

» AUGMENTED REALITY

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2013 ISSUE 4

trajectory

THE OFFICIAL MAGAZINE

OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

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SHUTDOWN, BUT NOT OUT

The recent devastation caused by Typhoon Haiyan made me pause to think about the impact of last year's Hurricane Sandy. While the extent of the death and damage caused by Haiyan has yet to be fully measured, it's already off the front page, and, for the most part, it seems people without any familial attachment to the Philippines have stopped thinking about it. Sandy is also a distant memory for most. Discussion of the one-year anniversary was limited generally to areas heavily impacted by the storm. Whether in the midst of such a disaster, engaged in supporting relief operations from afar, or just watching events unfold on the news, the devastation provides valuable perspective when you pause to reflect.



The time since Sandy has been fairly tumultuous for those of us working with the U.S. government and the defense, intelligence, and homeland security communities. We've seen the effects of the 2012 sequestration as it forces budget cuts with little or no discretion. We've seen furloughs, layoffs, and companies fold as defense and intelligence spending recedes from the height of post-9/11 operations. This fall, we even experienced the embarrassing shutdown of the federal government, as our elected officials couldn't find any way to do their jobs on our behalf.

The government shutdown had a number of direct and indirect consequences, including the unanticipated and unavoidable postponement of the GEOINT 2013 Symposium. The interpretations of the Pay Our Military Act prevented government and military personnel from participating in or even attending public events. USGIF's partners in the greater Tampa Bay area suffered an immediate estimated loss of more than \$5 million to the local economy. The GEOINT Community missed the opportunity for the unique and critically important dialogue among government, industry, and academia that the Symposium annually provides.

Our exhibitors, sponsors, partners, and attendees were also impacted financially, many with unrecoverable, sunk costs.

The USGIF staff found itself in uncharted territory, working tirelessly to "un-plan" our annual event while mitigating the financial impact on the Foundation and all Symposium stakeholders, including simultaneously re-planning for the spring and managing the cascading effect on out-year obligations.

On behalf of the entire staff, I want to express our thanks to the GEOINT Community for standing by USGIF, for the constant expressions of support, and for demonstrating remarkable patience.

All along, we've aimed to maintain perspective. Although the events in Washington over the past year—including the government shutdown and subsequent postponement of the GEOINT 2013 Symposium—were inconvenient, they were by no means tragic. The tremendous loss of life and property caused by storms like Sandy and Haiyan are vivid reminders of such. We're also mindful that many in our business continue to face significant challenges in this time of remarkable change. USGIF remains strong, its mission remains relevant and important, and the GEOINT 2013* Symposium will be held April 14-17, 2014, in Tampa.

Please enjoy this latest issue of *trajectory*, which includes a cover story on the future of airborne ISR, a feature on the advent of augmented reality, and much more. Best wishes from all of us at USGIF for a joyous holiday season, and a healthy, safe, and productive 2014. We look forward to seeing you in April, if not before!

Although the events in Washington over the past year—including the government shutdown and subsequent postponement of the GEOINT 2013 Symposium—were inconvenient, they were by no means tragic.

KEITH J. MASBACK | CEO, USGIF

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*GEOINT 2013 ... Now in April 2014!

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Trajectory welcomes your feedback. Send us a letter at trajectory@usgif.org. Submission constitutes permission to reprint, and letters may be edited for length and clarity.



A FATHER-SON CONNECTION

My GIS analyst son and I (a geospatial application developer) enjoy reading *trajectory* magazine and discussing the articles. My interests include full motion video and multi-INT topics, and my son, Charlie, is interested in remote sensing. I believe *trajectory* successfully straddles the line between research and application topics of interest to the Intelligence Community.

My son, who maintains map data sets in a production shop, became interested in maps when Google Earth and Google Maps made commercial imagery available on the Internet. He would pan across our neighborhood looking for landmarks he knew. While in college, he worked with a GIS team at the Boy Scouts of America's Philmont Scout Ranch in New Mexico maintaining trail, road, and land-use map data. Charlie graduated with a degree in environmental science and a GIS certificate from the University of Mary Washington in 2011.

We both participate in USGIF events and Charlie is a member of USGIF's Young Professionals Group. USGIF is a great organization we share in common as members of the IC!

—Paul Devine, Senior Software Engineer, TASC

USGIF accreditation of collegiate *Geospatial Intelligence* certificate programs supports vital national security interests by assuring that students are prepared for careers within the growing GEOINT enterprise.

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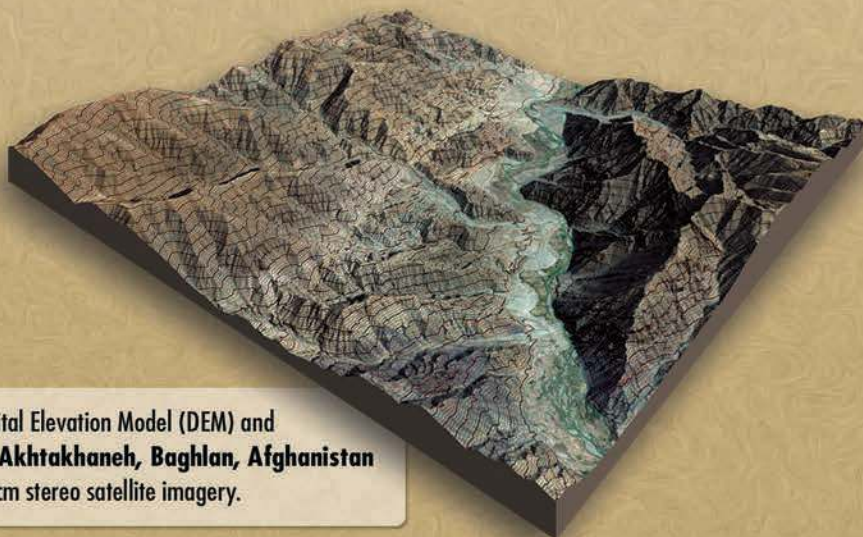


Vector feature extraction, vegetation mapping and Digital Terrain Model (DTM) of Mina (Tent City), **Mecca, Saudi Arabia** derived from 50cm stereo satellite imagery.



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NEWS UPDATES AND HIGHLIGHTS

IC ITE MOVES FORWARD

Director of National Intelligence James Clapper first announced his plan to integrate the Intelligence Community's information technology architecture at GEOINT 2011 in San Antonio. Since then, a series of projects have been under way to move toward a common IT platform for the Community, known as the Intelligence Community Information Technology Enterprise (IC ITE). On Aug. 16, the IC ITE initiative reached its initial baseline milestone with the limited deployment of a common Intelligence Community desktop, the launch of the first installment of the Intelligence Community cloud, and the opening of a community-wide applications mall.

THE MAIN GOALS OF IC ITE ARE TO PROVIDE EFFECTIVENESS, SECURITY, AND EFFICIENCY FOR THE COMMUNITY.

The main goals of IC ITE are to provide effectiveness, security, and efficiency for the community, said Al Tarasiuk, the Intelligence Community's chief information officer, during a press briefing Sept. 9.

"[IC ITE is] not this gigantic program that has a billion milestones,

and IOC and FOC hard-set dates," Tarasiuk said. "It really is a series of projects that the agencies are already executing that we are re-vectoring slightly to achieve this commonality across the Community."

The program has a service-based provider structure in which one or two agencies is responsible for governing each of the four major components of IC ITE: the Intelligence Community desktop, the Intelligence Community cloud, the applications mall, and a network requirement and engineering service.

The National Geospatial-Intelligence Agency (NGA) and the Defense Intelligence Agency (DIA) oversee the development of the IC desktop, and the initial deployment to a few thousand users is taking place within the two agencies. Rather than every agency building its own software desktop like it does today, when the new desktop is fully scaled, it will be used by all agencies and include a common email system and collaboration services such as voice, video, and instant messaging.

The Central Intelligence Agency (CIA) and the National Security Agency (NSA) lead the development of the IC cloud, which will be privately hosted within the Intelligence Community. The first installment



ODNI CIO Al Tarasiuk speaks on a panel about information innovation at GEOINT 2012.

of the IC cloud was made available to not just users on the new IC desktop, but to those on legacy systems as well — meaning any intelligence agency personnel connected to TS/SCI networks can now access IC ITE capabilities.

The final component of IC ITE is the network requirement and engineering service. The National Reconnaissance Office (NRO) leads this portion, examining how to connect both local and wide area networks for the purpose of providing a more efficient model that improves effectiveness.

Following this initial baseline milestone, IC ITE will continue to grow in increments of six months to a year. In 2014, the focus will be ensuring the resilience of the current infrastructure and making sure more production capabilities can be moved into it before scaling the number of desktops and the amount of data in the cloud, Tarasiuk said. He added that at the current pace, ODNI anticipates a substantial number of users on the new IC desktop and the cloud infrastructure to be built out by 2018.

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**In 2013, the global airborne
ISR market will amount to**

\$19.23B

NGA MAP OF THE WORLD

Foundation GEOINT + Intelligence = Integrated, Analytic Views

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FROM THE BOTTOM OF THE OCEAN TO THE TOP OF THE WORLD

To meet the growing demand for online spatial content, the National Geospatial-Intelligence Agency (NGA) is developing a “Map of the World” to provide easy access and one-stop shopping to the agency’s most complete and spatially accurate GEOINT data.

By providing a centralized focal point for exploring content, the Map of the World will integrate the display of foundation GEOINT and intelligence across Intelligence Community disciplines. It will link natural and man-made features on, above, and beneath the Earth to objects through intelligence observations and judgments from the GEOINT Community. Users will also be able to integrate their own content with the content they access via the Map of the World, and tailor the Map of the World displays in a variety of ways to provide the specific visualization solution needed for their mission.

“By integrating views of the physical Earth, mission-related content, and integrated intelligence, the Map of the World will enable analysts to substantially enhance the quality and impact of that support,” said John Goolgasian, director, Foundation GEOINT Group, Source Operations and Management Directorate, NGA.

NGA recently launched the initial Transportation and Names and Boundaries Map of the World views on government classified computer networks. Future releases will continue to lay the groundwork to build the Map of the World.

PROCRASTINATION TOOLS

CHECK OUT THESE ENTERTAINING GEOGRAPHY-RELATED WEBSITES

GEOGUESSR is a fun game in which the user is shown a panoramic Google Maps image of a randomly selected place from anywhere in the world, and can pan and zoom for clues to guess the location. After guessing, the correct location is revealed and users gain points based on how close their estimation was to the actual location.

www.geoguessr.com



THEY DRAW & TRAVEL looks at the world in a different and creative way. Users can select any region in the world, as well as their artistic style of choice, and the website will load vibrant maps created by artists from around the globe.

www.theydrawandtravel.com

WHATWASTHERE provides a geography and history lesson in one. The website ties historic photos to Google Maps, allowing users to select a location and see corresponding images of what was previously there.

www.whatwasthere.com

WORLDCAM fuses the Instagram photography social media platform with geography. By typing in a landmark and nearby city, users are provided with a collection of photos from that location, beginning with the most recent. For example, you can view a collection of the most recent Instagram photos taken at the Lincoln Memorial, Dulles International Airport, Kabul City Center, or even your child’s high school.

www.worldcam.com



I SPY...

Orbit Logic introduced its new iPhone app, SpyMeSat, in October. The app provides notifications when an imaging satellite is overhead, in addition to showing a map of orbiting satellites nearing a user’s location. Users can also customize the app by enabling or disabling individual satellites, or setting the app to track a particular satellite constellation. SpyMeSat was originally targeted for the aerospace, defense, and intelligence communities, but has attracted interest from everyday space enthusiasts as well. The app can be downloaded via the Apple App Store.

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The Lockheed U-2 reconnaissance aircraft has been in service for

56 YEARS





DIRECTOR OF NATIONAL INTELLIGENCE James Clapper speaks at a special event hosted by USGIF Oct. 15.

THE POWER OF COMMUNITY

IN THE WAKE of the decision to postpone the GEOINT 2013 Symposium, which was scheduled to be held in Tampa, Fla. Oct. 13–16, more than 200 Intelligence Community members gathered Oct. 15 for a USGIF special event in Springfield, Va.

As a result of the government shutdown, USGIF announced Oct. 8 it would postpone its 10th annual GEOINT Symposium to April 2014. The special event offered Community members the opportunity to reflect upon this news, look ahead to the spring, and network.

USGIF CEO Keith Masback said there is “no playbook” for postponing an event the size of the GEOINT Symposium.

“While USGIF is certainly disappointed in this unavoidable delay of our event, we are also cognizant that there have been furloughs and layoffs with profound and lasting impacts,” Masback said.

“We are a Community,” Masback told the crowd. “And you have acted like a Community with your emails and phone calls of support.”

Additionally, many senior leaders from the Intelligence Community attended the special event to show support for the Foundation, including Director of National Intelligence James Clapper; Deputy DNI for Intelligence Integration Robert Cardillo; Assistant DNI for Acquisition Kevin Meiners; Deputy Undersecretary of Defense for Intelligence, Warfighter Support, and Director of the ISR Task Force Lt. Gen. Ray Palumbo; National Geospatial-Intelligence Agency Director Letitia Long; NSA Deputy Director Michael Rodrigue; NSA Chief Operating Officer Ellen McCarthy; and Director

of the U.S. Army Geospatial Center and U.S. Army GIO Dr. Joseph Fontanella.

Masback asked DNI Clapper and Director Long to briefly address the crowd.

“We certainly all understand the decision that was made and support that and know the spring is going to be even better—even with all of the challenges that it comes with,” Long said.

Long thanked the attendees for being there and expressed appreciation for the Community’s flexibility throughout a challenging situation.

“It is great to see so many folks coming out here tonight,” she said. “We just very much look forward to next spring.”

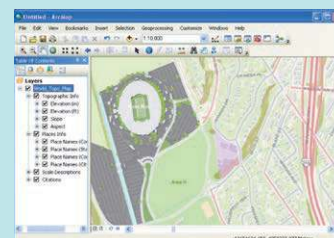
Clapper described the high turnout for the special event as a reflection on the importance of the Foundation and its efforts to foster relationships between government and industry. He also reiterated Masback’s sentiments about the power of Community.

“So as we contend with what I call the ‘4 Ss’—Syria, Sequestration, Snowden, and Shutdown—there has never been a time though when collectively all of us need to hang together more than right now,” Clapper said.

The DNI also gave a nod to the many industry partners present. “I’d be remiss if I didn’t take a moment to thank all of the corporate representatives here,” Clapper said. “Your presence here tonight speaks volumes about the success of the Foundation, and we’ll see you in the spring.”

Masback concluded that USGIF intends to communicate thoroughly and often as it shifts its focus toward an April Symposium, and the full array of other Foundation-sponsored events throughout 2014.

YOUNG PROFESSIONALS TRAIN AT ESRI



ArcGIS for Desktop

Members of USGIF’s Young Professionals Group (YPG) had the opportunity to learn more about what Esri offers beyond desktop capabilities during a private training event at Esri’s office in Vienna, Va., on Aug. 19.

Mark Bowlin, an account manager with Esri’s Defense and Intelligence team, helped coordinate the YPG session.

“The training held at the Esri office was an excellent fit for the YPG,” Bowlin said. “The members were exposed to the many facets of the ArcGIS platform. They were also able to get hands-on experience with the web-based offerings that they can take to their jobs and utilize immediately.”

The ArcGIS platform includes ArcGIS for Desktop, ArcGIS for Server, ArcGIS Online, and ArcGIS for Mobile. Overviews of Desktop, Server 10.1, and Online were shown during the presentation, and new imagery analysis tools were also demonstrated.

“The major message [YPG] members took away was that Esri offers more than desktop capabilities, and those capabilities are able to be used by any analyst,” Bowlin said.

The YPG is always looking for new opportunities to expose its members and the next generation of community leaders to varied technologies, services, and solutions. To learn more, contact carrie.drake@usgif.org.

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MOVING TOWARD A COMMON INFORMATION EXCHANGE MODEL

USGIF presented a luncheon panel discussion Sept. 16 on the National Information Exchange Model (NIEM), and how it is changing acquisition and collaboration. NIEM is a community-driven, standards-based approach to exchanging information across organizations. Originally a grassroots effort at state and local levels, the model is now being applied at 19 federal agencies.

Kshemendra Paul, program manager for the Information Sharing Environment (PM-ISE), moderated the panel, which included Donna Roy, executive director, Information Sharing Environment Office, Office of the CIO, Department of Homeland Security (DHS); David DeVries, deputy CIO for information enterprise, DoD; and Jeff Bell, deputy chief architect, and director, National Center for Geospatial Intelligence Standards, National Geospatial-Intelligence Agency (NGA).

Rather than creating new geospatial policy, the PM-ISE office works with NIEM and the Open Geospatial Consortium (OGC) to align existing policy in order to guide and advance geospatial interoperability, Paul said. The broad reach of his office has helped gain traction for the initiative, known as "GEO4NIEM," he added.

"NIEM IS A GREAT PLATFORM FOR SOLVING ISSUES WHERE THERE ARE NO OTHER STANDARDS OR WHERE THE INTEGRATION OF NIEM STANDARDS BECOMES CRITICAL." —Donna Roy

NIEM is growing and responding rapidly to community needs, according to Roy. NIEM 3.0 was released in October—the culmination of 13 months of engaging the community across 14 domains.

She added that NIEM is touching government at many levels, from the local and state, to DHS and the Intelligence Community, which recently achieved the baseline milestone for its developing Intelligence Community Information Technology Enterprise (IC ITE).

USGIF SHAPES PARTNERSHIP WITH DIGITALGLOBE FOUNDATION

USGIF has expanded its partnership with DigitalGlobe, corresponding with the Oct. 11 launch of The DigitalGlobe Foundation.

USGIF sponsors and promotes geospatial educational programs, and has accredited geospatial intelligence programs at eight colleges and universities. The DigitalGlobe Foundation will make grants to these academic institutions that need access to imagery, information, expertise, and tools in order to advance their research, develop their skills, and understand the unique potential of the geospatial industry and tradecraft.

"USGIF and The DigitalGlobe Foundation will make for a powerful team in support of the next generation of GEOINT professionals," said Keith Masback, USGIF CEO. "The students in our accredited programs will significantly benefit from the unique access they'll have to satellite imagery, as well as from the additional curriculum development assistance their schools will receive."

The DigitalGlobe Foundation is a nonprofit organization focused on fostering the growth of the next generation of geospatial technology professionals.

"The DigitalGlobe Foundation is uniquely positioned to help prepare the geospatial leaders of tomorrow," said Jeffrey R. Tarr, president and CEO of DigitalGlobe.



DIGITALGLOBE IMAGERY allowed Harvard graduate student Alyson Rose-Wood to map trends in malaria morbidity among Malian children.

PHOTO COURTESY OF DIGITALGLOBE FOUNDATION

SPOTLIGHT: USGIF SCHOLARSHIP RECIPIENT



Jennifer (Stitt) Bullock won a USGIF Scholarship in 2011 while obtaining her master's degree in geographic information science (GIS) at the University of Southern California.

Bullock always felt she had a knack for teaching and decided to use her degree to educate others. She currently teaches GIS at Helix Charter High School in La Mesa, Calif., and recently began her first year as an adjunct professor at Cuyamaca Community College in El Cajon, Calif.

In addition to teaching, Bullock collaborates with San Diego State University to discuss new ways of integrating GIS curriculum in grades K-12. She also researches and

gathers data on golden monkeys in China, a topic she has integrated into her high school courses.

Bullock said attending the GEOINT 2011 Symposium—she received complimentary registration the year of her scholarship award—has been a great source of inspiration for her in the classroom.

"I was able to network with professionals, which gave me topics and ideas to bring back to teach my high school students," Bullock said. "I enjoyed showing them the reality and application of GIS."

Although she enjoys teaching GIS, Bullock hopes to eventually become a digital learning consultant, where she can train GIS employees in the field.

Bullock's advice to students thinking about applying for a USGIF Scholarship: "Don't let your doubt blind you from applying—just give it a shot."



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AN INTERACTIVE EDUCATION

University of Redlands achieves USGIF accreditation for its accelerated master's degree program



PHOTO COURTESY OF UNIVERSITY OF REDLANDS

REDLANDS' GIS master's candidates brush up on basic GIS and cartography skills during a class assignment.



**STUDENTS ARE CURRENTLY
ENROLLED IN THE GIS MASTER'S
DEGREE PROGRAM AT REDLANDS**



PHOTO COURTESY OF WIKIPEDIA

THE MASTER of science degree in geographic information systems (GIS) from the University of Redlands in Redlands, Calif., is more than an average graduate program. With its unique Esri partnership and a dedicated full-time faculty of five, the Redlands graduate GIS program has helped students advance their skills and be catapulted directly into the workforce.

In addition to real-world workforce connections, the program now also offers students the opportunity to earn a USGIF Geospatial Intelligence Certificate. The Redlands GIS master's degree program gained USGIF accreditation in August 2013, making it the eighth university to be accredited by the Foundation.

Through the USGIF Collegiate Accreditation Program, students who meet high academic standards and graduate from accredited programs receive USGIF's GEO-INT Certificate, which is the first of its kind, and ensures the Community will have a robust workforce now and in the future.

"We're excited to be formally accredited," said Dr. Mark Kumler, a Redlands' GIS professor. "Students from the Intelligence Community, particularly from NSA, have been some of our very best, and we look forward to continuing a strong relationship with the Community, and taking advantage of our close ties with Esri."

Esri President Jack Dangermond and former University of Redlands' President Dr. James Appleton founded the master's program in 2001 as a way for mid-career GIS professionals to earn a graduate degree. The program has since graduated more than 300 students, with nearly 50 from numerous federal agencies, including the

National Geospatial-Intelligence Agency, Defense Intelligence Agency, Central Intelligence Agency, and Department of Homeland Security. The program also has great international participation. To date, students from approximately 50 countries have graduated or are enrolled. Currently, 62 students are going through the program.

Students complete the program in only one year—the duration of three Redlands semesters—taking courses ranging from basic GIS and cartography to more advanced classes in statistics, remote sensing, and imaging data. However, the crux of the program is a final research project where students apply GIS skills and assist local organizations working to integrate GIS capabilities into their day-to-day operations. Whether it's helping an arts and entertainment organization better its attendance to performances or locating the best spots for mussel farming in Southern California, the final project provides students a well-rounded base of project management and real-world skills.

"It was great to spend a year in this crazy, intense program with an excellent group of motivated students and supportive faculty, and come out the other side knowing that I had done something that someone really valued," said Caitlyn Raines, who graduated in 2013 and now works with Esri's database services team.

With Esri headquarters less than three miles from campus, Redlands students take advantage of the close proximity. As part of the curriculum, Esri professionals visit campus to present seminars and workshops on ArcGIS software and help train and prepare students for research. Esri also invites students to

present their research projects at the annual Esri International User Conference.

Having Esri at her fingertips was Lisa Berry's favorite part of her Redlands experience. She heard about the program's distinctive relationship with the company and the school's positive reputation from many friends and colleagues.

"My favorite aspect of the program is the support from the faculty. If you have questions, an idea, or need help finding job opportunities, there's always someone you can talk to."

—Numa Gremling, Redlands GIS student

"Being able to work closely with Esri, attend their conference, and network with professionals was very valuable," Berry said. "I like how Esri employees came to teach us and show [how] what we're learning can easily be used in the real world."

Numa Gremling, a current Redlands' GIS student from Luxembourg, said the positivity and encouragement from faculty is just another piece of what makes the program successful.

"My favorite aspect of the program is the support from the faculty," Gremling said. "If you have questions, an idea, or need help finding job opportunities, there's always someone you can talk to."

With the increasing demand for GIS and GEOINT professionals, many more future students will surely seek out an intense and interactive master's program such as this.

■ BY LINDSAY TILTON

To learn more about USGIF accreditation, visit usgif.org/education/accreditation.



PHOTO COURTESY OF UNIVERSITY OF REDLANDS

STUDENTS prepare their final projects, which are later presented at Esri's International User Conference.

BEYOND PRETTY PICTURES

USGIF's Modeling & Simulation Working Group applies standards to unite the GEOINT and M&S Communities



CAE'S COMMON DATABASE is an open, standard database that defines a single synthetic representation of the world for use by simulation systems.

IT'S IMPORTANT TO DIFFERENTIATE BETWEEN M&S FOR THE PURPOSE OF TRAINING SOLDIERS VERSUS INTELLIGENCE ANALYSTS.

To learn more about USGIF's Modeling & Simulation Working Group, email mswg@usgif.org.

GEOSPATIAL ELEMENTS such as terrain features, elevation, human geography, and imagery are often critical to the functionality of modeling and simulation (M&S) tools. Conversely, the opportunities for analysis of spatial intelligence activities and events using M&S are growing as geospatial information becomes more accurate and accessible.

For this reason, USGIF Members formed a Modeling & Simulation Working Group in 2012 to discuss common interests shared by the M&S and GEOINT Communities, as well as how the two can benefit from one another. Bridging the two communities is about effectiveness and efficiency, according to Dan Maxwell, co-chair of the working group and president of KaDSci.

"As computers get faster and there gets to be more and more data, the possibilities that present themselves by allowing GEOINT and M&S to interact even more fully are tremendous," Maxwell said. "But, there are also risks there that we want to make sure we think through."

For example, it's important to differentiate between M&S for the purpose of training soldiers versus intelligence analysts.

"Training simulations introduce a lot of realism for the purpose of helping soldiers to do their job better," Maxwell said. "But realism and reality aren't the same thing. From an intelligence perspective, we would rather integrate current data than have a pretty picture. It's a subtle but really important point as we start migrating away from training to things like decision support and rehearsal."

At USGIF'S GEOINT Community Week in May 2013, the M&S Working Group hosted demonstrations by VT MAK and USGIF Member Company CAE of their dynamic synthetic environment tools, both of which use open standards and common data.

"There are communities of simulation developers that are actually generating geospatial data to feed models and simulations for training and rehearsal," Maxwell said. "We could achieve efficiencies for the government if we could find ways to better share the data that they generate."

One governmental use of M&S is accurately replicating the joint operational environment for joint force development—a process where GEOINT products are critical according to U.S. Army Col. Dan Ray, with the Joint Chiefs of Staff's Joint M&S Environment Development Division.

A new era has just begun for M&S applications, Ray said, adding that standards reduce costs by allowing for the creation of common data structures from the outset.

"From our standpoint on joint M&S, a vast array of proprietary, simulation-specific formats are based on legacy data structures," Ray said. "We have a terrain team that expends a lot of energy, and therefore resources, in tweaking standard GEOINT data formats into simulation-specific formats, then modifying and normalizing the data so the various simulations can function. Our push to move joint M&S to a common database structure that uses standard GEOINT formats is going to move M&S in the right direction toward common and open data."

Building off the success of the GEOINT Community Week demonstrations, the M&S Working Group will host a more in depth follow-on session in April at the GEOINT Symposium in Tampa, Fla. The Symposium demonstrations will focus on using data published with standards from the Open Geospatial Consortium (OGC) that can be ingested directly into simulations. The working group and OGC are joining forces for the demonstrations, bringing together participants from DoD and federal agencies, as well as vendors, integrators, and data providers from industry.

"Open standards-based interoperability in M&S will enable the rapid repurposing of M&S data sets for use with other geospatial information in operational situational awareness and decision support applications," said Mark Reichardt, president and CEO of OGC. "Why is this important? For example, M&S data can be used to fill gaps in geospatial coverage, and it can support 'what if' scenarios as events unfold."

The Symposium demonstrations will feature participants from OGC, the National Oceanic and Atmospheric Administration, VT MAK, and USGIF Member Companies CACI, CAE, Compusult, DigitalGlobe, Envitia, and exactEarth. It will also include two demonstrations—one military and one civilian. The military scenario will simulate the rescue of soldiers from a combat situation in Yemen, with terrain modifications updated on the fly in response to late-breaking information. The civilian scenario will be set in Hawaii, and simulate an oil spill off the coast of Oahu. The purpose of the simulations will be to show how rapidly updates to an environment can be streamed using open standards.

"Both the GEOINT and M&S Communities have a challenging set of requirements," Ray said. "We need to maintain close alignment by collaborating and partnering in areas like data standards as we move forward."

■ BY KRISTIN QUINN

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and is rescheduled for April 14-17, 2014.

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THE WIE

This LiDAR image of the Konar Province of Afghanistan was captured under the U.S. Army Geospatial Center's BuckEye Program, which provides unclassified, high-resolution geospatial data for tactical missions.



THE NEXT GENERATION

OF AIRBORNE MILITARY ASSETS WILL DELIVER TROVES OF CUTTING-EDGE INTELLIGENCE. THE WAVE OF THE FUTURE, HOWEVER, ISN'T JUST COLLECTING DATA—IT'S FINDING BETTER WAYS TO EXPLOIT IT.

BY MATT ALDERTON

FROM ABOVE

“I can see my house from here!”

A boy's first flight aboard a commercial airliner is magical. At an altitude of 40,000 feet, he realizes for the first time the sheer size of the world in which he lives.

The view from above — more vast than he'd ever imagined on the ground — offers him new perspectives and possibilities. The best way forward, he realizes, is up.

PHOTO COURTESY OF USACE



A soldier's first flight aboard an Enhanced Medium Altitude Reconnaissance and Surveillance System (EMARSS) aircraft promises the same awakening all over again. Thanks to its seven-hour flight time, high-bandwidth data links, modular open system architecture, and generous payload capacity, the Boeing-built multi-INT platform offers a view that's not only farther and wider than that on the ground, but also deeper. When it's accessorized with cutting-edge sensors that capture imagery and other information, one can not only see the enemy's house, but also who's entering it, where they're coming from, when they leave, and where they're headed when they do.

"This one airplane can do what it used to take more than three airplanes to do," said Mark Stephenson, Boeing's EMARSS program manager, whose team in 2010 won a U.S. Army contract for four EMARSS aircraft, the first of which completed its first test flight in May 2013.

EMARSS is but one cog in an enormous machine that's shaping the future of airborne intelligence,

surveillance, and reconnaissance (ISR). For the boy looking down on his house—who one day becomes a soldier looking down on a threat—that future is one in which adversaries cannot hide. Along with sophisticated platforms and advanced sensors, this future requires new ways of working that replace "seeking" with "finding."

THE CASE FOR AIRBORNE

Airborne ISR dates back to the Civil War, when Union soldiers used hot air balloons to spy on Confederate troops. The deployment of manned observation balloons carried over into World War I, when Zeppelins and the use of fixed-wing aircrafts for reconnaissance were first introduced. By World War II, aerial photography was prolific, producing superior situational awareness, but at a significant cost: Gathering intelligence required flying great distances to and from the battlefield, as well as flying at low altitude over enemy territory and developing miles of film that had to be

manually analyzed and stored.

"Airborne ISR was very tedious in its infancy," said Eric Zitz, a lead associate at Booz Allen Hamilton, where he serves as an intelligence integration specialist for the National Geospatial-Intelligence Agency (NGA). "It produced an incredible amount of raw film that had to be taken off the airplane and processed just like you would an old Kodak roll, then given to someone who knew what they were looking for."

In the decades after World War II, when the dominant reconnaissance aircraft was the F-4 variant of Lockheed Martin's P-38, the United States made several notable advancements in aerial platforms, including the Lockheed U-2 jet-powered reconnaissance platform, which was introduced in 1955; the Ryan Model 147, an unmanned reconnaissance aircraft created in 1962; the Lockheed A-12 reconnaissance aircraft, first flown for the CIA as a U-2 back-up in 1962; and the A-12's doppelganger—the Lockheed SR-71 Blackbird, a high-speed, high-altitude reconnaissance platform in use from 1966 until 1998.

"There was a fairly major breakthrough [in airborne ISR] in 1983, when we learned to put data links on our aircraft with the U-2," said retired Air Force Maj. Gen. James Poss, former assistant deputy chief of staff for ISR at U.S. Air Force headquarters. "I'll make the argument, though, that aerial reconnaissance really hadn't changed much since WWII."

It finally did change—"fundamentally," according to Poss—in 1995, when Abraham Kareem designed the MQ-1 Predator unmanned aerial vehicle (UAV). "He took a miniaturized version of what CNN uses to broadcast live imagery and essentially designed an aircraft around it," Poss said. "After Desert Storm, we invented the Global Positioning System (GPS) and deployed a massive amount of laser-guided weapons. Our adversaries learned they had to be constantly moving, and we now had a surveillance vehicle that would allow us to follow them persistently—whatever it took to find them and wait for the perfect moment to strike. It revolutionized the way we do airpower."

The revolution wasn't the Predator's platform so much as it was its satellite data link, which allowed the military

to collect continuous imagery from behind enemy lines. "We realized that WWII-style reconnaissance wasn't going to work anymore," Poss continued. "We needed constant surveillance and we needed advanced data links to allow us to go deep in [hostile] territory."

Since then, demand for persistent surveillance and advanced data links has grown exponentially under the thumb of two trends—technology and terrorism. The War on Terror isn't a war against stationary military targets such as airfields, ports, and complexes, but rather individual adversaries who are constantly shifting locations.

Against this backdrop, airborne platforms are increasingly advantageous, as they can navigate around weather, get closer to targets, fly time- and place-specific missions, and allow for agility with respect to sensor selection.

"Satellite platforms offer data at a global scale according to a systematic time schedule, and with a highly centralized data processing and distribution system," said Nancy McGee, federal business development manager for Fugro EarthData, a remote sensing, mapping, and GIS services company. "Airborne platforms offer the alternative of a more user-specific service at a regional scale, so that data acquisition can be organized flexibly both in time and space. They're flexible, temporal, and targeted."

Put another way, spaceborne assets have breadth, but airborne assets have depth.

"Satellites have huge collection footprints, but airborne platforms get a lot closer," Zitz explained. "You don't get as much area, but you get a much higher resolution."

Given current threats, high resolution is a major benefit. "Imagine if the resolution is so good that I can not only see a guy, but I can see that guy's face, or maybe even read the paper he's holding," Zitz said.

EMERGING CAPABILITIES

High-resolution imagery is only the beginning. Ultimately, airborne ISR consists of three major aspects: platforms; sensors; and processing, exploitation, and dissemination (PED) technologies, all of which are maturing rapidly.

THE BOEING EMARSS airborne ISR platform is among new aircraft being designed to facilitate multi-INT fusion, and is therefore poised to exploit and integrate the next generation of aerial sensors.

AIRBORNE ISR AT HOME

When it comes to platforms, intelligence experts cite two major opportunities. The first is persistence: Platforms that can stay in the air longer can collect more and better intelligence.

"We're very interested to find the knee of the curve for cost per flight hour in endurance," Poss said. "We spend about 30 to 40 percent of our time transiting Predators and Reapers to target, so coming up with a long-endurance platform that won't have to make that transit time every 24 hours, but only once a week, is very attractive."

Because no pilot can fly for days, achieving longer flight times is reserved for UAVs—including the aforementioned Predator and Reaper, current versions of which have flight durations of 24 and 14 hours, respectively. In contrast, alternatively-fueled UAVs currently in development, such as Aurora Flight Sciences' hydrogen-powered Orion UAV and Titan Aerospace's solar-powered SOLARA UAV, promise endurance of five days and five years, respectively.

The second major opportunity modern platforms offer is payload capacity: Platforms that carry more weight can accommodate more sensors, the result of which is multi-INT functionality that produces a more complete intelligence picture.

"Multi-INT is extremely important," said Mike Manzo, director of geospatial solutions in the Imagery Systems division at General Dynamics Advanced Information Systems. "You get a much richer picture when you're looking at multiple [sources] of data."

Miniaturization of sensors—fitting more capabilities into smaller, lighter, and therefore cheaper packages—is also key, according to Dr. Armando Guevara, president and CEO of aerial imaging technology company Visual Intelligence. "Miniaturization will bring to bear the fusion of sensors in ways that were not possible before, thereby creating a brand-new opening for multi-INT," he said.

New platforms like EMARSS were designed with multi-INT fusion in mind and are therefore perfectly positioned to exploit and integrate the next generation of aerial sensors, including:

- Wide-area motion sensors capable of scanning entire cities;
- High-definition, full-motion video

sensors that can help analysts distinguish, for instance, a civilian raising a cellphone from a militant raising a weapon;

- Canopy-penetrating LiDAR sensors that generate weather- and light-independent maps;
- Biometric sensors that can remotely establish targets' identities;
- SIGINT sensors that detect telecommunications activity;
- Infrared sensors that register heat; and
- Hyperspectral sensors that can read hundreds of bands of color in order to identify materials and differentiate objects.

When all of these capabilities are combined, it creates considerable context for the end user. For example, not only can an analyst see a group of people outside a house, but can tell the group is setting up a decoy because the image's multi-spectral signature reveals what the house is made of. Or, if an analyst sees a car, he or she can also tell it recently arrived at the location because the infrared sensor shows the vehicle is still warm. Such insights are very powerful in decision-making.

THE POWER OF PED

The technological trajectory of platforms and sensors suggests infinite possibilities for airborne ISR. There's just one problem: Data collection is evolving faster than data processing.

"The volume of image and sensor data we can generate means that management of image and sensor data is the primary computational challenge of the 21st century," said Dr. David Brady, an optical engineer at Duke University, where researchers are developing an ultra-high-resolution camera—called Aware-2—for use in airborne ISR.

The data content already is too much for analysts to swallow.

"Presently, you've got a 4,000-person [data analysis] wing at Langley Air Force Base that's barely keeping up with what our present generation of sensors is giving us," Poss said. "We've got to put a lot more effort into figuring out ways to automate PED, which is really the toughest part of airborne ISR."

In fact, industry is hard at work on evolved PED solutions, including advanced data links. Boeing, for example, is working on the Family of Advanced

Advances in airborne ISR also have domestic, civic, and humanitarian applications. For instance, the same platforms and sensors used to track enemies abroad can be used at home for disaster response, environmental research, and law enforcement.

U.S. Customs and Border Protection uses UAVs to secure the country's borders and combat drug trafficking. Meanwhile, NASA uses them to study hurricanes, while the U.S. Department of Commerce has funded research to study whether UAVs can assist with bridge inspections.

Similarly, the Federal Emergency Management Agency has relied on high-resolution aerial imagery in the wake of natural disasters, such as the May 2013 tornado in Moore, Okla., after which it used advanced imagery from the Civil Air Patrol to create geospatial damage assessments.

"UAS [Unmanned Aerial Systems] have a wide range of domestic applications that can help everyone from firefighters to environmental researchers to farmers save money, save time and, most importantly, save lives," said Michael Toscano, president and CEO of the Association for Unmanned Vehicle Systems International. "Because of their low operating costs and ability to fly in dangerous situations, UAS are ideal for applications such as search and rescue missions and surveying severe weather."

Although domestic agencies typically can't afford their own airborne ISR assets, applying defense technology for non-defense missions presents many possibilities. "We're not just involved in wars," said Mike Manzo, director of geospatial solutions in the Imagery Systems division at General Dynamics Advanced Information Systems. "There's no reason a manned surveillance platform that was flying in the mountains of Afghanistan can't be reused and repurposed to provide humanitarian relief after a hurricane."



THIS AERIAL VIEW shows the damage caused by Hurricane Sandy to the New Jersey coast taken during a search and rescue mission by the 1-150 Assault Helicopter Battalion, New Jersey Army National Guard on Oct. 30, 2012.

IMAGE COURTESY OF MARK C. OLSEN/U.S. AIR FORCE



LIDAR impervious surface map of Springfield, Ohio.

Beyond Line-of-Sight Terminals (FAB-T), which could support airborne ISR in remote areas with High Data Rate satellite communications. Meanwhile, San Diego-based Cubic Defense Applications is using cutting-edge micro-electronics to develop a smaller, lighter multiband digital data link system for the U.S. Navy's MQ-8C Fire Scout unmanned helicopter.

"A data link system that used to be the size of a toaster oven is now the size of three Pop-Tarts," said Robert Kalebaugh, senior director of business development for Cubic Defense Applications. "The smaller size benefits manned and unmanned air platforms because lighter-weight systems will save on fuel, which could allow the aircraft to fly longer missions. It is also much easier for ground troops to transport."

And yet, new PED policies and infrastructure ultimately are needed in order for software and data links to deliver their promised benefits—especially as the U.S. shifts attention and resources out of Iraq and Afghanistan and into new, less familiar areas of interest, such as South America, Africa, and Asia, where paucities of permissive airspace, funding, ground assets, and coalition partners could pose significant challenges.

"In the past, we have essentially owned the skies in the areas in which we wanted to operate, and because of that we've had the luxury of flying any type of airborne mission we wanted," Manzo said. "Because we don't necessarily own the airspace in the emerging

areas we want to look at, the concepts, techniques, and procedures we use will be different."

In asymmetric regions where targets are complex and resources scarce, collecting data is futile without the means to also interpret it.

"The discussion about PED should precede the discussion about platforms because it's how information is examined and analyzed that allows us to get more squeeze out of the fruit," said Lt. Col. Faye Cuevas, an intelligence officer in the U.S. Air Force Reserves. "Instead of focusing entirely on advanced sensors and integrating new phenomenology, we need to look at how we treat information once we have it."

The DoD understands the importance of PED, which is why it created the Distributed Common Ground System (DCGS). As part of the Defense Intelligence Information Enterprise (DIZE)—the information network that connects DoD with the rest of the Intelligence Community (IC)—the goal of DCGS is to improve data processing and exploitation by activating shared intelligence across all four U.S. military branches.

"The DCGS family of systems was established to create a unified intelligence picture," said Army Col. Charles Wells, program manager for the Army's DCGS system, DCGS-A, which launched in 2005 and now contains more than 131 million pieces of data, not to mention every intelligence report made since 2004. "That's powerful for

two reasons. First, when you bring all your intelligence into one system you have what we call an all-source analyst who looks at all the pieces of the puzzle and puts together very powerful answers because they're literally seeing all the dots they need to connect. Second, when you have a common architecture and a common framework, you start to get collaboration between services; we're all building to a common blueprint."

Although more progress is needed, current PED hardware—for example, Northrop Grumman's Ground Station, Operational Intelligence (OGS) truck-mounted military shelter—already is advancing the DCGS vision by connecting disparate Army networks, operators, and multi-INT sensors.

"We're now getting more and more data at the tactical edge," Wells said. "The question that remains is: How do we get more meaning out of that data?"

REACHING NEW ALTITUDES

The first step is to make sure PED technology keeps pace with advances in platforms and sensors.

"Where you achieve maximum capability is when all three are in sync," said Dave Bottom, director of NSA's information technology services directorate. "We have to make sure we have the PED that is able to handle what the sensor is able to collect and deliver it in such a way that the analyst or decision maker can understand it and act on it."

The analyst is just as important as the technology, according to Bottom, who stressed the need to develop and deploy more multi-INT analysts, as has been done to support DCGS-A. "Both PED and collectors need to be optimized for the whole more than they are a particular type of phenomenology," he said.

Instead of traditional PED centers of excellence, Cuevas advocates the deployment of analysts inside non-traditional organizations, like the U.S. Agency for International Development (USAID).

"In somewhere like Africa, you don't always see bad guys, but because you're in a place where bad guys go and bad things happen, there are other things within a frame of video or an image still that have relevance," she said, emphasizing the

value of seating analysts next to subject-matter experts who know problem sets best. "As a DoD intelligence analyst, I can analyze data for its intelligence value, but an environmental engineer, an agronomist, or a hydrologist can bring a unique texture that generates better understanding of the operational environment."

Optimizing PED in this manner requires eliminating traditional stovepipes to facilitate more data sharing and collaboration across DoD and the IC, which despite DCGS and DI2E has been hindered by gaps in policy, culture, and governance.

One solution is democratizing data with cloud computing, resulting in PED that's based on access instead of dissemination.

"Moving to a cloud or distributed model allows you to connect things that were once not connected," Manzo said. "By pushing a lot of data into the cloud you're broadening its reach and utility, and also breaking down those typical stovepipe barriers."

Take PIXIA's HiPER STARE and HiPER WATCH software, for example, which catalog, organize, and share large volumes of multi-INT data within a cloud-based architecture. With such solutions, intelligence is more "pull" than "push." Analysts previously tasked with answering questions about disparate pieces of information can now query the cloud like they would a search engine to discover all relevant data, regardless of type or heritage.

Because it keeps data stationary, cloud computing also solves storage and bandwidth challenges associated with advanced sensors.

"What we have now is intelligence that requires a lot of storage and processing," explained Wells, who said the next iteration of DCGS-A would live in the cloud. "Cloud computing allows us to do local processing and storage to get meaningful answers out of massive amounts of data on the tactical edge."

Moore's law—the principle that computing power doubles every 18 months—likewise will help streamline data processing through automation. For instance, many sensor companies are developing onboard processing capabilities—as computing power increases, their ultimate goal is equipping sensors with

processors that can sort data upon collecting it and filter only relevant information to PED specialists on the ground.

"That's a smart thing to do for two reasons," Wells continued. "First, you're not getting as much raw data. When I receive data at DCGS-A, I already have half the answer I'm looking for. Second, it helps with bandwidth.

Next-generation sensors are collecting terabytes of raw data, so doing some of the processing on board [reduces stress on our network]."

This could allow analysts on the ground to spend minutes looking at video instead of hours, thereby catalyzing better and faster decision-making.

"It's all about collecting the right data at the right time and having the right system in place to exploit it," Manzo said.

THE ROLE OF GEOINT

Because so much of airborne ISR is grounded in imagery, the GEOINT Community is ideally positioned to lead the transition from a focus on platforms to a focus on PED, the result of which will be crucial for realizing a future in which intelligence isn't just informational, but also contextual.

"GEOINT has a unique ability to integrate with other [types and sources of data]," Bottom said. "Everything happens somewhere and at some time, so location is usually the first point of integration."

Simply put: The GEOINT Community has the opportunity to champion consolidation and collaboration by modeling them.

"Geospatial intelligence is a critical component supporting our common operational picture. It is a central focus and foundation area for consolidated multi-intelligence, and will only increase in importance as we consolidate previously stove-piped intelligence and mission command systems into a common operational environment," Wells concluded. "GEOINT subject matter experts must partner with their Intelligence Community counterparts to collaborate on technology advances, data collection, research and development to ensure the [U.S.] gets the maximum benefit from high-payoff [airborne ISR] capabilities." ■

A TIMELINE OF NOTABLE AIRBORNE ISR PLATFORMS*

CIVIL WAR BALLOON (1861): Airborne ISR in its most basic form dates back to the Civil War, when Union soldiers used hot air balloons to spy on Confederate troops.



LOCKHEED P-38 LIGHTNING (1939):

Originally a fighter plane; a reconnaissance version known as the F-4 Photo Lightning—in which the guns were replaced with cameras—was the first Lightning to see active service during World War II in 1942.



LOCKHEED U-2 (1955): The U-2, nicknamed "Dragon Lady," is a high-altitude reconnaissance aircraft that has been flown variously over time by both the Central Intelligence Agency (CIA) and the U.S. Air Force. It figured prominently during the Cold War, when U-2s frequently conducted airborne ISR missions over Communist states.



MCDONNELL DOUGLAS F-4 PHANTOM II (1958):

The Phantom is a large fighter jet that was originally developed for the U.S. Navy. During the Vietnam War, the U.S.

Air Force deployed a photoreconnaissance variant known as the RF-4C, which was similarly utilized for airborne ISR in 1990 during the Gulf War.



RYAN MODEL 147 LIGHTNING BUG (1962): The Lightning Bug UAV flew its first airborne ISR mission over Communist China in 1964, after which it flew numerous missions over Vietnam.



LOCKHEED A-12 OXCART (1962) AND SR-71 BLACKBIRD (1964):

The Blackbird is a long-range reconnaissance aircraft operating at speeds and altitudes high enough to outrace enemy missiles. An offshoot of the Lockheed A-12 reconnaissance aircraft—built for the CIA as a U-2 back-up—Blackbird served the U.S. Air Force until 1998.

GENERAL ATOMICS MQ-1 PREDATOR (1994): The Predator is used by the CIA and the U.S. Air Force. Outfitted with sensors, cameras, and munitions, it was the first weaponized UAV.



BOEING F/A-18E/F SUPER HORNET (1995): The Super Hornet is a multi-role fighter jet whose missions for the U.S. Navy include air superiority, fighter escort, armed reconnaissance, aerial refueling, close air support, air defense suppression, and precision strike. Its Shared Reconnaissance Pod (SHARP) is a high-resolution, digital tactical air reconnaissance system that features advanced day/night and all-weather capability.

NORTHROP GRUMMAN RQ-4 GLOBAL HAWK (1998):

The Global Hawk is a UAV surveillance aircraft operated by the U.S. Air Force and U.S. Navy. Often compared to the U-2, it's notable for its long endurance and wide-area capabilities.



GENERAL ATOMICS MQ-9 REAPER (2001):

A larger version of the Predator, the Reaper carries both sensors and missiles; it is the first "hunter-killer" UAV designed for long-endurance, high-altitude airborne ISR.

*Years based on first flights.

PN: 9472950

PASSENGERS STRIDE: MATCH
KINEMATIC MOVEMENT: 35.46
SPEED: .56



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REPLICATION

The new host, now fully infected with the meme, engages in various behaviors, the goal of which is to close the memetic feedback loop, and perpetuate the symbiotic relationship between the brain and thought.

MATERIALS OF
CONCERN FOUND
IN BAGGAGE

PN: 5784030

PN: 5305968

BY MARK WOLVERTON

AUGMENTING REALITY

AUGMENTED REALITY TRACKS ONE'S LOCATION IN BOTH SPACE
AND TIME. THUS, ITS VERY FOUNDATION IS GEOSPATIAL.

A COSMOPOLITAN YOUNG COUPLE appears lost as they tour a busy city street in a foreign country. The man holds up his smartphone and a digital overlay appears on his camera view, dropping a pinpoint at a nearby building to identify a restaurant recommended by a friend. This is a common storyline in TV commercials touting the latest smartphone and its corresponding capabilities, but it's also an illustration of augmented reality in its most basic form.

Augmented reality (AR) is simply defined as “a technology that superimposes a computer-generated image on a user’s view of the real world, thus providing a composite view.” Hence how the term was coined—it is a technology that literally augments reality.

In the commercial world, AR has been around for some time in the form of smartphone travel apps, allowing curious users to lay digital points atop of the real world, and quickly gather data on hotels, restaurants, landmarks, and more. More recently, the fervor over the development of Google Glass, an optical display worn like a pair of glasses for completely hands-free computing, has brought interest in the possibilities of AR to a whole new level.

“People tend to typically think of AR as ‘Terminator vision,’” said John Clark, chief innovation officer at Thermopylae

become as pervasive in our lives as smartphones; others see its adoption as a slower process. Either way, AR is rapidly growing in importance—and because it depends on keeping track of one’s location in both space and time, the very foundation of all AR data is geospatial.

FROM PRIVATE SECTOR TO PUBLIC SERVICE

It’s a misconception that AR is radically futuristic and brand new. As futuristic as it may seem, it’s hardly a new technology. AR was used, at least on a limited basis, by manufacturers such as Boeing and by the U.S. military as far back as the late 1980s. What is new is that computing technology has advanced exponentially in power, speed, and capacity while shrinking in size and cost, making AR more accessible and practical for broader audiences and generalized purposes.

“The interesting thing about that is we think of AR in the commercial marketplace as being pretty leading edge,” said Mark White, chief technology officer of Deloitte Consulting, which recently published a white paper on potential uses for AR in the federal government. “Particularly in military and defense, it’s not that new. Some of the very first systems that implemented AR were in the defense space.”

Take for instance the sophisticated capabilities in Lockheed Martin’s F-35 Lightning II helmet, which takes advantage of heads-up display technology to show flight conditions, targeting information, and warnings in real time. This eliminates the need for the pilot to refer to heads down displays, and therefore reduces workload and increases responsiveness. The helmet also provides the pilot with night vision capabilities, using the helmet’s camera and Distributed Aperture System (DAS).

But more remarkably, the DAS generates a global view of the world around the F-35, allowing the pilot to “see through” the fuselage to view what is above, beside, and beneath the aircraft. Items of reference such as waypoints and targets are also captured and displayed on the pilot’s line of sight.

“The information provided is a conglomeration of data gathered from all the sensors on the F-35 to produce

uniform situational awareness representation to the pilot,” said Casey Contini, Lockheed Martin’s F-35 engineering director for electro-optics and helmet.

While the F-35 team paves the way for pilots to employ augmented reality, the U.S. Army has taken a cue from Google Glass and is experimenting with the use of tactical glasses to develop solutions for soldiers on the move.

An early version of Google Glass is currently being beta tested through programs for early technology adopters such as Robert Scoble, startup liaison for open cloud computing company Rackspace and co-author of the book *Age of Context: Mobile, Sensors, Data and the Future of Privacy*.

“Using [Glass] for photography has been life-changing for me,” Scoble said. “I’m getting moments with my kids that I never got before because it’s the first camera that’s always ready. It takes less than one second to take a picture.”

That ease of access to an application has wide-reaching implications, particularly for the DoD and Intelligence Community.

“I’m taking two to five times more photos and videos, and I’m much more likely to take a video with this thing in the street,” Scoble said. “So when we have something like the Boston [Marathon] bombing, we’ll have even more video and photos available.”

Scoble’s predictions are inching closer to reality. In July, the Army tested the use of tactical glasses during Enterprise Challenge 2013 at Fort Huachuca, Ariz. The glasses were at the heart of the Distributed Common Ground System-Army (DCGS-A) exercise.

Full motion video from a Gray Eagle unmanned aircraft was exported to soldiers equipped with tactical glasses from Osterhout Design Group. Although the exercise deployed a Gray Eagle UAV and soldiers were tethered to the DCGS-A Tactical-Intelligence Ground Station vehicle, the prototype is designed to work with any airborne ISR platform and to eventually be untethered, according to Col. Edward Riehle, U.S. Army Training and Doctrine Command capabilities manager for sensors and sensor processing.

“The soldiers that used the glasses appreciated the ability to conduct



IMAGE COURTESY OF LOCKHEED MARTIN

THE REVOLUTIONARY LOCKHEED MARTIN F-35 LIGHTNING II HELMET allows a pilot to “see through” the aircraft, providing views of what is in front of, alongside, and even below.

Sciences and Technology, referencing the character Arnold Schwarzenegger played in the 1984 film. “But from a computer science perspective, that’s only one application of AR.”

Indeed, AR is much more than just mobile, wearable computing, but Google Glass has the potential to catapult the technology into everyday life. The capabilities and promise of AR also reach into law enforcement and security, intelligence, and even the military.

As both the hardware and software for AR is developed to greater sophistication, some experts predict it will

operations on the move,” Riehle said. “The fact that you can put the glasses on, drive, provide reports, and not be encumbered by a computer was very helpful for them.”

In the case of Enterprise Challenge, the tactical glasses allowed an intelligence analyst to more easily wear his other hat of Track Commander while the convoy was on the move.

“Normally you’re looking at a computer to see the FMV display,” Riehle said. “When you’re moving, your job is to be the Track Commander, not so much an analyst. Putting the imagery on his head allows [the analyst] to do both jobs.”

Riehle added that tactical glasses eliminate the light signature put off by computers when a convoy is traveling at night. The Army will continue developing the project, with another tactical glasses exercise planned for Enterprise Challenge 2014. Riehle predicts the service will move toward head-worn computing devices for a number of capabilities in the near future.

“I don’t believe it’s just an intelligence analyst tool,” he said. “It shapes our situational understanding and awareness for soldiers at any echelon, so we need to move this capability to the soldier who’s on the edge.”

Riehle added that GEOINT is what really creates the bridge from head-worn computing into full-blown AR technology, recalling how, in the past, data was overlaid on paper maps using acetate.

“When we go digital, we don’t have to do that anymore,” he said. “We can augment that geospatial layer in a continuous process and get it all the way down to the soldier.”

Riehle added that potential Army AR uses could include overlaying IED hot spots, road conditions, and both friendly and enemy force disposition, to name a few.

The Defense Advanced Research Projects Agency (DARPA) is also evaluating a prototype AR system for soldiers in the field called Urban Leader Tactical Response, Awareness, and Visualization (ULTRA-VIS). By overlaying full-color graphics onto the real-world scene confronting the soldier, ULTRA-VIS reveals other forces, vehicles, and threats in the area that

aren’t visible to the naked eye, such as a sniper lurking on the other side of a building. The system can also tie into remote data feeds to provide a variety of tactical information. Taking the idea a step further, DARPA is also working with a company called Innovega iOptics to develop AR-enabled contact lenses that project information in the field of vision near the eye, allowing the wearer to view data while still focusing on the more distant real-world scene.

REALIZING POTENTIAL—CAUTIOUSLY

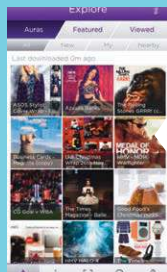
The burgeoning development of commercial-based AR has both inspired and driven the adoption and expansion of AR in government.

“It used to be that in order to afford a heads-up display for completing a complex task in a difficult situation, [you] had to have plenty of resources and it came from the labs, from the big guys down,” White said. “Now, with

FACETS OF REALITY (AUGMENTED)

Ready or not, augmented reality will soon be integrated into many public, professional, and personal realms. A few imminent, prospective, and sometimes already extant examples:

GOOGLE GLASS hardware is expected to be available for sale to the general public sometime in 2014. As with the iPhone, expect a flood of new apps and updates to quickly follow, including many built around AR.



Hewlett-Packard’s **AURASMA** app overlays “auras” of information and enhanced content for images provided through the smartphone’s camera.

SIXTHSENSE, developed at the MIT Media Lab, uses a pocket-sized projector and camera tied to a mobile computer to project information, labels, and more onto real-world surfaces such as a wall, newspaper, or tabletop. So far, it exists only in prototype form, but a future commercial version may yet evolve.



Already available are apps such as **PHILLYHISTORY.ORG**, which uses geospatial data to show tourists standing in a particular location a view of the same spot from various historical time periods.

Philadelphia’s Franklin Institute is implementing Augmented Reality for Interpretive and Experiential Learning (**ARIEL**) to take interactive science museum exhibits to a new level.





“There’s a real tendency to embrace technology because it’s the latest and greatest thing, but one of the things we have to think about is, what really will we get out of it?”

—Mark Borkowski, assistant commissioner for the Office of Technology Innovation and Acquisition, U.S. Customs and Border Protection

consumerization, democratization, and technical advancements, it’s coming from the little guys up.”

A 2013 study by Deloitte’s GovLab think tank, titled “Augmented Government: Transforming Government Services through Augmented Reality,” noted that despite the increasing use of AR in the civilian sector, “Its strategic application to government service delivery is still nascent.”

The report details three hypothetical scenarios in which AR could play a vital

role in government-based functions: one involving the scenario-based training of new border patrol agents; another depicting the detection and capture of a suspicious traveler trying to sneak explosives onto an airliner; and finally, FEMA personnel using AR to locate and rescue people trapped by a hurricane.

“The three examples that are in the paper are not real, but they are realizable,” White said. “None of them are beyond the reality of the technology.”

So, if augmented reality has such vast potential to enhance and improve government missions and tasks, why isn’t everyone using it already? Security, for starters.

“Security is critical—being certified to run this data over our networks,” Riehle said. “We have to get that right and it’s too important not to. I think that [is] one of our biggest challenges.”

There are other technical considerations, such as improving the battery life of visual displays and general reliability, as well as more ambiguous issues to consider, such as privacy, access to information, distraction, or confusing virtual layers with the real.

What will be the consequences of the technology when someone with AR-enabled contact lenses can glance at a stranger on the street and instantly access their entire personal profile, including address, employment and criminal records, family information, social media pages, and even real-time medical data such as blood pressure and heart rate—especially if that stranger is an undercover police

officer or federal agent? What happens if AR systems are hacked or spoofed? And is the technology dependable enough for situations that allow for zero margin of error, such as the battlefield or a natural disaster area?

Given such unanswered questions, it’s easy to see why some federal agencies are more hesitant to embrace the technology.

“We have some things that we do now that I think could be improved with the use of AR,” said Mark Borkowski, assistant commissioner for the Office of Technology Innovation and Acquisition with U.S. Customs and Border Protection (CBP). But, he added, “There’s a lot of work we all believe has to happen to make AR ready for that kind of an application.”

Inspecting people and vehicles passing through ports of entry is one job for which AR could be valuable, Borkowski said. But it’s not clear yet just how valuable.

“There’s a real tendency to embrace technology because it’s the latest and greatest thing, but one of the things we have to think about is, what really will we get out of it?” Borkowski asked. “Does it really make a difference if I have AR at a port of entry compared to looking at a monitor from a normal computer screen at my booth?”

Another possible application might be noting subtle changes in the physical landscape that could indicate illegal entry and activity.

“This is again somewhat in the future, but we’re very interested in being able to detect changes in areas,” Borkowski said. “Because if there’s a change in an area, there’s something that caused it, and that’s good information to us. So to the degree that AR would help us overlay what was in a

THERMOPYLAE SCIENCES AND TECHNOLOGY’S UBIQUITY mobile framework visualizes battlefield intelligence using U.S. Military Standard 2525B symbology.





COL. CHARLES WELLS, program manager, Distributed Common Ground System-Army, assesses the tactical glasses being demonstrated at Enterprise Challenge 2013, in which DCGS-A showed its ability to share full-motion video between Air Force assets, including a Global Hawk directly linked to the Army's DCGS-A Tactical Ground Station.

place yesterday compared to what's in a place today, that might be a very useful tool downstream for [CBP]."

Training is another area where AR could prove valuable. Police officers, federal agents, and soldiers who face tough decisions about the proper use of deadly force in dangerous situations often use virtual reality—large video game-like screens and simulated weapons—to train without the risk of live fire. But AR-based scenarios could potentially take the realism to a whole new level.

"Those kind of training scenarios would benefit from something like AR where we could do these things in the actual operational environment, overlaid and augmented with AR," Borkowski said.

But, Borkowski hasn't completely jumped on the AR bandwagon.

"It's the algorithmic development and then access to data that's more likely to be a challenge," he said. "To some degree, this could become a big data problem. How do you get access to data, synthesize that data to information, and then find a way to depict what you've concluded from all that data in a way that's useful to whoever's using the AR?"

Borkowski doesn't entirely dismiss the technology's promise, either.

"We haven't quite gotten our arms around what we might do with it," he concluded. "But [AR] intrigues us and we will want to follow it as we go forward."

THE FOUNDATIONAL LAYER

Handling the enormous amount of data required to make AR successful is where geospatial data management comes in. In the future, each time a pilot, soldier, or border patrol agent swivels his or her head to follow an ever-changing situation, their AR device must swiftly scan, locate, tag, and return information on a tsunami of data points, all in real time.

"We want to be able to ubiquitously share our geospatial AR library with all of these devices," said A.J. Clark, president of Thermopylae Sciences and Technology. "That means having to manage potentially billions of objects. If you're walking down the street, AR could be everything from giving you the name and address of a building, to walking up close to it and wanting to see where the bricks came from that are on it, or what kind of parts you might need to replace the doors or the hinges. It gets kind of complex. So for us, we just

want to be able to deal with broad AR down to detailed objects, which requires storing this geo-data in new ways."

John Clark added, "I like to say all data is geospatial, even if it's just your device's location or how much information you requested when you're in that area. Because it's not just the location of the building where you are, it's what you do when you're near it, how many people go in and out of that building, how many Google searches about that building there are. It's relating all that other content in time and space that we're focused on. And then how to make it relevant for businesses, government, and users."

Riehle is enthusiastic about AR's ability to enhance and bring "flat maps" to life.

"AR allows you to analyze and annotate the changes and get them forward to the soldier, so not only are they seeing what the sensor is looking at, but also can be informed by what the analyst is looking at, and that data can be moved to them over the geospatial plane."

Choose to embrace it fully for the missions and tasks at hand, or choose to adopt it sparingly and cautiously, but it's undeniable—augmented reality will soon be a part of our reality. ■



FUTURE GEOINT LEADERS

MEET THE 2013 USGIF
SCHOLARSHIP WINNERS

USGIF AWARDS SCHOLARSHIPS

annually to promising high school seniors, as well as collegiate undergraduates, graduates, and doctoral students studying or planning to study the geospatial sciences or a related field.

All scholarship recipients are chosen on academic and professional excellence. Qualified candidates are selected by the Foundation's Scholarship Subcommittee, which is composed of representatives from USGIF Member Organizations.

To date, USGIF has awarded \$691,000 in scholarship funds to exceptional students. This year, USGIF awarded \$107,000 to 25 recipients.

DOCTORATE



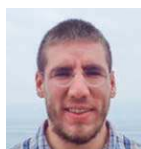
G. PAUL BAILEY
University of Colorado
Geography



ABBY FRAZIER
University of Hawaii at Manoa
Geography



SERGIO BERNARDES
University of Georgia
Geography



THOMAS GERTIN
George Mason University
Earth Sciences & Geoinformation



CRYSTAL ENGLISH
San Diego State University/University
of California, Santa Barbara
Geographic Information Science



TAMMY E. PARECE
Virginia Tech
Geospatial & Environmental Analysis

GRADUATE



STEVE CHIGNELL
Colorado State University
Watershed Science



JUSTIN FUNG
Columbia University
Operations Research



THOMAS MUSCOLO
MIT Sloan School of Management
Business Administration



THOMAS DAVIS
Texas A&M University, Corpus Christi
Geospatial Engineering



SHANE GRIGSBY
University of California, Santa Barbara
Geography



JAKEB PRICKETT
University of Arizona
Geographic Information System Technology



GRANT DELOZIER
University of Oklahoma
Geographic Information Science



MATTHEW MACDONALD
Northwest Missouri State University
Geographic Information Science



RICHARD "MIKE" RODRIGUEZ
George Mason University
Geoinformatics & Geospatial Intelligence

UNDERGRADUATE



PATRICIA BURROS
Texas State University, San Marcos
Water Resources



BRIANA NEUBERGER
Rochester Institute of Technology
Imaging Science & Industrial/Systems Engineering



ANNA KALINOWSKI
University of Missouri
Electrical Engineering



TANYA PETACH
Harvard University
Earth and Planetary Sciences

GRADUATING HIGH SCHOOL SENIORS



ALAYNA BIGALBAL
Heritage High School, Leesburg, Va.
Now attending George Mason University



ROBERT WESTON GADDIS
Homeschooled, Riverton, Utah
Now attending Missouri State University



RACHEL TAYLOR
West Springfield High School, Springfield, Va.
Now attending Brigham Young University



CHANDLER BURKE
St. Mark's School of Texas, Dallas, Texas
Now attending Rice University



JASON MOEDER
Bowie High School, Bowie, Md.
Now attending University of Maryland, College Park



LOUIS WERTS III
Tuscarora High School, Leesburg, Va.
Now attending College of William and Mary



SUCCESSFUL SYNERGY

AN INSIDE LOOK AT DIGITALGLOBE'S GROWTH AND INITIATIVES POST GEOEYE MERGER

Before Marcy Steinke joined DigitalGlobe, she surveyed its strengths, as well as the legacy of GeoEye, with which the company had recently merged.

"As I was looking at DigitalGlobe, I knew it had a really strong constellation, with three satellites up there functioning very well," Steinke said. "Then I looked at GeoEye's advanced analytics capabilities. Put those two together and it showed capacity for significant growth."

Now DigitalGlobe's senior vice president of government relations, Steinke said the merger has been an exciting and successful combination, yielding an advanced and agile satellite constellation, coupled with impressive revisit rates and in-depth analytics.

"Generally when you have a combination of two similar companies you think you're going to have a lot of overlap," said Bert Turner, senior vice president of sales for

DigitalGlobe. "We've been increasingly pleased with the great complimentary synergies."

A GLOBAL OUTLOOK

The growing DigitalGlobe has turned its attention to remaining competitive in the global marketplace—transitioning from a data and imagery provider into an information and insight organization, Turner said.

"We're moving rapidly into providing answers to our customers versus just giving them the raw materials to work with," he explained.

Steinke echoed this intent.

"We are clearly looking at moving beyond providing raw data," she said. "We'd like to put that on steroids and be able to provide some really great final products."

On the government side, for example, DigitalGlobe is now in the second year of its Global Enhanced GEOINT

◀ **SPACE SHUTTLE** Endeavour being carried over the White Sands Missile Range in New Mexico last year.

Delivery program, which provides U.S. government users with easy and immediate access to the company's most current, high-resolution imagery. Additionally, the initiative integrates the imagery into the individual agency's workflow—whether it's ArcGIS, Google Earth, or a native system.

DigitalGlobe is experiencing commercial imagery expansion in all of its markets, including defense and intelligence, oil, gas, mining, insurance, finance, forestry, and agriculture, Turner said. He added that the company is also seeing regional growth in Russia, India, and Latin America.

Meanwhile, the overall global commercial imagery marketplace is expanding, with an influx of international competition. Steinke said DigitalGlobe seeks equality when competing globally.

"Obviously resolution limits are an issue as we go forward, so we are hoping for a decrease in resolution limits as far as our ability to sell commercial imagery," she said. "That would put us on par with aerial and other competitors internationally."

In May, the company petitioned the National Oceanic and Atmospheric Administration (NOAA) to reduce the resolution restrictions for the images DigitalGlobe provides to its commercial customers.

"DigitalGlobe has officially requested NOAA to amend the current resolution restrictions from its WorldView remote sensing space system license to allow DigitalGlobe to sell commercial satellite imagery down to 0.25 meter panchromatic resolution, multi-spectral imagery

down to 1 meter resolution and short-wave infrared (SWIR) imagery down to 3 meter resolution," said Walter Scott, founder and chief technology officer of DigitalGlobe, in a written statement.

It's uncertain when NOAA will reach a decision on the request, as regulation of licensing can be a slow process, and commercial remote sensing licensing is relatively new. DigitalGlobe also plans to increase the orbit height of GeoEye-1, allowing the company to see a wider area, while obtaining higher-resolution imagery from the rest of its constellation.

AN INNOVATIVE ECOSYSTEM

DigitalGlobe is investing considerable time and money to co-innovate with many companies around the world in the areas of research and development, according to Turner.

"What I love about our approach right now—what makes it so exciting—is it's really about an ecosystem," Turner said. "It's about leveraging and not having this attitude or perspective that we have to invent everything here. That's not the case."

In the last year, the company has acquired geospatial crowdsourcing pioneer TomNod, expanded its partnership with custom map designer MapBox, collaborated with startup analytics software provider Recorded Future, and made a big marketing

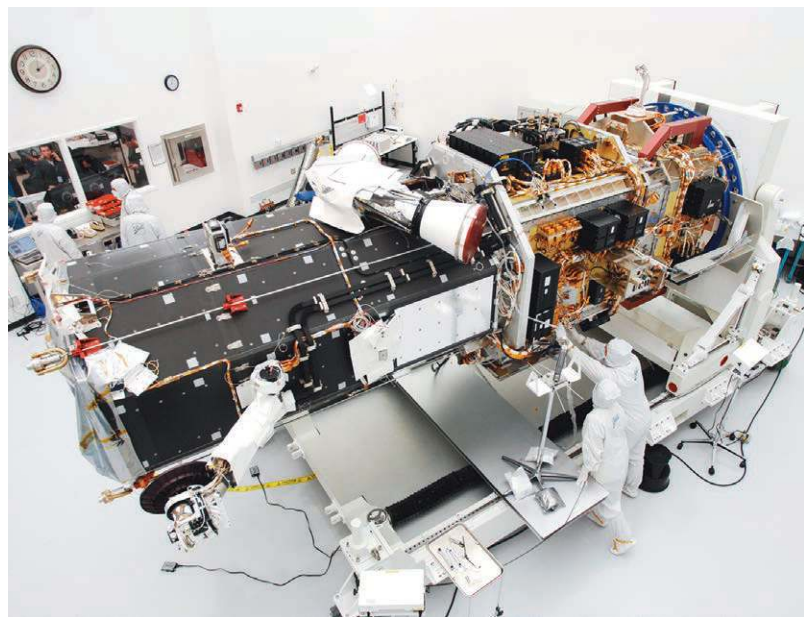
push for its My DigitalGlobe platform, which is free to all U.S. government employees—to name just a few of the exciting things happening.

In addition, the combined company is also better equipped to apply the benefits of satellite imagery to humanitarian issues. For example, the analytics capabilities brought to the table by legacy GeoEye now allow DigitalGlobe to provide even more answers to NGOs, Turner said.

The company recently formed its "Seeing a Better World" team, devoted to proactively reaching out to a select group of NGOs where DigitalGlobe wants to invest and contribute its imagery, analytics, and crowdsourcing expertise. With this new team, DigitalGlobe hopes to replicate efforts such as its partnership with the Satellite Sentinel Project in Africa, and the company's humanitarian outreach is expected to significantly expand over the next couple of years, Turner said.

Steinke said DigitalGlobe's business reach would also continue to expand in the near future.

"There will be other combinations of capabilities that we are looking at," she said. "We are still evaluating what directions are best mixed with our capabilities. There will be growth in other arenas as we go forward in the next five years or so." ■ BY KRISTIN QUINN



THIS 2009 PHOTO shows DigitalGlobe's WorldView-2 satellite being built.



IKONOS images taken in 1999 and 2013—both of downtown DC. This comparison was shown recently when DigitalGlobe announced hitting 4 billion sq. km. of imagery in its archive.



"WHAT I LOVE ABOUT OUR APPROACH RIGHT NOW—WHAT MAKES IT SO EXCITING—IS IT'S REALLY ABOUT AN ECOSYSTEM."

—Bert Turner, senior vice president of sales, DigitalGlobe

SHAPING GEOINT'S FUTURE

Meet the new young professionals on USGIF's Board of Directors



GABRIELA MALDONADO and **JENNIFER STANSALL**, both members of USGIF's Young Professionals Working Group, are also now members of the Foundation's Board of Directors.

PASSION FOR GEOINT and dedication to advancing their careers make Gabriela Maldonado and Jennifer Stansall successful leaders in the GEOINT Community. At the ages of 28 and 33, respectively, these young women have already made a breakthrough in their careers by devoting time to USGIF's Young Professionals Group (YPG) and Young Professionals Working Group (YPWG). Now, they also have been named to USGIF's Board of Directors.

Both Maldonado and Stansall have been involved with YPG since 2011, planning and attending networking events and service projects for the group.

"[The Board is] a great opportunity to be in this position with other great leaders giving input for the Community," Maldonado said. "I knew I wanted to take a leading role and be a voice for the YPG. This is a great opportunity because, later down the road, the current young professionals are going to be the leaders, and we'll be the ones mentoring young professionals and shaping GEOINT."

Neither new Board member originally expected to end up with a career in the GEOINT Community. It wasn't until they both spoke with their college geography departments that they found geographic information studies (GIS) to be an interesting and exciting field.

Maldonado began her career at Penn State University, earning in 2006 a bachelor's degree in geography with a focus on GIS, and in 2008, a master's in geography with statistical analysis from Ohio State University. She previously worked for Esri, and is currently a senior consultant at Booz Allen Hamilton. In this role, she works closely with the Department of Homeland Security, applying GEOINT development expertise to the department's mission.

Stansall in 2002 graduated from the University of Colorado Boulder with a bachelor's degree in geography with a focus on GIS and remote sensing. A year later, she began her career at DigitalGlobe. Stansall, who is currently celebrating her 10th year with the company, is a senior account manager, responsible for developing and managing DigitalGlobe's Global Strategic Alliance partners serving both commercial and defense and intelligence markets.

"Learning occurs through both good and trying times," Stansall said when asked what aspiring GEOINT professionals should keep in mind while thinking about their careers. "Sometimes it can be hard to say 'yes' to change, or the

unknown, but take on new challenges and experiences. It may help direct your career path in ways you didn't realize at the time. Pursue what interests you, work hard, and have fun."

When the women are not busy collaborating with the Board or networking and volunteering with fellow young professionals, they enjoy keeping active. As a Colorado native, Stansall loves to snowboard, go running, and spend time with

"Sometimes it can be hard to say 'yes' to change, or the unknown, but take on new challenges and experiences. It may help direct your career path in ways you didn't realize at the time." —Jennifer Stansall

family and friends. Maldonado said she keeps busy by hiking, listening to music, and planning her upcoming wedding.

Looking to the future, Stansall and Maldonado both said they plan to remain at their current jobs and continue to build relationships, empower users, and show others the value of the GEOINT tradecraft.

Maldonado and Stansall's advice to fellow young professionals and those studying GEOINT: Be open to new experiences and always push yourself to be your best.

■ BY LINDSAY TILTON

To learn more about the YPG, contact Carrie Drake at carrie.drake@usgif.org.

BIG DATA AND MISSION OUTCOMES

The four components to achieving success in the data deluge era

By Bob Gourley, publisher of CTOvision.com and AnalystOne.com

BIG DATA is a term that originated in the e-commerce world and resonates with most of us in the Geospatial Intelligence Community. GEOINT professionals have always been tasked to optimize analysis over growing datasets and to be open to new capabilities that better serve the mission. This is why GEOINT was one of the first domains to adopt the new Hadoop-centric open source software frameworks, and why the Community leads the next wave of improvements to Big Data processing.

Most organizations in the federal space have spent several years thinking through the architectural impacts of new, ultra-large data sets, and most have either established a foundational infrastructure to build on or have mapped out a framework they believe will work for their mission set. There is still work to be done here, but since much progress has been made, a shift in attention and resources is occurring. The shift is an increased focus on mission outcomes.

This “mission outcomes” shift can be considered in four key categories:

1. PEOPLE

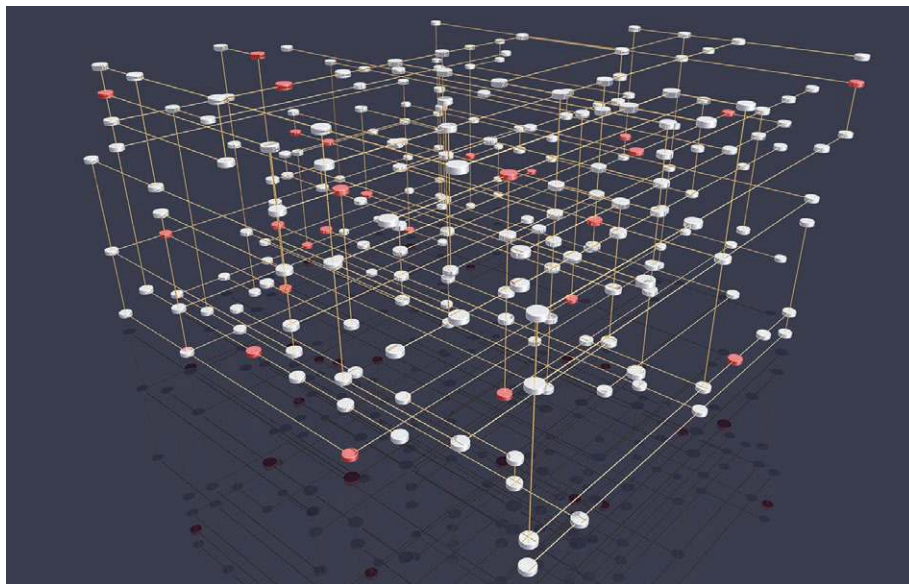
The IT personnel working Big Data solutions will continually need to upgrade their skills, with an increasing focus on the solutions coming from the open source community, especially the Apache Software Foundation. This group stewards the many activities around the Hadoop framework of tools. IT experts are critical to success with Big Data, but we really aim to empower those making mission decisions.

Analysts, operators, and even executive decision makers are increasingly empowered with the ability to interact with Big Data holdings. This is a significant shift, empowering the people with mission responsibility to run their own queries, including interactive queries.

2. PROCESS

You should never automate a bad process. Focusing on mission outcomes can help reduce the risk of this occurring. Reworking processes should be done early on when new technologies are introduced, and may result in tremendous optimization of activities.

For example, if a Big Data solution could enable multiple agencies to share common data sets and better leverage common infrastructure, the cost savings might extend beyond IT. A good look at process may result in massive restructuring of activities and in new options for roles and missions.



3. TECHNOLOGY

As noted, some very important shifts are occurring technologically. The shift is toward technologies that are more aligned with mission-focused outcomes, and technologies that empower the end user are most important.

Analysts are already empowered with solutions that are easier to learn, and this trend is expected to continue. No analyst should have to be a Java programmer to create queries over data. The technology that serves analysts this way may be complex for the IT department to configure, but should be easy on the end user.

4. SECURITY

Big Data solutions provide cyber defenders with new capabilities, including ways to bring the right data together. In this way, they provide positive enhancements to the overall cybersecurity posture of modern enterprises.

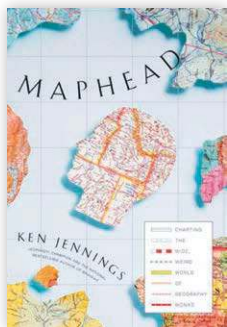
But there are other impacts on security, including challenges. For example, Big Data solutions must be fielded with strong methods for authentication, authorization, and access control, as well as auditing and overall management of the data clusters. These critically important elements must be completed before deployment, and therefore the need for them should be articulated early in the fielding process.

Still, there is room for more work to be done in Big Data security. It is not as simple as mandating that Big Data solutions have encryption. Every encryption solution currently available introduces new vulnerabilities. New solutions are on the horizon that will help the Community better protect data, but they are not here just yet. For now, Hadoop clusters should be on owner-controlled networks and data access should be limited to trusted components.

Big Data is a dynamic area for the GEOINT Community. As your company or organization engineers for change, keep the key areas of people, process, technology, and security in mind, and please share with the rest of the community how you face and solve Big Data challenges. ■■

**IT
EXPERTS ARE
CRITICAL
TO SUCCESS
WITH BIG
DATA, BUT WE
REALLY AIM
TO EMPOWER
THOSE
MAKING
MISSION
DECISIONS.**

READING LIST



MAPHEAD: CHARTING THE WIDE, WEIRD WORLD OF GEOGRAPHY WORKS

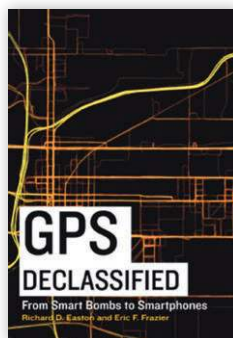
by Ken Jennings

The well-known *Jeopardy* champion shares his knowledge and love for geography in this educational, yet comedic, book. Jennings gives his readers interesting factoids on ancient maps, digital mapping, and everything in between.

GPS DECLASSIFIED: FROM SMART BOMBS TO SMARTPHONES

by Richard D. Easton and Eric F. Frazier

This book takes readers through the research and technological development of GPS. From its secret use during the Cold War to its emergence in the consumer industry, the authors delve behind the scenes of GPS and its long and storied history.



USGIF EVENTS CALENDAR

JANUARY

14

GEOINteraction Tuesday
Maggiano's, Tysons, Va.

MARCH

11

GEOINteraction Tuesday
Maggiano's, Tysons, Va.

APRIL

14-17

GEOINT Symposium
Tampa Convention Center,
Tampa, Fla.



EVENTS For the latest event listings,
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TASC promoted **Mark Bruno** to vice president of its Global Systems business unit. Bruno is a 20-year veteran of the company with 30 years of space engineering and technology experience.

Serco has reorganized its global senior leaders. **Ed Casey**, formerly chairman and CEO of the company, is now chief transformation officer. Bringing a strong background in services and information technology as the former CEO and president of CACI International, **Daniel Allen** will join Serco as the new chairman and CEO. **Mike Plymack** was promoted to chief operating officer. Formerly, Plymack was Serco's senior vice president of the Federal Civilian Services business group.

Chirantan "CJ" Desai joins EMC as president of the company's Emerging Technology Products division. Formerly executive vice president of information management at Symantec, Desai brings a depth of expertise to the newly formed division.

John D. Harris II was appointed vice president of business development and CEO of Raytheon International. Harris has worked 30 years with the company, and brings a strong business, customer, and product knowledge to his new roles.

Ball Aerospace selected **Dave Kaufman** to lead its National Defense strategic business unit as vice president and general manager. He has worked 12 years

with Ball, previously as the director for Ball's National Security Space mission area within National Defense.

NVIDIA appointed **Colette Kress** executive vice president and chief financial officer for the company. She has 24 years of experience in the technology industry, and was previously the senior vice president and chief financial officer with Cisco's Business Technology and Operations Finance organization.

Marc Welinski was named deputy director of broadcast and broadband at Euroconsult. He has 20 years of experience, and will oversee and further develop the firm's activities in broadcast and broadband.

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Scholarship Program



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PHOTO BY DAVID CONOVER/U.S. ARMY

From Radioplane to Walk of Fame

While unmanned aerial vehicles (UAVs) have only come into the public parlance in recent years, the United States has used them for combat purposes for decades. In 1944, the manufacturing of UAVs for use in World War II inadvertently created one of America's most well-known icons. Most people recognize Marilyn Monroe as the glamorous blonde from classic films such as *Some Like It Hot* or *The Seven Year Itch*, but few may know that her career began in a less stylish fashion, as a technician at the Radioplane munitions factory. Beginning

in 1940, the Radioplane Company—headed by famous British actor and former observer/gunner in the Royal Flying Corps Reginald Denny—produced its RP-4 and RP-5 Radioplanes for use as targets by anti-aircraft gunners. Believing his factory might make a good public relations story for the military, Denny contacted the Army, and a photographer from *Yank*, the Army's weekly magazine, visited Radioplane to document the work being done on the factory floor. The photographer snapped a series of photos of the workers, but was especially drawn

to one Norma Jeane Dougherty. He was so taken by the young woman that he offered to create a portfolio for her to get involved in the world of modeling. Monroe skyrocketed to fame, eclipsing that of her former boss Denny many times over. Interestingly enough, the original photos of Monroe never appeared in *Yank*, possibly because most of them were lost in the mail on the way to be processed. Fortunately, the photographer saved a few rolls, providing this rare glimpse of Marilyn Monroe just before her meteoric rise to stardom.



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