \$5,775 to fund the shipment of USGIF's Portable Planet map of North America and corresponding learning materials to

schools throughout the country. This year's event was a true representation of GEOINTers giving of their time, talent, and treasure to build a Community that reflects the values of its members.

Nicely done and thank you to all! See you this fall at one of our many exciting events, to include the GEOINTegration Summit, Geospatial Gateway Forum, and GEOINT Community Week.

**THE HONORABLE JEFFREY K. HARRIS**  
CHAIRMAN, USGIF BOARD OF DIRECTORS



*GEOINT 2019 Golden Ticket winners lead San Antonio Boy Scouts in geography activities at GEOINT 2019.*

# trajectory

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# INTsider

COMMUNITY NEWS,  
EVENTS, AND EDUCATION

 GEOINT 2019

 USGIF NEWS  
 EDUCATION  
 APPLICATIONS

## GEOINT 2019 Symposium Highlights

“In under two years, Maven has made steady progress as a pathfinder for AI/ML.”

—KARI BINGEN, DOD



Kari Bingen, DoD



Brig. Gen. Mark Easley, U.S. Army

“Underpinning conflict at its very core is GEOINT.”

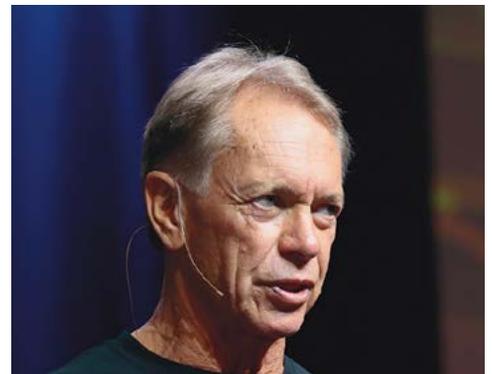
— BRIG. GEN. MARK EASLEY, U.S. ARMY

“We’re all trying to acquire and interpret a diverse range of data, we’re integrating the data into simulations that can optimize the results, and then we’re presenting that in an easy-to-digest fashion, so that many different groups can feed off of that information.”

—CHRIS EDWARDS, THE THIRD FLOOR



Chris Edwards, The Third Floor



Bo Ewald, ColdQuanta, Inc.

“To borrow from Winston Churchill, ‘We’re coming to the end of the beginning’ of quantum computing. It’s really an exciting time in the field.”

—BO EWALD, COLDQUANTA, INC.

“This is the new issue for CIOs in our role: We need to be thinking ahead of our own agency about how technology trends in industry will disrupt the agency’s operations in the future.”

—JULIANE GALLINA, CIA



Juliane Gallina, CIA



William Hurley, Strangeworks, Inc.



Sue Gordon, PDDNI

“Quantum computing is a trip to Mars to save the species, not a trip to Vegas for the weekend, OK?”

—WILLIAM HURLEY,  
STRANGWORKS, INC.

“Each of these problems I posed has a GEOINT component, but none can be solved by GEOINT.”

—SUE GORDON, PDDNI



Jeff Johnson, Western Fire Chiefs Association



Lyda Krewson, St. Louis Mayor

“From the minute this fire started, around 6:30 in the morning, this fire traveled 6.3 miles in less than an hour and a half.”

—JEFF JOHNSON, WESTERN FIRE CHIEFS ASSOCIATION

“I’m proud to say that St. Louis is the nation’s center for geospatial excellence.”

—ST. LOUIS MAYOR LYDA KREWSON

“We’re reaching out to even the K-through-12 schools in programs like GenCyber, focusing on STEM development.”

—DAVID LUBER, USCYBERCOM



David Luber, USCYBERCOM



Katie McGaughey, USDA Foreign Agricultural Service

“Leveraging technology allows us to more accurately report on global agricultural food production, which is important because food security is a key component to national security.”

—KATIE MCGAUGHEY, USDA FOREIGN AGRICULTURAL SERVICE

“These are the kinds of things you have to think about ahead of time when you’re defining metrics by which you’re going to improve and optimize your algorithms.”

—DR. LISA PORTER, DoD



Dr. Lisa Porter, DoD



Vice Adm. Robert Sharp, NGA

“Our goal is to partner with machines so that we can make best use of the exponential growth in volume and source of data, letting machines do what machines do well and analysts do what analysts do even better—think critically and solve problems.”

—VICE ADM. ROBERT SHARP, NGA



Jeffrey R. Smith, NASA

“Whatever you can do to eliminate false positives early on in your pipeline, the more efficient you’re going to be.”

—JEFFREY R. SMITH, NASA



**Complete GEOINT 2019 Coverage**

With so many speakers, presentations, and exhibitors, it would have been impossible to see everything at GEOINT 2019. *The GEOINT Symposium Show Daily* by *trajectory* provided wall-to-wall coverage. Visit [trajectorymagazine.com/geoint-symposium](http://trajectorymagazine.com/geoint-symposium) for keynote recaps, videos, exhibitor profiles, features, panel discussion overviews, and much more!

**PROCRASTINATION TOOLS**

**Star Walk 2**

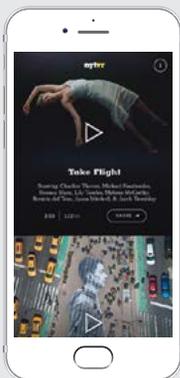
The creators of the popular stargazing app, Star Walk, recently unveiled Star Walk 2. The app taps into your device's GPS functionality to determine the exact position in relation to your location of celestial events and objects such as stars, planets, meteor showers, constellations, comets, and more. Explore the night sky while enjoying new features like "Visible Tonight" and "What's New." With "Visible Tonight," receive notifications on upcoming astronomical events and celestial object visibility. With "What's New," learn about historical and current celestial events.



**Available on iOS, Google Play, and Windows 10**

**New York Times VR**

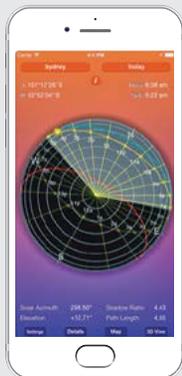
From climbing the spire of the World Trade Center to setting foot on Mars, *New York Times* VR immerses you in the story using 360-degree video technology. Explore the full library of immersive video experiences from around the world (and beyond) captured by *New York Times* journalists.



**Available on iOS, Google Play, and Samsung Gear VR**

**Sun Seeker**

With the Sun Seeker solar tracking and compass app, you can view the sun's hourly direction intervals, winter and summer solstice paths, sunrise/sunset times, golden hour lighting windows, and more. The app uses GPS sensors, a magnetometer, and a gyroscope to predict accurate solar positions and paths. Add "sun event" notifications and receive solar data every day. Sun Seeker comes with both a 2D compass view as well as a 3D augmented reality view.



**Available on iOS and Google Play**



*Tara Bradburn discussed NGA's first exploratory sprint to operationalize its Artificial Intelligence, Automation, and Augmentation (AAA) capabilities.*

**GEOINTERACTION**

**NGA's Tara Bradburn on the Agency's AAA initiative**

The National Geospatial-Intelligence Agency (NGA) is undergoing both a cultural and technological transformation according to Tara Bradburn, senior lead for the agency's Artificial Intelligence, Automation, and Augmentation (AAA) initiative.

Bradburn spoke May 14 at USGIF's GEOINTERaction Tuesday event in Tysons, Va., sponsored by Thinklogical, and discussed NGA's first exploratory sprint to operationalize AAA capabilities.

"Analysts must be front and center in the modernization process," Bradburn said.

The first AAA operational sprint took place in 2018 and was primarily about empowering people, with technology as the enabler. According to Bradburn, NGA called upon experienced analysts to lead the sprint. With support from technical experts, the analysts worked for six months to meet operational objectives to automate NGA's end-to-end mission—including collection, processing, analysis, reporting, and data management.

This first operational sprint yielded many valuable lessons learned. "NGA affirmed that it needs a AAA ecosystem or framework to support these new capabilities," Bradburn said. "And we now have a better understanding of the investment required to create that ecosystem."

One of the most significant lessons learned was that data must be machine readable as a prerequisite for AAA. Though conditioning and centrally storing historical data was a sprint success, Bradburn also described it as a "wake-up call."

"Our data scientists and analysts spent large amounts of manpower resources getting the mission data ready for automation," she said. "That's not sustainable from a scalability standpoint. We need a scalable solution for standard data capture, centralized storage, and access in order to apply advanced analytics and automated reporting at scale."

## EVENTS

## USGIF Opens Trajectory Event Center

In July, USGIF opened its own state-of-the-art event space, known as the Trajectory Event Center (TEC), in Herndon, Va. The TEC will be a year-round resource for the GEOINT Community and beyond.

Featuring flexible meeting spaces for up to 300 people, cutting-edge audio-visual technology, and live streaming capabilities, the TEC is an ideal location to host corporate events, training sessions, sales meetings, product launches, receptions, table-top exhibits, hack-a-thons, and much more.

“Whether it is our Young Professionals Group looking to combine networking and professional education, or providing a flexible space to accommodate the cadences of USGIF working groups, we recognized the potential for the TEC to help USGIF advance our community,” said The



Honorable Jeffrey K. Harris, chairman of USGIF’s Board of Directors. “Extending our ability to leverage diverse opinions in a collaborative environment is a best practice where we can intensify the cycle of learning and adapting to help GEOINT organizations evolve.”

The TEC is in proximity to Dulles International Airport and a four-minute walk from the planned Herndon Metro stop on the silver line. Ample complimentary parking is also available.



Visit [tecdulles.com](http://tecdulles.com) to learn more about the Trajectory Event Center. For pricing and availability, contact [info@tecdulles.com](mailto:info@tecdulles.com).

## DATA SCIENCE

## USGIF Announces New Scholarship in Partnership with Dun & Bradstreet

USGIF announced during its Board of Directors meeting at GEOINT 2019 that it has partnered with Dun & Bradstreet to offer a new academic scholarship.

The Dun & Bradstreet Geospatial Data Science Scholarship will award \$15,000 to a graduate student pursuing a Master of Science or Ph.D. in data science who is focused on solving data-intensive, large-scale, location-based problems using engineering, computer science, math, and/or spatial science.



“Dun & Bradstreet is pleased to work with USGIF to support emerging talent in a field that is crucial in the data science landscape,” said Tim Solms, Dun & Bradstreet’s General Manager, Government Services. “This scholarship will help the geospatial industry grow as it works to address and solve important national security challenges.”

The recipient of the Dun & Bradstreet Geospatial Data Science Scholarship must be enrolled in any full-time graduate program and be in good academic standing. His or her expertise should include geospatial data accessibility, spatial decision support systems, and geospatial problem-solving. The student’s academic pursuits should demonstrate understanding of how AI, machine learning, and data mining can be used to augment GIS workflows and provide solutions.



Advancing Technology  
& Driving Innovation for the  
Intelligence Community

**RADIANCE**  
TECHNOLOGIES



The Honorable Jeffrey K. Harris (left), chairman of the USGIF Board of Directors, and Stu Shea (right) present the \$15,000 Stu Shea scholarship to Clark University Ph.D. student Jaclyn Guz along with the USGIF Board of Directors.

 SCHOLARSHIPS

## Clark University's Jaclyn Guz Awarded Stu Shea Endowed Scholarship

Jaclyn Guz was recognized at GEOINT 2019 as the recipient of the Stu Shea USGIF Endowed Scholarship. Guz is a student at Clark University in Worcester, Mass., pursuing her Ph.D. in geography.

The scholarship honors K. Stuart Shea, one of the founders of USGIF and the first chief executive and chairman of the organization. The \$15,000 scholarship is awarded annually to one Ph.D. student studying cartography, geography, or imaging science.

"I am very happy to be the recipient of the Stu Shea Endowed Scholarship," Guz said. "This scholarship enables me to better conduct my research by allowing flexibility and freedom to explore questions and methods that were not previously feasible. Additionally, it opens networking opportunities and the ability to interact and collaborate with experts in my field."

Guz earned her bachelor's degree in environmental science from Texas A&M University in 2016. In the first year of her Ph.D. program, she completed a research project in Colorado and Wyoming that quantified how post-fire regeneration density has decreased throughout the past century. The project was partially funded by a USGIF Scholarship she was awarded in 2018.

Two internships at Esri helped Guz develop skills in machine learning and big data that she applied during her Ph.D. research. Outside of school, Guz volunteers with the Worcester chapter of Girls Inc., a nationwide nonprofit that helps young girls gain life skills, specifically through its Eureka! STEM and Leadership Program.

 CERTIFICATION

## USGIF Workforce and Certification Development Initiative



USGIF recently introduced a Workforce and Certification Development Initiative, offering organizations the opportunity to train and/or certify their workforces through the Foundation's Professional Certification Program at discounted rates.

GEOINT professionals can be certified in one or more of the areas identified in USGIF's GEOINT Essential Body of Knowledge (EBK), to include GIS & Analysis Tools, Remote Sensing & Imagery Analysis, and Geospatial Data Management.

In February, USGIF published version 2.0 of its EBK to provide background information and context as well as to outline standards for the broad practice of GEOINT. Because the GEOINT EBK is at the heart of USGIF's efforts to professionalize the global GEOINT workforce, the Foundation also invested in matching its training and professional certification exams, so all reflect the appropriate knowledge and competencies.

"While the EBK sets the expectations for recent college graduates and working professionals at different stages of their careers, the Workforce and Certification Development Initiative aims to help our community meet those expectations," said USGIF Vice President of Academic Affairs Dr. Camelia Kantor. "We hope to accomplish that by supporting GEOINT continuing education coupled with our certification exams. We developed Boot Camps designed to provide hybrid learning and practice opportunities for individuals seeking to refresh and upgrade current job-related skills. In addition, the initiative aims to provide a thorough examination as part of aggregated reports that assess the GEOINT Community's readiness at large."

Organizations who participate in the initiative will benefit from: discounts of up to 80% on individual registrations by training and/or certifying 15-25 employees at one time; refreshed GEOINT knowledge among their personnel; aggregated feedback; and Continuing Education Units and college credits for employees who participate in USGIF's online Boot Camp.

 Visit [usgif.org/certification/WorkforceInitiative](http://usgif.org/certification/WorkforceInitiative) to view options and rates. If your organization is interested in participating in this initiative, please contact USGIF's Dr. Camelia Kantor at [camelia.kantor@usgif.org](mailto:camelia.kantor@usgif.org) by Nov. 8, 2019.



Director of the U.S. Army Geospatial Center Gary W. Blohm (right) along with Ronda Schrenk, vice president of programs at USGIF (left), presented the 2019 Lt. Michael P. Murphy Award in Geospatial Intelligence to Capt. Katherine Meckler of the U.S. Air Force.

## MURPHY AWARD

# Air Force Capt. Katherine Meckler Relies on GEOINT for Mission Success

At GEOINT 2019, the Lt. Michael P. Murphy Award in Geospatial Intelligence was awarded to Capt. Katherine Meckler of the U.S. Air Force.

Meckler is from Mechanicsburg, Penn., and completed her undergraduate degree at Pennsylvania State University, where she also received an Air Force commission through the U.S. ROTC program. She is currently pursuing a master's degree in geographic information systems at Penn State while stationed at Naval Air Station Pensacola, where she serves as an Electronic Warfare Officer with more than 1,300 flight hours on the RC-135U COMBAT SENT.

"Until I began studying GEOINT with Penn State, I did not realize just how essential it was to nearly every stage of my mission," Meckler said. "I rely on GEOINT for mission planning, pre-mission briefs, mission execution, and post-mission analysis to provide situational awareness, operational expertise, and context to my collected strategic electronic reconnaissance information. Without GEOINT, I would be left to execute the mission in the blind, and my collected information would be meaningless to the warfighters. GEOINT achieves for

my mission what every other 'INT' cannot—it provides a powerful frame of reference with which to easily digest complex life-or-death ones and zeros."

The Murphy Award is named for Navy SEAL Lt. Michael P. Murphy, a distinguished Penn State alumnus. Murphy was killed June 28, 2005, by enemy forces during a reconnaissance mission in Afghanistan. For his selfless leadership and courageous actions, he was posthumously awarded the Medal of Honor. The Murphy Award recognizes achievement by a Penn State graduate who is serving or has served in the U.S. Armed Forces or Intelligence Community. The generosity of USGIF, Maxar, and faculty, staff, and friends of Penn State contributed to endowing the Murphy Award.

**"Until I began studying GEOINT with Penn State, I did not realize just how essential it was to nearly every stage of my mission."**

— CAPT. KATHERINE MECKLER, U.S. AIR FORCE

**USGIF AWARDS**

# Recognizing Outstanding Contributions to the GEOINT Community

At GEOINT 2019, USGIF announced this year's recipients of its annual Awards Program. The USGIF Awards Program recognizes the exceptional work of the geospatial intelligence tradecraft's brightest minds and organizations pushing the community forward. Award winners are nominated by their colleagues and selected by the USGIF Awards Subcommittee.

**THE 2019 USGIF AWARD WINNERS ARE**

**1. Academic Achievement Award**

Aaron Gerace and Matthew Montanaro, Rochester Institute of Technology

**3. Government Achievement Award**

Rachael Brady, CAL FIRE

**4. Industry Achievement Award**

Jeffrey D. Clark, Ph.D., Riverside Research

**2. Community Support Achievement Award**

Taking Autism To The Sky, Inc.

**5. Military Achievement Award**

GUARDIAN Team, National Guard Bureau



 LIFETIME ACHIEVEMENT AWARD

## Dr. Annette J. Krygiel Honored for Decades of Influential Service

USGIF announced Dr. Annette J. Krygiel as the 2019 recipient of the Foundation's Arthur C. Lundahl-Thomas C. Finnie Lifetime Achievement Award at GEOINT 2019.

Krygiel is a native of St. Louis, Mo., having earned her bachelor's degree in mathematics from Saint Louis University and a Ph.D. in computer science from Washington University. She served 38 years with the Department of Defense in positions at the Aeronautical Chart and Information Center, the Defense Mapping Agency (DMA), and the Central Imagery Office (CIO). She was DMA's chief scientist until her appointment as director of CIO in 1994.

Krygiel has been an independent consultant since retiring from federal civil service in 1999 and has also participated in many advisory roles, including serving on the Naval Studies Board for the National Academies.

"I am surprised, stunned, and deeply honored to receive the Lundahl-Finnie award," Krygiel said. "I am also very humbled at this connection to two great visionaries who enabled geospatial intelligence capabilities critical to our nation. My own career has been framed by their organizations, by people they mentored, and to some extent by strategies they employed. I am immensely grateful to the USGIF Board for this recognition and for including me among such distinguished awardees."

The Lundahl-Finnie Award recipient is nominated and voted upon annually by USGIF's Board of Directors. This distinguished award was named for Arthur C. Lundahl and Thomas C. Finnie, celebrating their accomplishments in imagery analysis and mapping, respectively.



*Dr. Annette J. Krygiel received USGIF's 2019 Arthur C. Lundahl-Thomas C. Finnie Lifetime Achievement Award at GEOINT 2019.*

## ACCELERATE INNOVATION. ADVANCE SCIENCE.

*As a not-for-profit chartered to advance scientific research, our experts perform multidisciplinary R&D; anticipating and solving complex mission challenges.*

### Mission-focused R&D:

AI/Machine Learning  
ISR Mission Planning  
OPIR  
Bistatics  
Radar  
Optics & Photonics



# the sky's

From agriculture and energy to construction and communications, airborne imagery is taking off in myriad industries—and lifting GEOINT to new heights.

*This aerial image was captured following 2018's Woolsey fire in Malibu, Calif.*

# the limit

BY MATT ALDERTON

 **ADVANCES IN COMMERCIAL AIRBORNE IMAGERY** are transforming aviation from a mode of transport into an instrument of understanding. The private sector's growing appetite for location information is putting fuel in the tanks of both manned and unmanned aircraft.

"Ten to 15 years ago, consumption of remote sensing data was almost completely dominated by government customers. And even if it looked commercial, there was probably government money behind it," explained Richard Cooke, director of global remote sensing and imagery at Esri. "Now, commercial entities are starting to understand that their enterprises almost always have a location component to them. Because of that, they want more and more location information—and ... remote sensing data is absolutely required to drive the majority of the rich content behind location information."

Given the increasing accessibility and affordability of commercial satellite imagery, whose future is especially compelling with the advent of small sat constellations, many companies have fixed their remote sensing gaze on space-based systems.

And yet, airborne assets continue to offer unique advantages and singular opportunities, the realization of which promises to make geospatial intelligence (GEOINT) as ubiquitous in the private sector as it already is in the defense and intelligence communities.

## A TOOL FOR EVERY JOB

From Leonardo da Vinci to the Wright brothers, the forefathers of aviation pursued flight for the euphoric and time-saving experience.

"The desire to fly is an idea handed down to us by our ancestors who, in their grueling travels across trackless lands in prehistoric times, looked enviously on the birds soaring freely through," Orville Wright once said.

Photographers pursued flight for different reasons than scientists and engineers—they wanted to see what birds saw. In 1858, French photographer Gaspard-Félix Tournachon took the world's first aerial photograph from a camera tethered to a balloon. Two years later, American photographer James Wallace Black went a step further when he took photographs of Boston from a hot-air balloon. As cameras became lighter, subsequent photographers mounted them to kites and even rockets.

Military commanders recognized the benefit of a bird's-eye view almost immediately. Though none survived, the Union Army is said to have used aerial photographs from balloons during the American Civil War, and during World War I the French Army used aerial photographs from miniature cameras worn by pigeons. Reconnaissance from airplanes also debuted during World War I and was routine practice by World War II.

When it comes to appreciating, integrating, and exploiting airborne imagery, commercial enterprises are late to the party. Now that they've finally arrived, however, commercial users must choose their method—imagery from satellites, manned aircraft, or unmanned aerial vehicles (UAVs)—wisely.



*First flight of the Wright Flyer, December 17, 1903; Orville Wright piloting, Wilbur Wright running at wingtip. (Photo courtesy of Wikipedia)*

“I don’t think any one is particularly better than the other; they just serve different use cases,” said Chuck Dostal, geospatial sales engineer at Nearmap, an aerial imagery company with operations in the United States and Australia. “There are tradeoffs for each of them.”

One of satellites’ greatest advantages, for instance, is wide-area coverage.

“The extensive coverage we can achieve with satellite imagery is immense,” said Brock Ryder, head of sales at senseFly, a commercial UAV company with operations in Switzerland, the U.S., China, and New Zealand. “You can capture data for a state, a country, or an entire continent.”

Then there’s temporal resolution.

“Satellites are always on,” said Alex Chernushin, director of commercial aerospace and strategic technology at Ball Aerospace. “Depending on what orbit you’re in, you can go over the exact same point on the Earth at a certain time of day and at a given revisit rate.”

Satellite disadvantages, meanwhile, include weather—most space-based systems can’t see through clouds—and speed: Imagery typically is not available in real time because downlinks are slow, and new sensors can take years to deploy. Spatial resolution is also a consideration.

“As you get farther and farther from the ground, resolution gets lower and lower,” said Dave Kroetsch, vice president of unmanned aircraft system solutions at Oregon-based FLIR Systems.

Where satellites fall short, fixed-wing aircraft excel and vice versa. Fixed-wing aircraft capturing images from the sky instead of space have superior spatial resolution but inferior

temporal resolution, and more speed but less scale.

“A lot of commercial applications out there right now need really high resolutions, and I think that’s what’s driving the aerial market today and keeping it healthy,” Cooke said.

Among remote sensing platforms, UAVs offer the highest resolution for the lowest cost.

“Where drones really shine is when you’re trying to get incredibly high-resolution data that’s updated on a frequent basis,” explained Jono Millin, co-founder and chief customer officer at DroneDeploy, a San Francisco-based company that makes mapping software for commercial UAVs. “And because drones are so cheap, you can fly them on-demand. We have customers who keep them in their glove compartment; they just drive around in a truck, and whenever they see the need they ... make a map and continue on their way.”

The compact size and limited battery life render UAVs impractical for large areas, but ideal for small ones.

“Manned aircraft are typically best for something on a larger scale,” Millin continued. “But if I have an area that’s less than 200 acres, and it’s changing a huge amount on a daily basis, drones are very well suited to that.”

## AIR OF OPPORTUNITY

Airborne imagery is appealing to virtually any business that needs to understand assets or activities in a given time and place.

“There’s no disputing that there is huge capital in spatial awareness,” Ryder said. “Nearly all industries now utilize imagery—and aerial imagery, in particular, is phenomenal as a decision-making tool.”

The applications are seemingly infinite. And yet, a few use cases stand out as especially compelling. One of the most frequently discussed is precision agriculture.

“We see quite a bit of demand in agriculture—not for big row crops, which satellite imagery handles pretty well, but for specialty crops,” Cooke said. “If you’re a small farm that has a vineyard or is growing things like berries, you’re probably adopting aerial imagery.”

“Ten to 15 years ago, consumption of remote sensing data was almost completely dominated by government customers. And even if it looked commercial, there was probably government money behind it.”

—RICHARD COOKE, ESRI

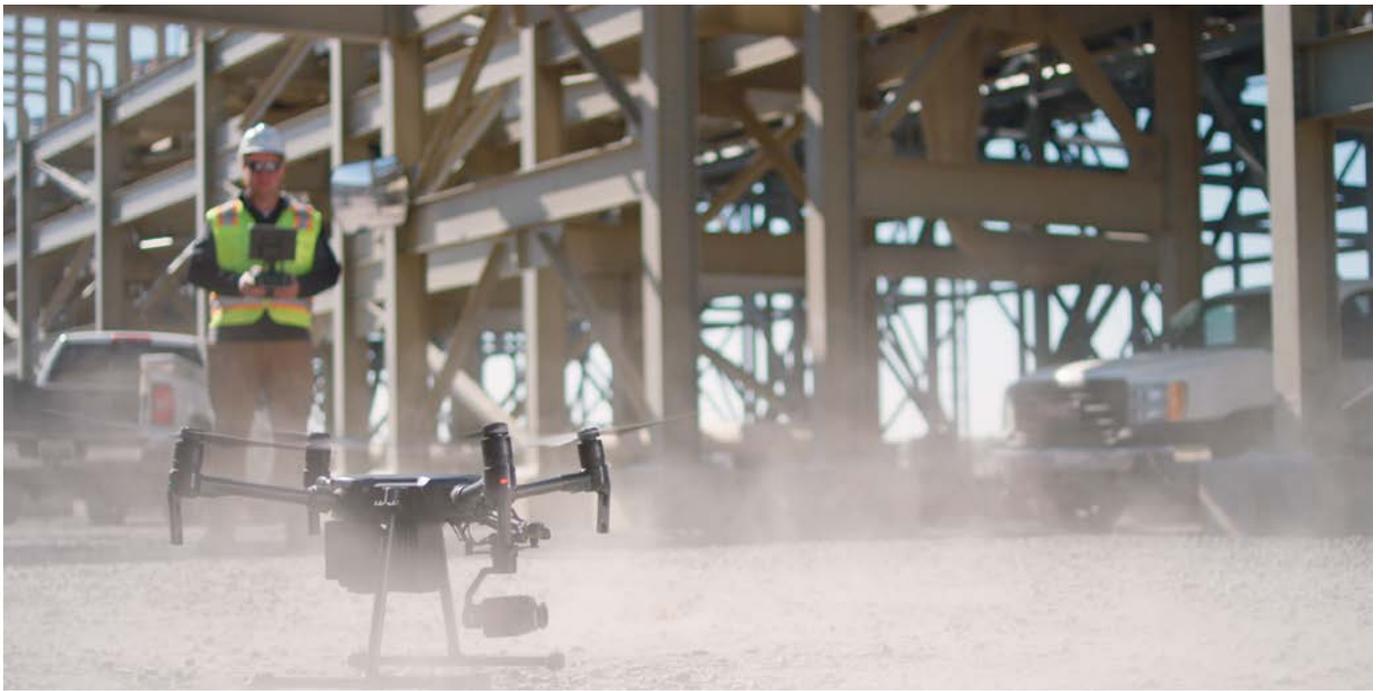
*DroneDeploy's FieldScanner, a real-time mapping application, provides quick detection of variability in agricultural fields.*



Small farms are especially interested in UAVs, according to Millin, who said agriculture is the second largest revenue driver at DroneDeploy.

“In the days of old, the process of crop scouting was just walking around in a random pattern hoping to stumble on a potential problem in the field,” he explained. “Now, we have drone technology that can, in real time and with no connectivity, create a map of your field and do some analysis on where we suspect there are potential problem areas.”

But DroneDeploy’s largest vertical is architecture, engineering, and construction (AEC), according to Millin, who cited a 2016 report by McKinsey & Company showing that large-scale construction projects on average are 80 percent over budget and 20 months behind schedule. “With aerial imagery, we can very easily and rapidly map a parcel of property and do the analysis that’s needed to determine whether work is going according to plan, and to figure out who’s doing what, where, and when,”



he said. “That kind of information is what ultimately is going to help the construction industry drive down all its inefficiencies.”

Construction foremen can fly UAVs over their job sites daily if needed, said Joshua Ziering, co-founder and chief pilot of Kittyhawk, a San Francisco-based company that helps Fortune 500 companies adopt, scale, and manage UAV operations. “Construction people want to know what’s there, and they want to measure what they have,” explained Ziering, who said aerial imagery from UAVs enables change detection for AEC users, who can observe new structures and measure material stockpiles to assess progress.

For large-scale projects like roads, bridges, and railways, fixed-wing aircraft offer similar visibility.

“The AEC market tends to use a lot of satellite imagery, and it’s moving toward drones for site-based applications. But if you believe policymakers when they say we’re going to spend \$2 trillion on infrastructure in the next 10 years, [fixed-wing aircraft] will be the only practical solution for those large infrastructure projects,” Cooke said.

Some of the largest builders of critical infrastructure are energy companies, which are adopting airborne imagery at a rapid clip, according to Millin, who said renewable energy projects such as solar are a growth center.

“The energy sector is using aerial imagery to do initial site surveys that assess the topography of the land. It can then use those topographical maps to do hydrology studies, and to understand what the grading of the earth should be in order to prep the site,” Millin explained. “And in the operations and maintenance phase, having people with handheld thermal cameras walk up and down rows of solar panels to manually identify potential diode failures or string outages is very inefficient. ... Using aerial imagery, you can detect those issues faster.”

Maintenance is as critical for oil and gas as it is for renewables.

“Large refineries and chemical plants require constant inspection to make sure they’re up to the standards required of them by the federal government and by the companies themselves,” Millin continued. “Drones allow you to conduct those inspections faster and safer than ever before.”

Fixed-wing aircraft can service pipelines in the same manner, and can also enable remote asset monitoring.

“Oil and gas has a really significant problem to solve, and that is that its asset base is very geographically distributed,” Cooke said.

“Even if you’re a mid-sized operator who’s working only in the Permian Basin in West Texas, that’s still a pretty large area in which you

have to know on a regular basis where all your assets are.”

Because they face many of the same challenges as agriculture, AEC, and energy, industries such as mining, forestry, and real estate can apply airborne imagery in many of the same ways.

“I can’t think of an industry where we don’t have customers,” Dostal said. “Your imagination is the limit.”

*Airframes that include both thermal and visible camera sensors afford operators significantly more utility for commercial applications.*

## NEW HORIZONS

Airborne imagery already has a wide and diverse commercial fan base. And the user community is poised to grow even larger with advances in payloads and processing.

The future starts with next-generation sensors.

“What’s really key is having not just the platforms, but also a selection of sensors that you can plug and play and switch around to get the job done,” said senseFly’s Ryder, whose company makes pocket-sized, hybrid sensors—

a multispectral camera, for example, and a dual RGB/thermal mapping camera.

Industry-specific sensors are a goal post that will drive further commercial adoption, predicted Ball Aerospace’s Chernushin, who cited as an example his company’s Methane Monitor, an airborne

“Using aerial imagery, you can detect those issues faster.”

—JONO MILLIN,  
DRONEDEPLOY

## ASSURANCE FOR INSURANCE

Insurance companies are the gutsy gamblers of the business world. Like high rollers in a Vegas casino, they spend their days playing the odds in a game of real-life roulette. Every policy they issue is a roll of the dice, and every claim a customer files—a flooded basement, a totaled car, a home invasion, a devastating house fire—is a lost bet. If they play their cards right, however, they can walk away with a windfall.

As any actuary, underwriter, or adjuster can attest, the difference between winning a bet and losing it is information. And to make gambles that are responsible rather than reckless, insurers need lots of it. Some of the best information they can acquire is geospatial in nature.

“Everything you insure has a location, so geospatial information is increasingly important to insurance companies, many of which want to leverage technology to improve the way they do business,” said Rob Agee, vice president of business development at Vexcel Imaging, an Austrian maker of aerial camera systems, mobile mapping platforms, and photogrammetry software.

For those companies, a bird’s-eye view can be a Holy Grail. That makes insurers among the most voracious users of commercial airborne imagery, according to Paul Smith, a business development manager at Hexagon Geosystems, whose HxGN Content Program is a commercial marketplace for airborne imagery. “Insurance is a big driver for us,” Smith said. “Insurance companies use aerial imagery on the front end for

risk mitigation—looking at properties and portfolios before events [to assess their risk exposure based on] proximity to places that could be subject to fires, flooding, or hailstorms. Then, they also use it on the back end to feed into their post-disaster response.”

The “blue sky” view can help insurance companies spot features like swimming pools and trampolines that add additional risk to homeowners’ policies. The “grey sky” view, on the other hand, can help them assess everything from burned homes to damaged roofs.

Historically, insurance companies have used satellite instead of airborne imagery to obtain both views. Recently, however, its high spatial resolution convinced the industry that the latter would better suit its needs, according to Agee, who said property and casualty insurers in 2017 decided to pool their resources to create the Geospatial Intelligence Center (GIC). Established by the National Insurance Crime Bureau (NICB) in partnership with Vexcel Imaging and Esri, the GIC’s goal is to create a shared database of commercial airborne imagery from fixed-wing aircraft that is jointly funded by and accessible to NICB members.

The GIC has two primary charges, according to Agee. The first is mapping the country’s top metropolitan areas with high-resolution aerial imagery—including oblique imagery—every year and mapping the entire continental U.S. every other year. The second is mapping impacted areas immediately after a disaster, yielding imagery in short order that insurers can use and share with first responders.

The result is a “before and after” picture that makes underwriting and adjusting faster, more efficient, and more accurate.

Because the GIC is a collaborative entity comprising shared resources, insurers enjoy lower costs and decreased risk. Consumers, meanwhile, receive both financial and emotional returns.

“It’s incredibly valuable because insurance companies can settle claims in days if your house is a total loss during a disaster,” Agee explained. “The customer doesn’t even have to call up the insurer anymore and say that their house is damaged; because they have the data, the insurer is now the one calling the customer and saying, ‘We see that your house is a total loss so we’re sending you a check right away.’ That’s changed the entire conversation between insurers and policyholders, and it’s really improving the customer experience.”

LiDAR system that uses pulsed light to detect hazardous methane gas leaks in natural gas pipelines.

FLIR Systems’ Kroetsch said his firm makes thermal sensors designed specifically for users in public safety, construction, and security, among other verticals. One camera, for example, can help construction workers identify holes in a building’s envelope; another can help firefighters see fire through smoke; and another can help security professionals identify human and vehicle intrusions.

“There’s been a proliferation of visible-light cameras that have a bunch of applications in the commercial and enterprise world. But where the real value starts happening is with non-visible imaging,” Kroetsch said. “Those sensors open up a whole new set of applications.”

And yet, when it comes to visible-light imaging, what’s old can be new again. Case in point: oblique aerial camera systems, which in urban environments enable 3D modeling and mapping by way of capturing 45-degree images that showcase the sides of buildings the way traditional imagery showcases the tops of them.

“[Oblique] camera technology is really interesting,” Cooke said. “Companies like Nearmap and Vexcel are flying really intriguing cameras that allow [Esri] to do 3D point cloud generation or 3D textured mesh generation out of imagery, and that’s really differentiating [commercial airborne imagery] from satellite data.”

Echoed Nearmap’s Dostal, “People have been using aerial imagery for a really long time, so they know what value it brings. But they haven’t been using 3D. So, our next objective is to educate our customers on how they can use 3D products.”

The commercial potential for 3D imagery is vast. Real estate agents and developers can use it, for instance, to simulate views that help them value and sell properties. Public safety and security professionals can apply it for improved situational awareness. And everyone from telecommunications providers to automakers will need it as “smart cities” emerge.

“5G has a very different propagation model than 4G does,” Cooke said. “It’s much more subject to structural and vegetation interference, and because it’s a denser signal you have to have more antennas around to propagate

*Aerial imagery captured following Florida’s Hurricane Michael in 2018.*



IMAGE COURTESY OF VEXCEL

the signal. You need high-resolution 3D models to do that propagation analysis to determine the location of cell sites, and airborne oblique imagery gives you that.”

Likewise with autonomous vehicles. “Autonomous vehicles will have devices to sense where they are in relation to what’s going on around them, but the vehicle has to have a dense 3D model as a base map to start with,” Cooke continued.

Importantly, 3D products will also enable the transformation of airborne imagery from a visual into an analytical asset, according to Paul Smith, a business development manager at Hexagon Geosystems. The company’s HxGN Content Program offers a commercial marketplace for orthorectified aerial imagery collected from airborne sensors made by Hexagon’s Leica Geosystems brand. One of those sensors is Leica CityMapper, a hybrid airborne sensor that combines oblique and nadir imaging as well as LiDAR into a single system.

“Our CityMapper sensors are ... being driven for their derivatives, which are three-dimensional data that can be put into machine learning algorithms for feature extraction to discern things like building materials and roof characteristics. So you can understand not only that you’re looking at a house, but that you’re looking at a stucco house with a terracotta roof,” Smith said. “That’s what I see as the future of our hybrid sensors: They’ll be feeding machines.”

Dostal envisions a similar future. “Aerial imagery is rapidly changing into a more intelligent product,” he said, adding that Nearmap recently launched a beta product that applies machine learning algorithms to its imagery database for change detection and feature extraction.

Oil and gas companies, for example, can be automatically alerted to pipeline leaks while insurance companies can automatically receive images of damaged roofs after a storm.

“[Airborne platforms] generate gigabytes and gigabytes of images. How do you process those in a way that summarizes the data for the end user?” Kroetsch asked. “You use artificial intelligence. That’s the next frontier.”

### SCALED FOR SUCCESS

Because algorithms must be trained, success in machine learning hinges on both quality and quantity of available training data. Thanks to its high resolution, airborne imagery has quality covered. Quantity, on the other hand, can be challenging due to poor temporal resolution. But that’s changing thanks to another fundamental shift in airborne business models.

“Seven to 10 years ago, the market was too fragmented. There was no consistency in how data was collected, processed, and used, and that made it difficult for anybody to gain a big foothold. As a result, everything was fly-on-contract,” Cooke explained. “A few years ago there was a lot of consolidation in the industry, and with that you started to see some economies of scale that have allowed a lot of aerial fliers to collect on spec.”

Among those fliers are Hexagon, Vexcel, and Nearmap, each of which collects airborne imagery on spec for use by commercial enterprises, who consume it via subscription-based web services.

“They envision a business model akin to what the satellite companies have: You collect it once and sell it many times,” continued Cooke, who said Esri hopes its ArcGIS platform will serve as a clearinghouse for companies’ speculative airborne imagery. “Everybody is going to have their own marketplace,



but eventually somebody’s going to become an aggregator of all those marketplaces.”

The aforementioned economies of scale have made it possible for collectors to increase their revisit rates over high-value areas in pursuit of the temporal cadence that both enterprise customers and machine learning algorithms require. They’ve also reduced the cost of airborne imagery and made it accessible to new users.

“We’ve got a model now where everyone from [small businesses] to giant corporations can afford to use our imagery,” Dostal said. “It’s really disruptive, and it’s opening aerial imagery up to the masses.”

Even more disruption is likely. As the regulatory environment evolves, the federal government could eventually green-light commercial use of larger, fixed-wing UAVs, as well as UAVs that can operate beyond line-of-sight, both of which would have significant implications.

And yet, collectors and users of commercial imagery must resist the urge to keep score. Advances in the air won’t displace advances in space; instead, each will enhance the other, leveraging complementary strengths to solve shared problems.

“Airborne and satellite imagery are not necessarily competition,” concluded Kittyhawk’s Ziering. “If anything, I think they’re synergistic.” 🌐

*Oblique aerial imagery is used to measure roofs in Salt Lake City, Utah.*

# data



PHOTO BY U.S. AIR FORCE TECH. SGT. THOMAS GRIMES

# *for relief*

**GEOINT provided indispensable support to humanitarian aid efforts following Cyclone Idai in Mozambique.**

**BY MELANIE D.G. KAPLAN**

*Locals gather in the village of Bebedo, Mozambique, to receive humanitarian aid from the World Food Programme following Cyclone Idai, April 8, 2019.*



**BEFORE U.S. AIR FORCE LT. COL. LEONARDO TONGKO**, commander of the 435th Contingency Response Squadron, traveled to the Republic of Mozambique following Cyclone Idai this spring, he jumped into information-gathering mode. >>

This was the first Department of Defense (DoD) humanitarian assistance operation for Tongko, whose squadron was assigned to deliver food and supplies to areas in need. From his station at Ramstein Air Base in Germany, Tongko read about past hurricane relief efforts in New Orleans and Puerto Rico to learn what he might face in southeast Africa.

Tongko had already sent a five-person assessment team to Mozambique—which had endured 110-mile-per-hour winds and catastrophic flooding and destruction—and studied snapshots his team sent back of the current situation. Analyzing those images, as well as historical data provided by the National Geospatial-Intelligence Agency (NGA) from the days before the cyclone, helped Tongko understand exactly where flooding had occurred.

“Before you go into harm’s way you want to have the best data you can,” said Tongko, a pilot by training. But no amount of data was as memorable to the squadron commander as the picture he viewed on his mobile device within a couple days of arrival.

“In this photo, there was a mother feeding her child a RUSF (Ready to Use Supplemental Food) that we had just packaged and delivered,” said Tongko, who received the image from a United Nations World Food Programme aid worker. “Seeing it immediately, we knew what we were doing was making an impact.”

Cyclone Idai, which also caused significant damage in Zimbabwe, Madagascar, and Malawi, made landfall March 14. The storm left more than 1,000 dead and thousands more missing. It knocked out electricity and communications, closed the airport in Beira (Mozambique’s fourth largest city), burst a dam, and flooded roads. Idai destroyed 90 percent of Beira, according to The International Federation of Red Cross and Red Crescent Societies.

“What the Mozambicans needed was relief, and they needed it quickly,” Tongko said.

*A Mother feeds her child RUSF (Ready-to-Use Supplemental Food) delivered by Lt. Tongko’s team.*



PHOTO COURTESY OF WFP/DEBORAH NGUYEN

## DEFENSE TOOLS FOR HUMANITARIAN AID

In the challenging weeks that followed, NGA provided geospatial data and products to support the relief effort in Mozambique, working closely with the United States Agency for International Development (USAID), the lead U.S. response agency. First responders and humanitarian organizations that provided food and shelter relied heavily on NGA’s public website, which includes information such as population data from Oak Ridge National Laboratory’s LandScan, vector data derived from Sentinel 1A/1B radar imagery, and Landsat 8 imagery that revealed water inundation.

NGA analysts also provided unclassified information to the military—particularly to Combined Joint Task Force Horn of Africa (CJTF-HOA) and to U.S. Air Forces Africa, which is responsible for airlift support operations such as those carried out by the 435th. Both are components of U.S. Africa Command (AFRICOM), the lead organization for DoD’s efforts.

NGA Associate Director for Operations Maj. Gen. Charles Cleveland stressed that preparation for crisis response such as that required in Mozambique happens not in the days after a disaster occurs but during the months and years prior. The agency has built strong partnerships with the U.S. State Department, AFRICOM, and various commercial entities, so when a storm makes landfall, NGA is ready to provide mapping data and predictive analysis, whether it’s information on where flooding is most likely to extend or how well infrastructure will withstand the water.

“Every crisis is different. So, our support to every response is, too,” Cleveland said. “We strive to do things better and garner lessons learned from every crisis response we support. Our focus on people and partnerships helped us choreograph support from a wide variety of agencies and organizations.”

Among the most significant concerns during rescue efforts in Mozambique were another cyclone on the heels of Idai, flooding that would force workers to higher ground, a flooded airfield, and where to safely stage personnel and resources. Understanding both weather and flooding patterns was paramount.

Challenges faced by military personnel and humanitarian workers in the aftermath of disasters such as Idai are uniquely suited for GEOINT, according to Cleveland.

“They need to be able to see what’s on the ground,” he said. “GEOINT plays a huge role in supporting those who need support.”

Geospatial data can not only show which areas are most affected by natural disasters, it can also indicate the spatial relationships among locations and reveal recommended and alternative transportation routes.

In Mozambique, NGA coordinated with CJTF-HOA’s operations and intelligence directorates to provide reference maps and imagery for airfields used in relief operations as well as graphics illustrating damaged areas, the condition of transportation networks, and the extent of flooding. GEOINT was used to determine the status of airfields and to set up airfield distribution hubs, then to inform decisions as to where and how to transport supplies to secondary points.

During the mission, CJTF-HOA personnel reached out to NGA personnel in the agency’s Springfield, Va., and St. Louis, Mo., offices for support. According to NGA, one particularly useful product was a road trafficability assessment, which helped those on the ground get supplies to affected populations as quickly as possible.

Sharing information with local responders quickly is often one of the most significant challenges in an area with limited communications.

“The GEOINT data requires high bandwidth, so it comes down to what can you push through what we call ‘limited data pipes,’” Cleveland said, adding that the agency sends a lot of data to a known, central location with dependable internet, and then workers head into the field and subsequently may not be able to refresh the information. “We would like to figure out a way to get information to people with a very low bandwidth.”

### OPEN SOURCE IN TIMES OF CRISIS

Though NGA provides both classified and unclassified data, the consensus among military forces and government personnel who were part of the Mozambique relief effort is that unclassified imagery, data from NGA’s public website, and material from PIX—an unclassified, password-protected system sponsored by the U.S. government and hosted on AWS GovCloud that includes an image repository—were preferable to classified data because of the ability to share with anyone.

“In a humanitarian crisis like this, I think unclassified becomes one of the most important resources we have,” Cleveland said.

David Crow, the NGA site lead at CJTF-HOA in Djibouti said that in general, the classified information was used by military planners and the unclassified information was used by non-DoD units on the ground in Mozambique.

“Open-source information was the first information received regarding the extent and type of damage, flood conditions, and severity of the weather conditions, so it was crucial in getting a rough estimate of the storm’s impact,” Crow said.

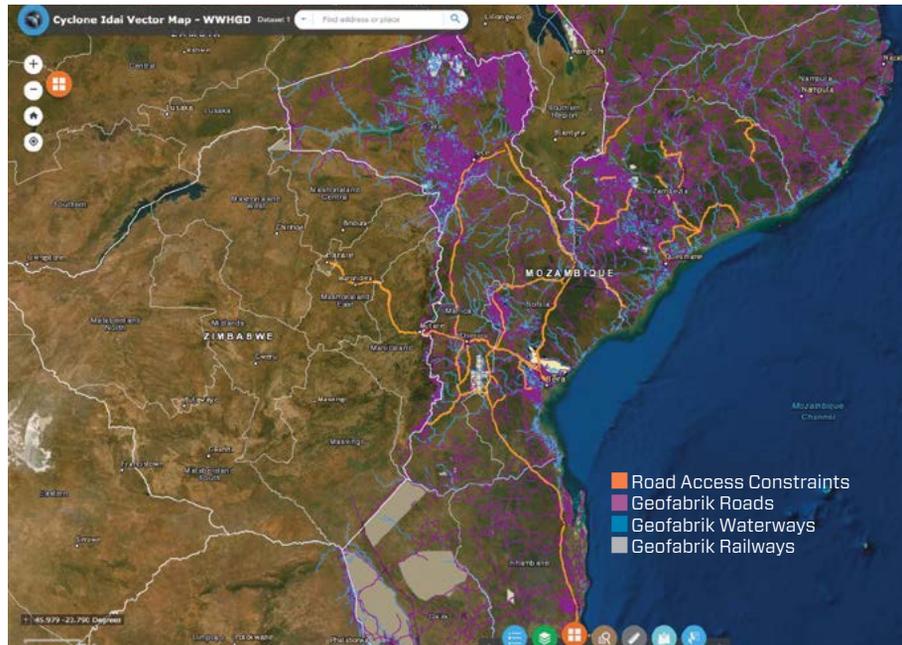
He added that much of the open-source information came from those who had endured the storm on the ground—someone in the capital city of Maputo relaying information from someone in Chimoio on social media, for example. At times, this can lead to unverified information, which muddies the overall assessment of the situation. Hearsay is to be expected in the initial reporting after any crisis, Crow continued, so the use of open-source reporting should be approached with caution.

Unsubstantiated reports aside, Cleveland said information from people on the ground can be useful, including handheld photographs, verbal updates, news reports, and social media posts from citizens and aid workers.

“There’s great information that comes from social media,” Cleveland said. “What’s more important than the collection platform is the dissemination. In some cases, we just want to get it out on the [internet]. We want more data, want to get it faster, and want to turn it to the hands of the people who need it faster.”

One important lesson the agency learned from the Mozambique crisis was that its ability to quickly disseminate mapping data in support of humanitarian aid was not as robust as its ability to share commercial imagery.

“We have built into our contracts a humanitarian crisis support plan that releases new imagery of a crisis almost immediately on the [internet], but we did not have that clause written into some of our other contracts,” Cleveland said. “This caused minor delays in the delivery of some of the data types. The first few hours and days of a crisis like this are critical, so



we’re working to remedy these delays and provide all the necessary support in an even more timely fashion.”

Tongko echoed Cleveland’s thoughts on welcoming intelligence from a variety of sources. When he arrived at the joint operations center, he didn’t necessarily know where all of the briefing information came from, only that he and his C-130 pilots felt confident relying on that material in aggregate moving forward.

“It’s not exactly to the second, but it’s high fidelity,” Tongko said about the GEOINT data that was available to him in Mozambique. “Geospatial intelligence was able to give us a very good visual depiction of where there was flooding, and open-source information helped us round out our decision-making.”

Also invaluable were products that allowed pilots to compare reference GEOINT (what they see on their charts) with current GEOINT (what they’re seeing out the windshield).

“There might be buildings in location XYZ en route to your runway, and it’s important to know if they’re no longer there or flooded,” Tongko said.

During its 21-day relief mission, Tongko’s 435th squadron delivered 1.8 million pounds of supplies provided by USAID, including food, cholera vaccines, temporary shelters, support vehicles, blankets, hygiene kits, water purification tools, and cooking oil—beneficial for the high calorie count and as a cooking substitute so scarce clean water could be reserved for drinking. In total, the U.S. military flew more than 120 flights to deliver supplies.

Tongko said the power of geospatial intelligence combined with open-source information from social media can’t be understated. “Especially when you see the devastation,” he explained. “The biggest concern was that the kids weren’t going to develop because they didn’t have food. And now they have a chance.”

Strong partnerships were essential to making the relief effort a success, according to Cleveland.

“We have good working relationships with our partners, and this event allowed us to grow the team,” he said. “This was not just an NGA effort; it was a global effort that truly demonstrates the power of the enterprise.” 🌐

*Cyclone Idai vector and raster data sources gathered by the World Wide Human Geography Data Working Group.*



IMAGE COURTESY OF AT&T

## AT&T: A Global Leader

Q&A with Jill Singer, vice president, National Security

**Q** What are some of the primary markets AT&T serves?

We are a diversified, global leader in telecommunications, media and entertainment, and technology. We provide more than 100 million U.S. consumers with entertainment and communication experiences. We serve educational institutions with technology, network and Wi-Fi coverage, and long-distance learning capabilities. We serve nearly three million business customers, providing high-speed and highly secure connectivity and smart solutions. We also serve federal, state, local, and tribal governments. We can trace our support for the government back 143 years, from the beginning of our company. Today, we support every branch of the federal government.

Our network is the largest, most advanced, and most powerful global

backbone that exists. Generally, you're going to find access to the AT&T network around the globe, wherever your business or personal travels take you.

**Q** What challenges does AT&T help its customers overcome?

In the public sector, we help intelligence agencies modernize and improve their ability to deliver their missions through an array of capabilities and expertise. We provide network and information technology design, engineering, development, operations, maintenance, management, security integration, and testing. We offer enterprise IT support and management, wireless innovation testing, software development including cloud applications and support, and voice and video services.

As the carrier delivering the FirstNet network, we offer intelligence

agencies the communications platform built specifically to support their engagements with the public safety community. We deliver wireline and wireless networks to support intelligence missions and provide near real-time connectivity combined with robust cybersecurity to safeguard people and information. And, we help with network infrastructure assessment, accreditation, and authorization processes in government and enterprise IT environments.

I am proud to be at AT&T and everyone here is proud to do our part to help keep our nation safe.



Jill Singer

**Q** What differentiates AT&T with regard to intelligence systems and data analytics?

We provide the underlying foundation in the IC. We offer the IC wireline and wireless network environments that allow them to operate their intelligence systems and perform data analytics in support of their missions. We do this with cybersecurity as a core capability of their network environments—offering confidence the systems and analytics are highly secure.

**Q** In what ways is AT&T digitally innovative?

In the past several years, there has been exponential growth in the demand for bandwidth—mainly driven by video, mobile technology streaming, and other capabilities. Since 2007, data traffic on the AT&T wireless network has grown more than 470,000 percent. We could not continue our hardware-centric deployment of infrastructure to all corners of the globe—it would have been incredibly expensive and takes a lot of time.

We migrated to a software-defined network to offer customers the ability to access bandwidth on demand and respond to real-time needs around the globe. We took individual hardware pieces—like firewalls, routers, and accelerators—and moved them into software—a flexible and less expensive commodity-based hardware. We did this out of necessity to better serve our customers.

**Q** How has USGIF Membership helped your business?

USGIF events allow us to bring our message to the various communities USGIF serves. The GEOINT Symposium is a perfect example. At GEOINT 2019, we had numerous opportunities to connect with government leaders and hear firsthand their concerns and mission challenges. These interactions allow us to hone our capabilities, so we are laser-focused on their top mission priorities and delivering the capabilities and solutions that help them succeed. The Symposium also allows us to connect with industry colleagues and develop joint market partnerships to create solution ecosystems that offer greater value to customers.

**Q** What excites you about the IC's future?

Geospatial context is critical to intelligence, diplomacy, warfighting, law

enforcement, and more. And when you combine geospatial information with imagery intelligence and other intelligence data, it empowers the United States with a deeper understanding of global events. It supports U.S. competitive advantage on the global stage. That, in itself, is exciting. Also exciting is AT&T's ability to apply innovative technologies—such as augmented and virtual reality training—to assist the IC.

Finally, AT&T is excited about the state-of-the-art cybersecurity innovations we can bring to protect the IC from edge to edge and everywhere in between. We're honored and thrilled to provide network and communications support to the IC.

**Connexa: Intelligent Integration Pays Data Dividends**

*Q&A with Harold "Andy" Goodson, chief executive officer*

**Q** Who are the main customers and industries Connexa serves?

We focus on secure data management and the exchange of information within the intelligence, surveillance, and reconnaissance (ISR) domain. We provide secure, distributed intelligence processing solutions for the United States Department of Defense, Intelligence

Community (IC), and allied nations.

Connexa provides development and integration support for the Distributed Common Ground System (DCGS) Programs of Record as the foundation for ISR interoperability. Connexa is an open-source company. We firmly believe in collaboration over competition throughout the IC because collaboration drives rapid advancement.

**Q** What GEOINT trends are you currently experiencing?

I see trends that address both the future capability and the future of software procurement. I have seen modern software development methods move the GEOINT discipline forward at a faster pace required for success. I see communities moving toward agile development and government acquisition processes getting behind it—the outcome is new capability though rapid integration of new applications.

Challenges exist. The seemingly insatiable appetite for ISR products and their use are driving the community to consider new technologies and new platforms. The challenge, to date, in the use of artificial intelligence (AI) and machine learning (ML) is that there is potential to create new stovepipes of information. To harness the power of data, data must be accessible in operational systems and it must be trusted. Data has an inherent provenance that must be maintained to be trusted. As a community, we need



Harold "Andy" Goodson

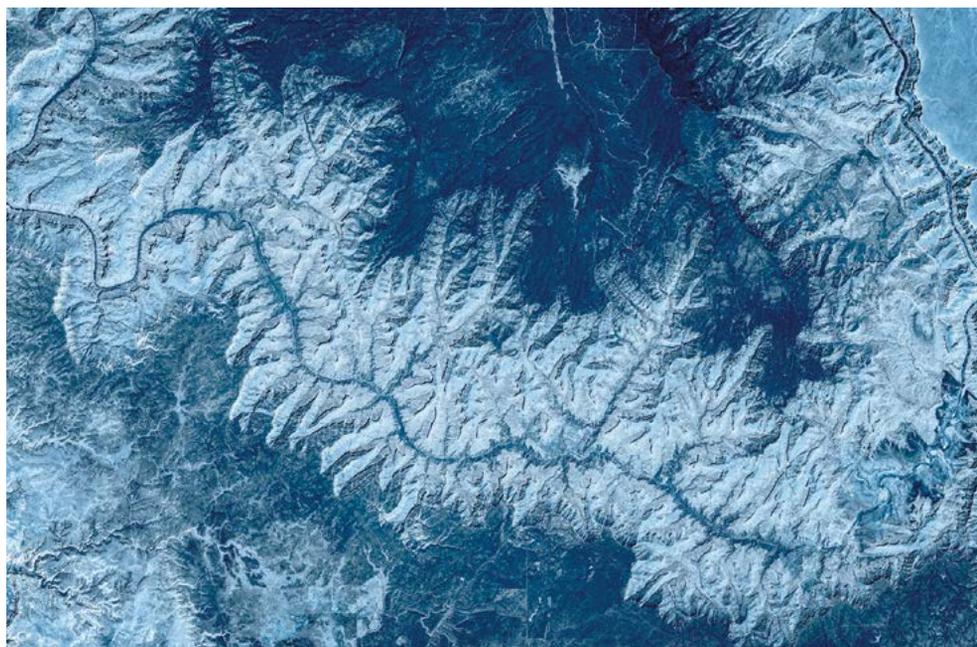


IMAGE COURTESY OF CONNEXA

to solve how the algorithms access the data and how the results are made available to the enterprise and find their way to the decision-makers.

**Q Why do you believe open-source is important for the IC?**

Open source offers the ability to adapt quickly to emerging threats and requirements. The model of collaboration behind open source allows us to integrate heritage solutions while accommodating the rapid integration of new capabilities. Our customers leverage one another's investment. As new capabilities are fielded for a single customer, everyone benefits.

**Q What differentiates Connexa with regard to open-source systems?**

Connexa is unique in our community. We embrace modern software development methods, keep a constant focus on the mission, and understand the rigors of government contracting. Our products are a foundation that we provide to the community through free licensing with unlimited rights.

**Q How does Connexa help customers overcome challenges?**

Agility is a core tenant of our team's culture. Software and importantly the process for agile development and continuous delivery is becoming recognized as the means to adapt faster than the threat. At Connexa, we employ agile practices to allow rapid integration of new capabilities to expedite the development of quality software. Our open platform facilitates rapid integration of new applications to realize the benefits that new technologies such as AI and ML bring.

**Q How has USGIF Membership helped Connexa achieve its goals?**

USGIF provides our team a unique lens through which to spot relevant industry trends and gain valuable insights. The GEOINT Symposium and forums hosted by the Foundation encourage community participation and the exchange of ideas and collaboration. The Connexa team highly values this open collaboration.

**Q How is Connexa preparing for the future of GEOINT?**

At Connexa, the foundation of our culture is characterized in the three C's—Connect, Create, and Contribute:

- Connecting people with technology to respond to emerging threats.
- Creating innovative, high-quality solutions through the rapid integration of new software. We embrace agility and transparency.
- Contributing back to those we serve through our open-source offerings.

**Q What excites you most about the future?**

Greater connectivity means our world is shrinking. Therefore, users are going to require deeper situational awareness, faster responses, and greater collaboration. At Connexa, we are committed to open-source software, agile methods, and collaboration with the GEOINT Community to deliver a decisive advantage to decision-makers and to the warfighter at the tactical edge.

**Building Analytic Cultures**

*Q&A with Kathy Pherson, chief executive officer, Pherson Associates*

Before establishing Pherson Associates, Kathy Pherson was director of the Central Intelligence Center for Security Evaluation, where she managed the Intelligence Community's involvement in embassy security issues, including rebuilding the penetrated U.S. embassy in Moscow. After 27 years in intelligence and security analysis and resource management, Pherson took early retirement from the CIA in 2000.

She and her husband, Randy, who retired as the National Intelligence Officer for Latin America, founded Pherson Associates in 2003 after being asked to support analytic tradecraft projects at the CIA and to train FBI analysts. While Pherson Associates serves the U.S. government, its subsidiary Globalytica offers analytic training and mentoring for private and international customers.

**Q How would you describe the work you do at Pherson Associates?**

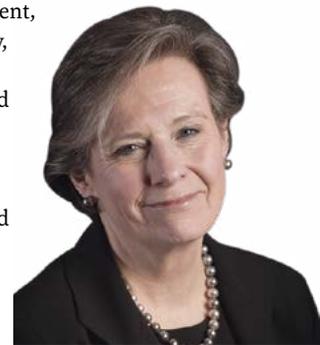
We build analytic cultures by teaching and guiding analysts in the effective use of strategies and techniques to make sense of the present and to anticipate the future. We offer a variety of tradecraft classes and mentoring programs, including critical thinking, analytic thinking, and structured analytic techniques as well as executive and leadership coaching programs. As retired intelligence managers, we did not originally think of ourselves as trainers or curriculum developers. But we knew how to produce valuable intelligence products and how they are used at the highest levels.

The people who we bring aboard, from senior consultants to instructors, have extensive experience in the Intelligence Community (IC). This allows us to offer a range of analytic training and tradecraft development services, such as collecting and arraying critical data, developing and applying analytic techniques, maximizing the power of analysis, and improving analytic production and evaluation.

**Q Who primarily uses your services?**

We are a small company, but we've worked with just about every IC agency, including the Department of Homeland Security; the Departments of Defense, State, and Justice; and the National Geospatial-Intelligence Agency (NGA), in addition to several non-IC agencies. Through Globalytica, we have served 10 Fortune 100 companies and more than a dozen foreign nations. Our books, available on our website, are used across government, private industry, and academia.

We are proud of our support for NGA's All Leaders Coaching Program and are particularly committed to helping the government



Kathy Pherson

reform security processes. In addition to my service as IC legend Charlie Allen's vice chair on the Intelligence and National Security Alliance's Security Policy Reform Council, we are helping develop analytic approaches to security at the Performance Accountability Council Program Management Office, the National Background Investigations Bureau, and the Defense Security Service.

**Q What are some of the most significant challenges you face?**

Acquisition is by far the largest hurdle. Government agencies are in a difficult position because they must adhere to a lot of rules to maintain fair competition. They don't want procurements to be challenged and therefore delayed. But frankly, the system continues to disadvantage small businesses. There are always reasons why the rules are there, but few acquisition officers understand the business perspective. I'm convinced we can do better at truly

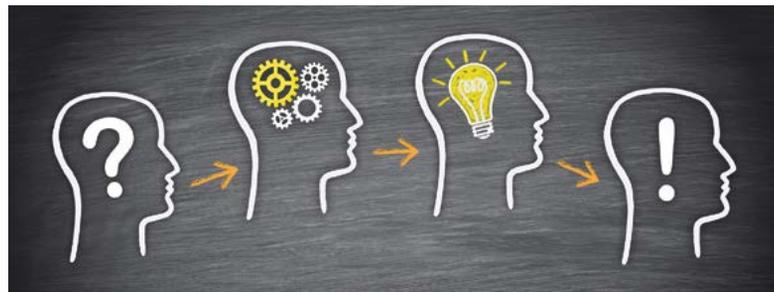


IMAGE COURTESY OF PHERSON ASSOCIATES

building our partnerships and providing opportunities for small businesses—those that offer services as well as technologies.

**Q When did you become a USGIF Individual Member?**

I joined several years ago for two reasons. First, I wanted to be able to participate in the GEOINT Symposium and other USGIF activities to interact with the GEOINT Community we had been working with at NGA since 2008. Second, I wanted to be active in USGIF's Small Business Advisory Working Group (SBAWG), which I chaired for four years.

**Q How has USGIF Membership helped you reach your goals?**

The road for small businesses is hard. USGIF and the SBAWG provide access to decision-makers and leaders. So, you have a chance of getting your brand, company, and services out there. You can attend different events, meet people, and then follow up. USGIF provides an essential platform for networking and learning about the needs of the GEOINT Community. I've also learned a lot from participating in the NGA Advisory Working Group, which enables members to engage on acquisition problems in partnership with other large, medium, and small businesses. 🌐



## Join Today as an Individual Member

### Grow your Network

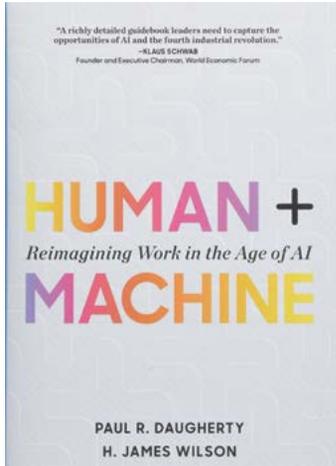
- Be a part of your professional association dedicated to the GEOINT Community
- Network with your peers while developing new business opportunities
- Complimentary attendance at GEOINteraction Tuesday networking events

### Stay Informed and Save Money

- Receive up to \$200 off the cost to attend each USGIF event
- Save \$100 on each Certified GEOINT Professional (CGP) exam
- Attend members-only events

[connect.usgif.org](http://connect.usgif.org)

## READING LIST



### *Human + Machine: Reimagining Work in the Age of AI*

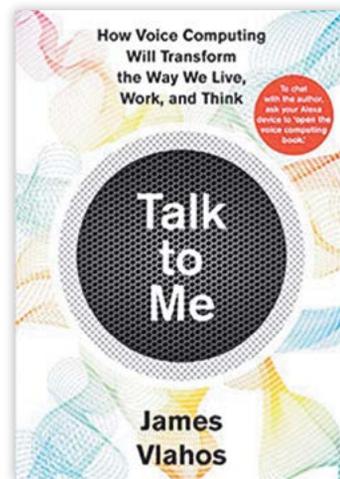
By Paul R. Daugherty and H. James Wilson

Artificial intelligence (AI) has transformed the business process, whether in breakthrough innovation or everyday customer service. In this book, the authors explore how AI has changed the way companies operate. From AI rules for increasing profitability and innovation to six new human-machine roles companies should develop, *Human + Machine* provides a playbook for success in this new era of automation.

### *Talk to Me: How Voice Computing Will Transform the Way We Live, Work, and Think*

By James Vlahos

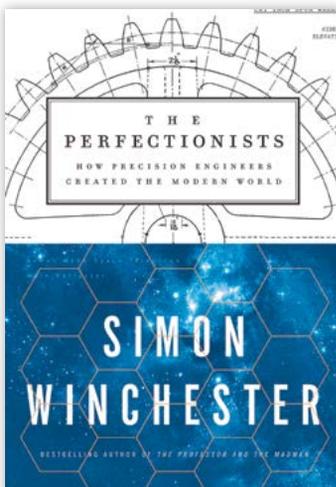
What happens when our computers become as articulate, compassionate, and creative as we are? This is the question journalist James Vlahos grapples with. Vlahos meets with researchers from titan tech companies such as Google, Amazon, and Apple to explore how voice technology has the potential to transform everyday life. He then tries to understand the significance of voice-computing by developing a chatbot version of his terminally ill father.



### *The Perfectionist: How Precision Engineers Created the Modern World*

By Simon Winchester

*New York Times* bestselling author Simon Winchester recounts technological advancements from the industrial age to the digital age. Through the retelling of history, Winchester explores a key factor to technological advancements—precision. He also begins to ask some fundamental questions, such as, “Why is precision important? Who has invented and perfected it? And has the pursuit of the ultra-precise in so many facets of human life blinded us to other things of equal value, such as an appreciation for the age-old traditions of craftsmanship, art, and high culture?”



## USGIF EVENTS CALENDAR

**AUGUST 27**

**USGIF Working Group**

**Summit**

Herndon, Va.

**SEPTEMBER 27-28**

**GEOINtegration**

**Leadership Summit**

Herndon, Va.

**OCTOBER 7-9**

**Geospatial Gateway**

**Forum**

St. Louis, Mo.

**NOVEMBER 18-22**

**GEOINT Community**

**Week**

Northern Virginia

**NOVEMBER 23**

**GEOGala**

Northern Virginia

**APRIL 26-29**

**GEOINT 2020**

Tampa, Fla.

**PEGGY AGOURIS**, former dean of the College of Science at George Mason University, was selected as William & Mary's sixth provost. Agouris began at William & Mary July 1.

CACI International President and CEO **KEN ASBURY** retired June 30. **JOHN MENGUCCI**, CACI COO, was elected president and CEO effective July 1.

**NICO BELMONTE** joined Mapbox as general manager for maps, owning maps service and map design. Belmonte was formerly Uber's head of visualization.

Utah State University's Space Dynamics Laboratory announced former NGA Director **ROBERT CARDILLO** has been appointed to its Guidance Council. Saint Louis University also announced that Cardillo has been named a Distinguished Geospatial Fellow in the Saint Louis University Research Institute. Additionally, Cardillo joined the boards of advisors at AGI, Beacon Global Strategies, Cesium, Hawkeye 360, and Peraton.

MITRE announced **CHARLES CLANCY** as vice president for intelligence programs, effective July 8, and **GUS BENTIVEGNA** as its new vice president of human resources and talent enablement.

NGA announced **STACEY DIXON, PH.D.**, former director of the Intelligence Advanced Research Projects Activity (IARPA), as the agency's eighth deputy director. Prior to her IARPA assignment, Dixon held a number of positions within NGA, most recently as deputy director of the agency's research and development directorate.

**ARMY LT. GEN. KAREN H. GIBSON** joined the Office of the Director of National Intelligence as deputy director of national intelligence for national security partnerships. She arrived April 1 from MacDill Air Force Base in Tampa, Fla., where she served as the intelligence director, J-2, for U.S. Central Command.

The board of directors at Ball Corporation elected **BETTY SAPP**, former NRO director, to serve as a director of the corporation.

**KATHY J. WARDEN** now serves as chairman of Northrop Grumman, effective Aug. 1. Warden will also continue to serve as CEO and president of the company.

**BOB WORK**, former Deputy Secretary of Defense, has been appointed to System High's board of directors.

# USGIF Accredited Programs

Thinking about going back to school?

There's no better time than the present. Earning a geospatial intelligence certificate from a USGIF-accredited institution provides the skills required to address challenges, offers competitive advantage, and ensures organizations get high-caliber employees who understand GEOINT.

## ALL PRESENT AND ACCOUNTED FOR

*A conversation with Patty Mims, director of Global National Government at Esri and a USGIF Board member*

**Q** In your tenure at Esri, what are the most substantive business changes you have overseen?

The impact of the cloud has been amazing. I've been at Esri for 17 years, and when the cloud emerged, first there was a lot of hype, and people weren't sure what it could do for them. Now, people really understand its usefulness. They can quickly access data and the backend support the cloud provides. There were about 1,000 people using geospatial capabilities on the cloud via Amazon C2S for the Intelligence Community seven years ago; now, Esri software is enabling more than 165,000 people to share, collaborate, and create geospatial applications and products on C2S. Barriers have been broken down and access is much easier.

On the unclassified side, organizations like the Federal Emergency Management Agency (FEMA) can use the cloud for real-time software-as-a-service to provide information to the public, letting residents know what the damage assessment on a certain building is, for example, or letting people know what roads or shelters are open or closed.

**Q** What are some of the most intriguing products Esri is pursuing right now?

We are viewing environment as a convergence of the outdoors and the indoors. Today, people are not stopping at a building's exterior when making decisions, they are going to the assets inside the building when evaluating a given environment.

Esri is working with Autodesk on seamless integration of building information. This makes it possible to integrate design data with the real world, covering things like environmental controls—allowing someone to actively manage the temperature or air quality to cut down on utility costs—and critical aspects of building security. For example, managing evacuation if there is a weather event like a tornado and using sensors to account for all of the building's occupants.

From a geospatial perspective, we have tools that are designed to manage people in a given building. For instance, if you are moving or doing construction, we can make sure that people are located properly. This is valuable for organizations that are moving teams constantly. A place like NGA has thousands of people that move around or need proper proximity to one another or certain resources.



*Patty Mims at the GEOINT 2019 Symposium*

**Q** Could you describe an interesting project in Esri's federal/civilian line of business?

One thing that will touch everyone in the U.S. is our work with the Census Bureau. For the first time, the census will be totally digital. Individuals can fill out the form online, and we hope this motivates more people to respond. We will also be using GIS and satellite imaging to discover new residences created between 2009 and 2019.

As census data is collected, and if people haven't responded online, the bureau will be able to follow up with community outreach to boost response rates. Esri will enable enumerators with the ability to conduct field data capture on handhelds. Each census taker will have a mobile device such as an iPhone that will plan their route, collect responses, log hours, and track expenses all in one app. And because the handheld devices will have location tracking, the bureau will know where the enumerator is at all times and if the addresses reported match his/her actual location. There is built-in verification. This is one of the

greatest examples of digital adoption in government using mapping and location intelligence.

**Q** What are some of the challenges in working with governmental entities, either domestically or abroad?

Because we are a software company, Esri invests 30 percent of its earnings back into research and development each year. We have new products that are coming so fast that it is hard to keep up, so educating our customers about new technology and how can they adopt and implement it is an ongoing challenge.

Esri has customers in nearly every federal organization globally. To help our customers stay on top of the latest technology, we host a user conference, a federal user conference, and regional events. We also have account teams and professional staff working in many of our customer footprints. Esri knows the government's greatest asset is its employees, and ongoing training and education to keep their skills current continues to be extremely important. 🌐

# USGIF Workforce & Certification Development Initiative



**Geospatial Data  
Management**



**GIS & Analysis Tools**



**Remote Sensing &  
Imagery Analysis**

USGIF is offering organizations the opportunity to save up to 80% off individual registrations by training and/or certifying 15-25 employees at once through the USGIF Professional Certification Program. Employees have the chance to be certified in one or more of the areas identified in USGIF's GEOINT Essential Body of Knowledge (EBK), to include:

## How Will My Organization Benefit?

- Save up to 80% off individual registrations by training and/or certifying 15-25 employees at once.
- Your employees will refresh their GEOINT knowledge and stand out among their peers as certified GEOINT professionals.
- Your organization will receive aggregated feedback on specific areas of improvement.
- Participants will receive a Certificate of Completion including Continuing Education Units (CEUs). *Applies to online Boot Camp only.*

**LEARN  
MORE**

If your organization is interested in participating in this initiative, please contact USGIF's Vice President of Academic Affairs Dr. Camelia Kantor at [camelia.kantor@usgif.org](mailto:camelia.kantor@usgif.org).

**Organizations must sign up no later than Nov. 8, 2019.**



## WE'LL HELP YOU TURN A CITY INTO A CITADEL

Learn about our mission critical imagery and data captured to help you protect infrastructure. Contact us today, let us help you complete your mission.

