2014 ISSUE 4

trajectory
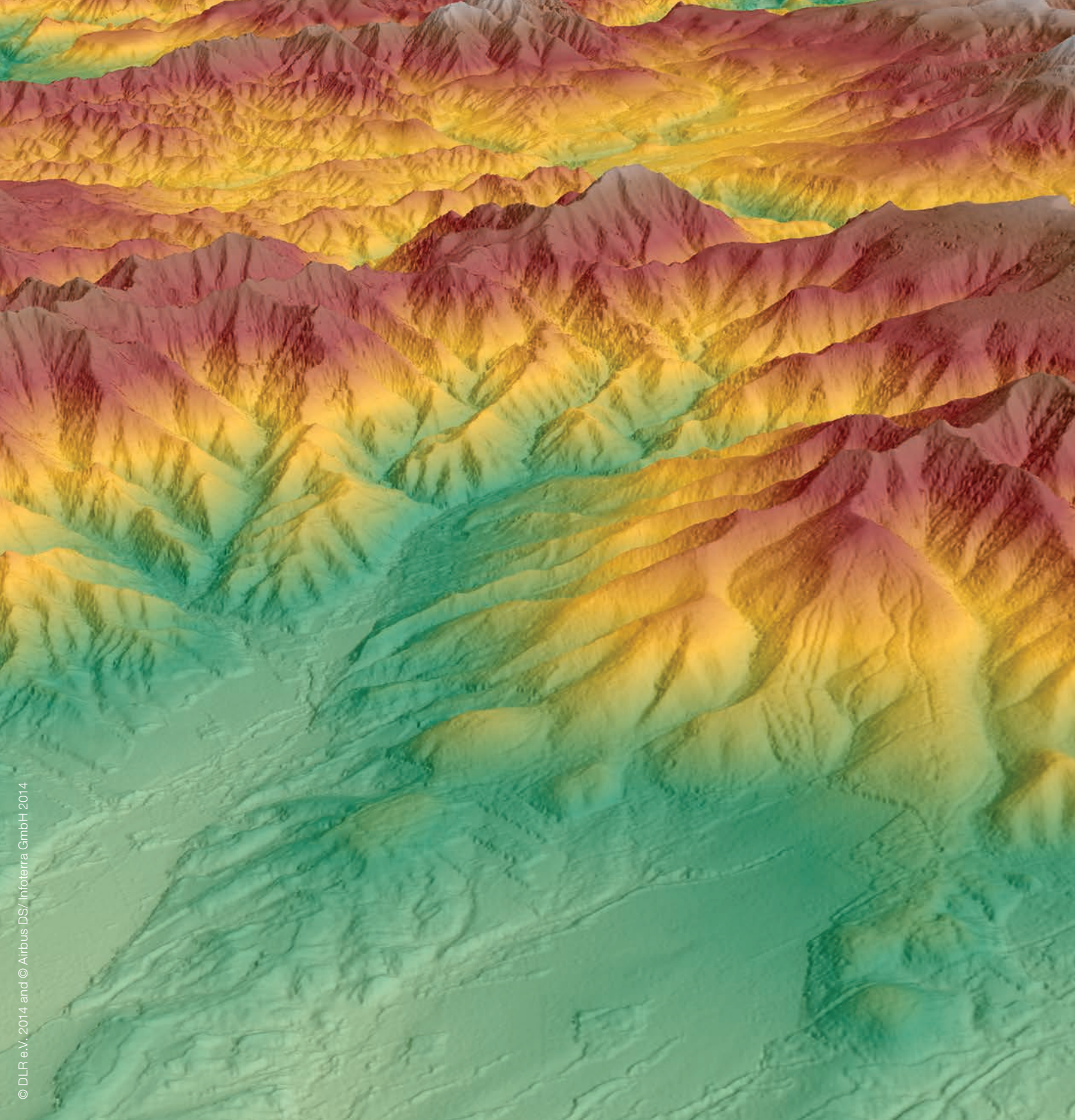
THE OFFICIAL MAGAZINE   OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

2014 USGIF MEMBERSHIP DIRECTORY

WATCHING THE WATER

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trajectory

The USS Antietam (CG 54), the USS O'Kane (DDG 77) and the USS John C. Stennis (CVN 74) steam through the Gulf of Oman. As part of the John C. Stennis Carrier Strike Group, these ships are on regularly scheduled deployments in support of Maritime Operations, setting the conditions for security and stability, as well as complementing counterterrorism and security efforts to regional nations.

ON THE COVER: This photo illustration depicts some of the many air-, water-, and space-based assets that are currently or could potentially be used for Maritime Domain Awareness, including sensor buoys, manned aircraft, UAVs, and satellites. *Credits: MacDonald, Dettwiler and Associates, Northrop Grumman, Boeing, U.S Navy.*

TRAJECTORYMAGAZINE.COM

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Conversations with some of the 2014 USGIF Scholarship winners.

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VANTAGE POINT

FOSTERING INNOVATION

"Build the Community. Advance the Tradecraft. Accelerate Innovation." These are the strategic pillars of USGIF. We focus on ensuring our activities, programs, and offerings to the Community tie back to this vision. However, accelerating innovation is more challenging for us than the first two pillars. Fortunately, innovation is very much in vogue at the moment. Undersecretary of Defense for Acquisition, Technology, and Logistics Frank Kendall recently announced the Defense Innovation Initiative, and his remarks align with what we've all heard from Kendall's bosses and others in our extended community.

USGIF is committed to supporting innovation, and from the Foundation's earliest days with our first interoperability demonstrations, USGIF has provided a trusted environment for overarching discussions and technical engagement across corporate, agency, and academic institutions—all while being respectful of ethics, law, policy, and the protection of intellectual property.

We're excited about the Industry Solutions Marketplace we are working on with NGA and others, supported by our member organizations. At our most recent GEOINTeraction Tuesday, Karyn Hayes-Ryan, the NGA component acquisition executive, and Doug McGovern, director of NGA's InnoVision Directorate, detailed their vision for agile, innovative acquisition and the important role USGIF and our members will play in helping the agency achieve this objective.

In this issue of *trajectory*, you will find interviews with former NGA Director Letitia Long, as well as Director Robert Cardillo. I encourage you to read the Q&As with them here, and visit *trajectorymagazine.com* for the full, unabridged versions. Both of these leaders talk to innovation and the criticality of partnering more closely with industry. USGIF is perfectly placed at the nexus of industry, academia, and government to help facilitate this mandate.

Additionally, our cover story about maritime domain awareness includes rich lessons to be learned about innovative approaches to operational success in a critically important mission area, including an interesting public-private partnership between the Canadian government and industry.

This issue also highlights some of our Community's achievements. Our scholarship award process is very rewarding for all of us who have a hand in it, especially the volunteer USGIF Scholarship Committee. You'll see brief bios on each of this year's USGIF scholarship winners on page 28. Even in the short write-ups, you get a sense of their inspiring work.

One of my favorite activities is personally signing every one of our academic GEOINT Certificates. More than 450 students have earned one to date, and we now have 10 accredited schools with the recent addition of the College of Professional Studies at Northeastern University and Fayetteville State University. FSU is a particularly exciting addition because it is the first Historically Black College and University program to achieve USGIF accreditation.

Finally, the back of the magazine contains the 2014 USGIF Membership Directory, a listing of our nearly 250 sustaining member organizations. The breadth of the organizations continues to grow, and USGIF couldn't deliver our rich set of offerings to the GEOINT Community without the ongoing support of our membership. Please take some time to review the remarkable array of capabilities represented in the guide, and keep this issue on your shelf as a handy resource throughout the year.

I hope you enjoy this issue of *trajectory*, and as always, we eagerly encourage your feedback so we can continue to make the magazine relevant, interesting, and fun. Best wishes for a safe and joyous holiday season, and a happy, healthy, and prosperous New Year.

KEITH J. MASBACK | CEO, USGIF
@geointer

CONTEXTUAL CLARIFICATION

The otherwise fine article "The Defining Decade of GEOINT" in the Q1 2014 issue contains a misleading quote: "We would collect imagery for a six-month period before we even thought about putting it into the mapping process." The author of the quote was not associated with map production operations as we were and may not be aware there were specific plans for near-term exploitation of all requested imagery. DMA-tasked imagery did not sit around for six months. Mapping collection requirements, beginning in the early sixties, were submitted against specific defense map and weapon targeting needs with anticipated timetables for exploitation of the imagery. These timetables were influenced by the vagaries of weather and other factors, including that film was only dropped periodically from the satellites by bucket. Regardless, as soon as film arrived it was processed and used. DMA received a national agency award in 1985 for the role it played in the Cold War. The 10,000 employees were exploiting overhead imagery to produce the critical products for the strategic and tactical weapon operations over the previous 15-year period.

> **"Mapping collection requirements, beginning in the early sixties, were submitted against specific defense map and weapon targeting needs with anticipated timetables for exploitation of the imagery."**
> — Al Anderson & Larry Ayers, former deputy directors, Defense Mapping Agency

The projected end of life for film-based overhead systems in the late 1986 timeframe introduced a national decision to create a new digital production system to utilize specially instrumented overhead imagery to produce modern digital and analog products for national special needs. The creation of NIMA/NGA continued and expanded the DMA and NPIC missions and altered the direction to a fusion of geospatial and geointelligence for national and defense needs. That reorganization, together with significant technological advances, has been a tremendous boon to the development of GEOINT, but the Cold War base from which those improvements sprang was a talented, experienced workforce and the first digital production system.

> —*Al Anderson & Larry Ayers, former deputy directors, Defense Mapping Agency*

STABILITY IN AFRICA

I very much appreciated the Q3 2014 cover story "Wildlife Crimes" and the inclusion of my thoughts on the topic. This is a critical issue for readers of *trajectory*. Why? This is not just about saving animals; it is really more about potential international security issues in sub-Saharan Africa.

There are at least 13 million Africans directly employed in the tourism business in Southern Africa with probably another 10-15 million—mainly young men—indirectly employed. These jobs vary from rangers to dock workers who unload French wine destined for the safari lodges. If the animals are gone, so are the tourists and there is the potential loss of 25 million jobs in that part of the world. Let's be frank—Apple is not going to build iPhone factories in Southern Africa.

In a region where global criminal syndicates freely operate and there is ample evidence that al-Shabaab, the Lord's Resistance Army, the Janjaweed, and Boko Haram are present, what will be the international consequence of putting tens of millions of jobless young men on the streets?

Our team at the University of Maryland must have solid geospatial imagery to build analytical models and our efforts cannot succeed without it. Therefore, when we think about wildlife crime, we also must look down the road to envision what might happen in the future, if we don't take appropriate actions today. It is a perfect example of how the Law of Unintended Consequences manifests itself in the real world of Africa.

> —*Dr. Thomas Snitch, Institute for Advanced Computer Studies, University of Maryland*

SECURE THE APP?

There's a nuance that may be missing in Keith Masback's Q3 2014 Vantage Point piece on readership analytics. *Trajectory* is, for lack of a better term, "work reading." Unlike *People* or *Popular Mechanics*, many folks prefer to read it at work. Most of your readers aren't permitted to take their personal tablets to work. But that doesn't mean there won't be tablets in the workplace. I'm seeing greater interest from my customers in making tablets a work tool. We have to modify the tablets to remove Wi-Fi and other features to meet their security concerns. These tablets won't ever connect to the Internet. Instead, they will connect to a docking station from where customers can download JWICS level information. As a result, if you want people to read *trajectory* on a tablet, you may have to do both: make it available in a tablet format on JWICS.

> —*Mike Shackelford, Dell*

SUBMISSIONS

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.
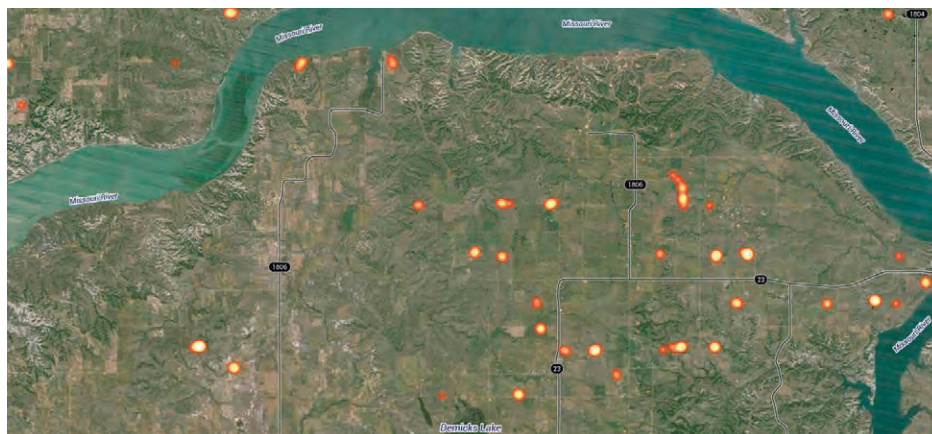
INTsider

NEWS UPDATES AND HIGHLIGHTS

MAPPING ENVIRONMENTAL IMPACT

Nonprofit organization SkyTruth recently unveiled an interactive map showing flaring activity in the U.S. and around the world based on nightly, infrared satellite data. SkyTruth released the map in conjunction with a report from its partner, Earthworks. The report describes flaring as "waste of the natural gas produced as a byproduct of oil drilling," and chronicles how the U.S. shale oil boom wastes natural gas and increases carbon dioxide emissions.

SkyTruth mines data for its flaring map from the National Oceanic and Atmospheric Administration's Visible Infrared Imaging Radiometer Suite aboard the joint NOAA/NASA Suomi National Polar-orbiting Partnership satellite. It then filters infrared detections to visualize only those hot enough to be natural gas flares and that occur more than three nights in a row, according to SkyTruth Communications Director David Manthos.

SkyTruth conducts case-by-case analyses of environmental issues and helps to provide the public with context for learning how to use aerial and satellite imagery to better understand human impact on the Earth.

The organization's long-term goal is to encourage citizens to participate in what it calls "skytruthing," using resources such as SkyTruth's FrackFinder, Appalachian Water Watch, Gulf Oil Spill Tracker, and more.

"'Skytruthing' is that anyone can get access to the same data and tools to make decisions about what they're seeing and investigate issues they're concerned about," Manthos said.

NGA ACCELERATES MAP OF THE WORLD

The National Geospatial-Intelligence Agency (NGA) has awarded 10 contracts to seven companies to provide support for the agency's Map of the World initiative under the GEOINT Data Services program. Single contracts were awarded to BAE Systems, Boeing, CACI, Geographic Services Inc., and Woolpert. Harris Corporation was awarded two contracts, and Leidos was awarded three. These companies will help support Map of the World by managing foundational GEOINT data.

Additionally, NGA awarded five companies contracts to develop tools for analyzing multiple layers of GEOINT data and bolster the Map of the World infrastructure. Boeing will develop a workflow system, SRI International will help create a framework to integrate content for Map of the World, ImageMatters and MapLarge will build tools for analyzing linked data sets, and DATA Inc. will produce a user-generated content system for end users.

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Hundreds of thousands of debris particles five centimeters and larger circle Earth at high velocity, each packing enough kinetic energy to disable a satellite.

NATIONAL PLAN FOR CIVIL EARTH OBSERVATIONS

The Woodrow Wilson Center Commons Lab in Washington, D.C., hosted a roundtable discussion Sept. 4 on the White House's National Plan for Civil Earth Observations. Presented to Congress in July 2014, the plan is billed as the first-ever assessment of the federal civil Earth observation enterprise, and involves approximately 300 volunteer subject matter experts across 13 areas of expertise. The plan is intended to provide strategic guidance for a balanced portfolio of civil Earth observations to fulfill agency mandates, achieve national objectives, and help inform federal investments. The plan outlines five key priorities: continuity of sustained observations for public services; continuity of sustained observations for Earth system research; continued investment in experimental observations; planned improvements to sustain observation networks and surveys for all observation categories; and continuity of, and improvements to, a rigorous assessment and prioritization process.

ARMY AWARDS $7.2B FOR INTELLIGENCE SUPPORT

The U.S. Army Intelligence and Security Command awarded a $7.2 billion contract to 21 companies to establish an intelligence services support program. USGIF members BAE Systems Information Solutions, Booz Allen Hamilton, CACI Technologies, Lockheed Martin Integrated Systems, Northrop Grumman, Sotera Defense Solutions, SRA International, and The Buffalo Group, were among the companies selected. The contract will provide services from Army intelligence missions to include intelligence analysis, surveillance and reconnaissance systems, security, and more.

BOEING RECEIVES FIRST PHOENIX SMALLSAT ORDER
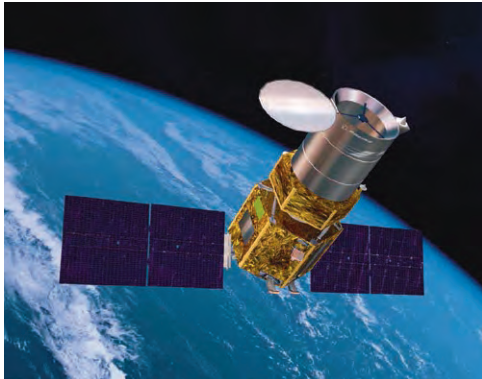
IMAGE COURTESY OF BOEING

THE 502 PHOENIX carries the commercial remote sensing industry's first high-resolution, hyperspectral payload.

Boeing received its first commercial order for its 502 Phoenix small satellite. HySpecIQ ordered two of the SmallSats for delivery in 2018. The 502 Phoenix carries the commercial remote sensing industry's first high-resolution, hyperspectral payload and contains command and control operations, image processing, and data storage of collected imagery.

"Hyperspectral imagery is the next step in understanding the world. For our inaugural 502 Phoenix customer, HySpecIQ, Boeing will provide an unprecedented satellite capability," said Erik Daehler, deputy director of Boeing Remote Sensing Programs. "HySpecIQ will deliver the highest performance commercial hyperspectral imagery to government and commercial customers, with minimal risk. The 502 Phoenix is a highly flexible platform that can be quickly tailored to missions including high-resolution imagery, environmental monitoring, space situational awareness, or the next new thing."
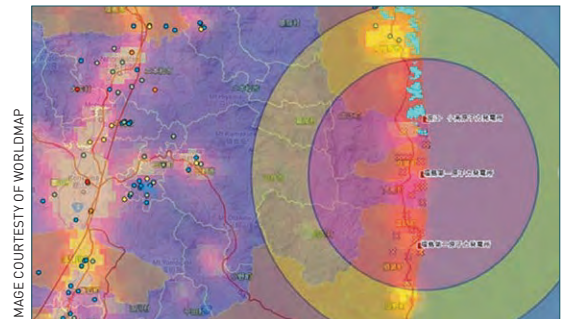
IMAGE COURTESY OF WORLDMAP

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20,000

The U.S. Air Force currently tracks approximately 20,000 space objects.

PANELISTS at the USGIF and Analyst One data analytics workshop discussed lessons learned in the national security community.

USGIF Director of Academic Programs Dr. Maxwell Baber presented a USGIF GEOINT Certificate of Accreditation to Northeastern University's Geographic Information Technology master's program.

INSIGHTS FOR MISSION IMPACT
USGIF AND ANALYST ONE HOST DATA ANALYTICS WORKSHOP

Context was an overarching theme at the Data Analytics workshop held July 30 in Reston, Va., by USGIF in partnership with Analyst One. The event attracted more than 250 attendees, who heard from keynote speakers and panelists featuring representatives from industry, academia, and government.

The day kicked off with a keynote by Jeff Jonas, an IBM fellow and chief scientist of context computing. Jonas gave an overview of how contextual computing provides a better understanding of data. He presented an example of this with an "asteroid hunting" project he teamed with NASA on to track 600,000 asteroids and compute the next 25 years of asteroid interactions.

"More data means better predictions," Jonas said.

Dr. Ilkay Altintas, director of workflows at the San Diego Supercomputer Center at the University of California San Diego discussed data science workflows and the center's development of WIFIRE—a data-driven simulation, prediction, and visualization of wildfire behavior.

Data came to life in Dr. Dave Warner's presentation on crisis threat analysis. The medical neuroscientist and director of medical intelligence at MindTel showed many real-life examples from his data visualization program, Antz, which helps users better understand and process complex data.

In an afternoon panel on analyst education, Carmen Medina, a specialist leader with Deloitte, said it's important to assemble teams that are cognitively as well as traditionally diverse.

"You need to think about your problem set and go, 'What kind of cognitive skills do I need to tackle?'" Medina said.

Ed Mornston, director of the National Geospatial-Intelligence Agency's (NGA) human development directorate, said the agency is gradually moving away from "five-day, instructor-led courses at brick-and-mortar institutions."

"Our college is in good shape," Mornston said. "We are working to become much more agile and trying to reduce the time between figuring out what operators need to when we actually deliver."

In another afternoon panel on lessons learned from the national security community, NGA's Dave Gauthier said the agency, perhaps more than any other in the Intelligence Community, is facing a flip in the way it approaches analysis.

"First we work on what's out there in the open … and then we can add what's special about us in the IC to fill in those gaps," Gauthier said.

The workshop rounded out with a closing keynote from Scott Sorensen, chief technology officer of Ancestry.com.

Sorensen emphasized the need to strategically organize your employees, citing an example from Ancestry: "The scientists were creating algorithms that were academic and didn't scale, and the engineers didn't think they needed scientists," he said. "They were in different buildings."

By reorganizing so every software engineer worked side-by-side with a data scientist, the engineers gained more domain knowledge and the scientists were able to better think about scalability.

USGIF announced the addition of the Northeastern University master's degree program in Geographic Information Technology (GIT) to the list of USGIF-accredited college and university programs. To date, USGIF has accredited 10 collegiate geospatial intelligence certificate programs, while several more university programs are in the pipeline.

"I am thrilled by this opportunity to partner with USGIF," said Cordula Robinson, faculty director for the GIT program at Northeastern University's College of Professional Studies (CPS). "The USGIF certificate provides a high-quality qualification for our graduates to work in areas such as international relief, disaster management, and national security with direct links to industry connected to USGIF. This is an exciting time in the industry and the certificate meshes well with the NEU's ongoing involvement with the Intelligence Community and homeland security."

Through the USGIF Collegiate Accreditation Program, colleges and universities are able to accredit geospatial intelligence programs accompanying a college degree. Graduating students who meet high academic standards receive USGIF's Geospatial Intelligence Certificate. To date, more than 450 students have graduated with USGIF GEOINT certificates.

SPOTLIGHT: USGIF SCHOLARSHIP RECIPIENT

Richard Medina received his bachelor's and master's degrees in geography from California State University, Los Angeles, in 2002 and 2004, respectively. During his studies, Medina worked in the commercial and government sectors, including two years at the Oak Ridge National Laboratory. He then went on to pursue a Ph.D. in geography at the University of Utah, during which time he won a USGIF Scholarship in 2008.

Having attended every GEOINT Symposium since 2008, Medina finds USGIF's flagship event and scholarship program to be great tools for helping GEOINT students better their academic future.

"Students need to make these connections and see what company and government needs are," Medina said. "It's great to have students involved because the academic viewpoint is important for the future of geospatial intelligence and its application—it would be great to get more students involved."

After obtaining his Ph.D. in 2009, Medina became an assistant professor in the geography and geo-information department at George Mason University—one of USGIF's 10 accredited universities—and continued the research he started at the University of Utah on international terrorism and human geography. With the many years he's dedicated to this topic, Medina was also selected in 2013 as the recipient of the USGIF Academic Research Award.

This fall, Medina began a new position as an assistant professor within the geography department at the University of Utah, also a USGIF-accredited school.

RICHARD MEDINA (left) won the 2013 USGIF Academic Research Award for his research on the geography of terrorist social networks and applying human geography to counterterrorism.

SIXTEEN-YEAR-OLD MOUNTAINEER Matthew Moniz talks to young professionals about climbing and his travels around the globe.

GEOINT FOR THE YOUNG ADVENTURER

16-year-old mountaineer Matthew Moniz spoke to USGIF's Young Professionals Group (YPG) during an Aug. 26 presentation: "GEOINT for the Young Adventurer."

"It wasn't until a 2007 trip to Nepal that I discovered my passion for climbing," said Moniz. "I enjoy the outdoors and being able to share my story and latest adventures with people."

Moniz, a Colorado native, has climbed four of the "Seven Summits"—the highest mountains on each of the seven continents—and holds the world speed record for summiting the highest points in each of the 50 U.S. states in just 43 days. In 2010, Moniz was recognized as *National Geographic*'s Adventurer of the Year.

Karen Diener, CEO of KD Geospatial Solutions and Moniz's family friend, suggested he speak to the YPG. "He witnesses the human geography around the globe firsthand and has real experience to add to the physical geography he uses and needs in order to climb."

Moniz and his team use an app that maps and monitors wind speeds and jet streams, which can significantly affect the outcome of an expedition. On one challenging climb, DigitalGlobe assisted the team by sending satellite images of the surrounding area in order to help them avoid bad weather.

Moniz said he climbs not only for love of the sport, but for his best friend, Ian, who suffers from pulmonary hypertension, an incurable disorder causing abnormally high blood pressure. The summits Moniz climbs are low-oxygen, high-altitude environments, which mimic the symptoms of the disorder.

"When climbing at high altitudes, I experience what Ian feels every single day," Moniz said.

Moniz's next adventure is planned for April 2015 in Nepal.

GOT GEOINT?
The newest cadets enrolled in the United States Military Academy at West Point's geospatial information science program show off their USGIF "got geoint?" T-shirts. West Point is one of 10 universities and colleges to have achieved USGIF academic accreditation.

STAFF CORNER

Ayana Nickerson joined USGIF Oct. 1 in the newly formed role of credentialing manager. Ayana will help USGIF move forward with its geospatial credentialing initiatives. Ayana brings more than a decade of credentialing experience with trade associations and nonprofit organizations.

Lisa Spuria, formerly director of NGA's Analysis Directorate, joined USGIF in September as an adjunct employee on special assignment from the agency. Lisa will help the Foundation with analytic tradecraft development and training, and other associated areas of interest.

In July, USGIF staff member **Carrie Drake** was promoted to senior manager of volunteer engagement. Carrie also recently received the Certified Association Executive designation from ASAE.

Also in July, **Jordan Fuhr**, USGIF vice president of strategic communications and marketing, earned an MBA from George Mason University's School of Business.

In November, **Jeff Ley**, USGIF vice president of business development and exhibitions, was named a 2014 Expo Group Show Manager of the Year.

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EXPANDING HORIZONS

Fayetteville State University builds geospatial intelligence curriculum

IMAGE COURTESY OF NGA

FAYETTEVILLE STATE UNIVERSITY geography students visited the National Geospatial-Intelligence Agency in 2013 to tour the Springfield, Va. facility and meet NGA personnel and HBCU alumni.

ACCORDING TO USGIF RESEARCH, more than 400 U.S. colleges and universities offer a program focused on the geospatial sciences and related fields—and this number is expected to grow. Though Fayetteville State University (FSU) does not have a traditional GEOINT program, it offers unique interdisciplinary opportunities for undergraduate students.

FSU students majoring in geography, intelligence studies, or computer science are offered the opportunity to take courses in geospatial intelligence. Students also benefit from the Center for Defense and Homeland Security, which emphasizes research in STEM education, cybersecurity, national security, and emergency management.

The university further expanded its offerings in 2012 by applying for a research grant from the National Geospatial-Intelligence Agency's (NGA) Academic Research Program (NARP). The awarded initiative supports academic research in GEOINT to further the education of future analysts. FSU received the five-year, $443,000 grant, which includes three option years, and has applied the funds toward establishing a USGIF-accredited GEOINT certificate program. Students who meet high academic standards and graduate from accredited programs receive USGIF's Geospatial Intelligence Certificate. USGIF accreditation ensures the GEOINT Community

has a robust workforce now and in the future.

"We seemed like an ideal choice for a geospatial intelligence certificate because of the pool of students FSU attracts," said Dr. Rakesh Malhotra, assistant professor and program coordinator of FSU's geography curriculum.

As a result of its proximity to Fort Bragg, FSU enrolls a large number of active-duty service members and veterans. This military connection also makes it a logical step for the university to offer students the opportunity to develop promising careers in GEOINT.

With the help of the NGA funding, FSU revamped its curriculum and in November achieved USGIF academic accreditation for its GEOINT certificate program, making it the tenth school to be USGIF accredited. The GEOINT certificate is available as a standalone credential or for students jointly obtaining an FSU degree.

"FSU was unique in what they proposed, with sound research and a solid plan on developing the curriculum," said Dennis Walker, an NGA research and development technologist as well as technical monitor for FSU's grant. "The faculty includes students in their research opportunities and attends conferences such as USGIF's GEOINT Symposium. Additionally, FSU is the first HBCU (historically black colleges and universities) with [a GEOINT offering]; this will help other HBCU institutions progress forward to have equal opportunities to develop GEOINT programs."

Student Larry Watson is pursuing the GEOINT certificate, along with dual bachelor's degrees in intelligence studies and geography. He is also an Army all-source intelligence technician at Fort Bragg.

"Being in the military, I never had the chance to go to school full-time," Watson said. "Now I can learn the material and become more

> **"FSU was unique in what they proposed, with sound research and a solid plan on developing the curriculum."**
>
> — Dennis Walker, NGA research and development technologist, and FSU's grant technical monitor

of a subject matter expert to do my job better and help other analysts understand their jobs better."

Malhotra and Dr. Adegoke Ademiluyi, government and history department chair and associate professor of geography, are both amazed by the number of inquiries the department has received about the certificate, as well as the excitement fueled by the NGA research grant.

"Achieving the grant has shown our students the power of these [geospatial] tools and what their futures can look like," said Ademiluyi. "Certification increases the ability to get a job."

In September 2014, FSU faculty and students were invited to present their research projects at NGA's NARP Symposium, as well as to update the agency on the university's GEOINT curriculum progress since receiving the grant. Geography classes have nearly doubled in size compared to the 2013 academic year, and Malhotra expects students will obtain the first batch of GEOINT certificates in spring 2015. Additionally, the school converted an old chemistry lab into a geography lab, which began hosting classes this fall.

A longer-term goal is for FSU to host an event for fellow HBCUs, with hopes that the FSU model will encourage other academic institu-
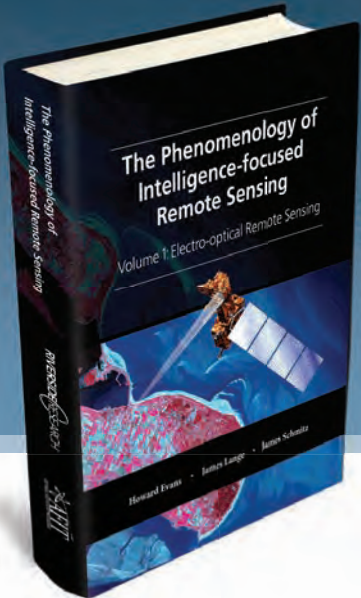
FSU STUDENTS presented their research in September at NGA's Academic Research Program Symposium at the Keck Center in Washington, D.C.

tions to consider adding GEOINT certificate programs. Malhotra also hopes FSU will someday offer master's degree level GEOINT coursework.

"I anticipate having the accreditation will bring greater visibility to FSU and our program," Malhotra said. "We have an amazing outreach at Fort Bragg and interest from many students. With the accreditation, we believe the students are on the right track to becoming GEOINT professionals." ▪ BY LINDSAY TILTON MITCHELL

BUILDING MORE AFFORDABLE AND RESILIENT SPACE SYSTEMS

USGIF establishes SmallSat Working Group

THIS CUBESAT from Spire (formerly Nanosatisfi) is one of the standard form factors for a SmallSat.

IMAGE COURTESY OF SPIRE/NANOSATISFI/TOMMY CHANDLER

"WE WANT SMALLSATS TO BE VIEWED AS MAINSTREAM GEOINT CAPABILITIES— IT'S NOT JUST ANOTHER SCIENCE PROJECT."

—Rob Zitz, SmallSat WG co-chair and chief systems architect, Leidos

SMALL SATELLITES, often called SmallSats, have existed for more than 30 years, but recently their popularity and utility have spiked. This new attention can be partly attributed to the White House National Space Policy released in 2010, which called for the United States to develop and exercise capabilities to operate through a disrupted space environment, and challenged the military and intelligence communities to build more resilient space architecture.

One way of achieving this is disaggregated space architectures, which means to have a large number of smaller, low-cost satellites performing missions, rather than a lesser number of exquisite satellites.

In an effort to help build traction for SmallSats in the GEOINT Community, a USGIF Small Satellite Working Group (SmallSat WG) was chartered in September, making it the eleventh working group currently governed by USGIF.

"Small spacecraft is not a new thing," said Jessica "J.B." Young, Lockheed Martin Space Systems' principal investigator for CubeSat research and development and SmallSat WG co-chair. "There are now more applications and uses for them, and the SmallSat community is starting to grow rapidly."

According to the group's charter, its overall mission is to inform and educate the GEOINT Community on a common understanding of SmallSat systems and associated tasking, processing, exploitation, and dissemination systems, aiming to form a community of interest in national space policies and current and emerging mission needs and capabilities. Additionally, the group hopes to increase awareness about the capabilities of SmallSats and their value to both government and industry.

"One of our main objectives is to influence decision makers to support and fund more SmallSat projects," Young said.

"There are many folks out there that are not supportive of small satellites and think they aren't capable enough, so it's important we educate the GEOINT Community and fill these gaps."

The idea to create a USGIF SmallSat working group was fueled at the GEOINT 2013* Symposium in April 2014, when the Foundation hosted several SmallSat-related events, including a flash talk with panelists representing several USGIF member organizations. Young said there was a lot of positive response from Symposium attendees, which powered the standup of the group.

"The defense and intelligence community, where most of the money is spent on satellite information collection, has never looked at SmallSats as capable of resolving their pressing needs," said Rob Zitz, SmallSat WG co-chair and chief systems architect for Leidos. "I think that's changing now—the need for resilience and improved technology has caused th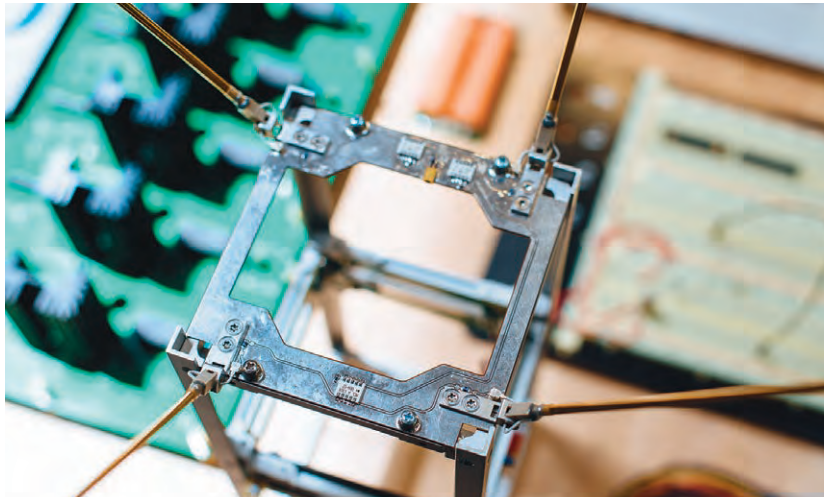e change—and the small satellite community is starting to see the defense and intelligence community seek more understanding about SmallSat capabilities."

Young and Zitz have organized several events to get the working group off the ground. The group attended the 2014 Small Satellite Conference at Utah State University in August and held a casual meeting to discuss findings and observations from the event.

"We tapped into the SmallSat community to get feedback on how to further our group and educate the GEOINT Community," Young said.

Not only does the group host monthly meetings, but Zitz and Young also strive to make them engaging and interactive. In September, the working group's monthly meeting included a panel discussion with representatives from government agencies who examined the tactical and national needs addressed by current and future SmallSat programs.

To maintain momentum, the SmallSat WG plans to continue to engage the GEOINT Community at its monthly meetings, special events, and at the GEOINT 2015 Symposium, June 22-25, in Washington, D.C.

"We want SmallSats to be viewed as mainstream GEOINT capabilities—it's not just another science project," Zitz said.

▪ BY LINDSAY TILTON MITCHELL

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Watching

FROM AIR, SEA, AND SPACE, GEOSPATIAL TECHNOLOGY IS HELPING NATIONS MONITOR ONE OF THEIR BIGGEST AND MOST UNDERSTATED THREATS: THE OPEN OCEAN.

The Arleigh Burke-class guided-missile destroyer USS Halsey, right, and the Ticonderoga-class guided-missile cruiser USS Antietam, participate in a maneuvering exercise. Halsey is on patrol in the U.S. 7th Fleet area of responsibility supporting security and stability in the Indo-Asia-Pacific region.

the Water

BY MATT ALDERTON

>> In ancient Greece, Zeus was king of the gods. Among ancient Greeks, however, the preeminent deity was likely his brother, Poseidon, God of the Sea, to whom fishermen and mariners prayed prior to each voyage. It's no mystery why: With its mountainous landscape, scant farmland, and vast coastline, Greece had no choice but to cultivate a maritime economy, shipping goods abroad to trade for food. Smooth sailing was paramount.

Today, 90 percent of the world's trade travels by sea, according to the United Nations' International Maritime Organization (IMO). Its most recent survey of international shipping, published in 2012, concluded the amount of cargo traveling by sea has grown more than three-fold in the last 40 years, increasing from 2.5 billion tons in 1970 to 8.4 billion tons in 2010. As of 2011, IMO estimated, the world's merchant fleet consisted of 104,304 ships manned by approximately 1.5 million seafarers of nearly every nationality.

Though Poseidon retired long ago, smooth sailing is as important as ever.

"You can buy a boat that's capable of going across the ocean a lot more cheaply than what most people imagine," said George "Guy" Thomas, former science and technology advisor to the U.S. Coast Guard and co-founder of Collaboration in Space for Global Maritime Awareness (C-SIGMA), an international initiative with the goal to foster a global exchange of space-based maritime surveillance information. "If terrorists ever got their hands on a weapon of mass destruction, that's how they'd bring it in."

That they haven't means there's still time for prevention. The solution: water-, air-, and space-based systems that provide persistent maritime domain awareness (MDA) by focusing assets to monitor any area of the global maritime domain in order to expeditiously assess potential adversaries.

to the port of Mumbai," explained Commander Richard Schgallis, former MDA and space operations officer for the U.S. Navy's 6th Fleet and former military deputy to the Naval Research Laboratory's Naval Center for Space Technology. "It's a prime example of why maritime domain awareness is so critical."

Indeed, the attacks may have been prevented—if only someone had been watching the water.

"There's a lot of stuff plowing the oceans, and there's very little awareness beyond the radar horizon as to what's out there," continued Schgallis, who is also operations director of the Coalition Tactical Awareness and Response (CTAR) joint capability technology demonstration (JCTD), a collaborative effort of the Departments of Defense (DoD) and Homeland Security (DHS).

terrorists had attacked the U.S. by air, an obvious question was: Where could they strike next? The answer—by water—had the U.S. Navy scrambling.

"On 9/11, the head of the Navy was tasked to figure out what our vulnerabilities were to maritime terrorism, and what we could do about them," recalled Thomas, who was in September 2001 a researcher at Johns Hopkins University's Applied Physics Lab. As the lab's liaison to the Naval War College, Thomas led numerous technology-focused war games and at-sea exercises, including a series of war games and discussions beginning Sept. 24, 2001, to determine why and how to build a maritime traffic tracking system.

From the war games emerged two proposals, both of which have since been enacted: One, all ships bound for the U.S. should be required to report their positions several times daily via satellite communications. Two, their locations should be confirmed from space using Automatic Identification System (AIS) signals.

AIS began as an at-sea anti-collision solution: Nearly all large commercial ships are equipped with both a transmitter and receiver to share its name and position locally with passing vessels, thereby avoiding crashes. Fusing these signals in space with unclassified commercial satellite imagery and GPS coordinates provides governments with maritime situational awareness they previously lacked.

"With the assistance of observation satellites, we can see all the vessels in the ocean at a given time and match them with their AIS position," said Olivier Surly, senior sales director at Astrium GEO-Information Services, the GEOINT line of business within France-based Airbus Defence and Space. "If [they don't match] it means there's something wrong."

Being able to tell when something's wrong is half the battle. Consider the equivalent problem set in aviation: Because aircraft are required to report and transmit their location, anomalies stand out on radar.

"Space-based AIS gives us the ability to track ships just like we can track airplanes," Thomas said.

Almost. Although space-based AIS

"**There's a lot of stuff plowing the oceans, and there's very little awareness beyond the radar horizon as to what's out there.**"

— Commander Richard Schgallis, military deputy to the Naval Research Laboratory's Naval Center for Space Technology

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AN OCEAN OF TROUBLE

Ten members of the Pakistani terror group Lashkar-e-Taiba commenced a four-day siege of Mumbai, India, on Nov. 26, 2008. Over the course of 56 hours, the group carried out 12 attacks on civilian targets, including two taxis, two hotels, a train station, a restaurant, a hospital, and a movie theater. By the end of their marathon of terror, the attackers had killed 164 people and wounded another 308.

Next to the carnage inflicted, the most terrifying thing about the attacks was how the terrorists entered Mumbai in the first place—by sea.

"Ten practicing terrorists went out to sea on a Zodiac inflatable boat, commandeered an anchored Indian fishing vessel, then executed the crew and steered that ship 600 miles across the Indian Ocean

"The maritime environment is largely unregulated, yet most of our commerce is in the maritime domain. This creates a threat axis that has to be dealt with."

Preventing terrorist attacks isn't the only benefit of improved MDA. It also can be used to protect cargo and crews from pirates, who, according to IMO, executed 245 armed attacks against ships in 2013; to establish sovereignty in areas rich with disputed natural resources, such as the Arctic; to stop illegal, unregulated, and unreported fishing, which contributes to global economic losses of up to $23 billion per year; to execute successful search-and-rescue missions; and to protect the environment from corporate polluters.

OF SPACE AND SEA

The need for an international MDA system became apparent on 9/11. Although

THE NAVY MQ-4C BAMS is a broad area surveillance, maritime derivative of Northrop Grumman's RQ-4 Global Hawk, designed to provide the Navy with persistent maritime surveillance and reconnaissance coverage of wide oceanographic and littoral areas. In this illustration, the BAMS is shown here alongside the Boeing P-8 Poseidon.

and space-based radar are ideal matches, the former has its flaws.

"The major limitation with AIS is that it's a cooperative system," noted Surly. While AIS transmission is required of all large commercial vessels by international regulations, any vessel with bad intentions can switch off its equipment and stop emitting.

MAKING WAVES

Since the introduction of space-based AIS in 2005, numerous stakeholders have employed the technology to advance MDA. Leading the pack is Canada, which has made MDA a top priority pursuant to its interests in the oil-rich Arctic Circle, where the country competes for sovereignty with Russia, among others.

"The Canadians are huge into maritime domain awareness," Schgallis said. "They have a lot of water they're trying to monitor, and they're doing that with a combination of AIS and synthetic aperture radar satellites."

Synthetic aperture radar (SAR) technology is capable of generating all-weather, broad-area, high-resolution imagery. Canada has been on the cutting edge of it since 1995, when the government and Canadian satellite operator MacDonald, Dettwiler and

Associates Ltd. collaborated to launch the RADARSAT-1 observation satellite. When the company subsequently launched RADARSAT-2 in 2007, it gave rise to one of the world's most evolved MDA programs to date, known as Polar Epsilon.

"Polar Epsilon is a maritime surveillance and security program that provides near real-time monitoring of Canada's coastline out to 1,000 nautical miles," explained David Belton, MacDonald, Dettwiler and Associates' vice president of geospatial services. "There are satellite data reception facilities on both of Canada's coastlines that take down imagery from RADARSAT-2 and generate ship detection reports within six to eight minutes after the targets have been illuminated."

In 2018, Canada will evolve its maritime surveillance capabilities even further when the Canadian government and MacDonald, Dettwiler and Associates launch the RADARSAT Constellation Mission, three satellites that will provide high-resolution, all-weather imagery and coincident AIS data collection of 95 percent of the world on a daily basis.

"What Canada is doing today is a pretty good template for what the

rest of the world should be doing," Belton continued.

But Canada isn't alone. In the past decade, the European Union, India, South Africa, the Philippines, and Japan have all taken an active interest in maritime domain awareness.

In the United States, MDA is a strategic priority for both DoD and DHS. One area where DoD and DHS are working cooperatively to advance MDA is through the CTAR JCTD program, which seeks to improve MDA by facilitating rapid tasking, processing, exploitation, and dissemination of commercial satellite imagery at the operational level within the Navy. The CTAR JCTD leverages many of the same technologies employed by the Polar Epsilon program in Canada, a method expected to allow for easier collaboration between these allied countries.

"For so long we've treated GEOINT—especially from space—as an intelligence product," Schgallis said. "CTAR is trying to take that data in near real-time and push it into the common operating picture."

At press time, the DoD Executive Agent for MDA (DoD EAMDA) was in the process of creating a five-year strategic plan, to be published in Q4 2014 and provide guidance on future DoD MDA investments.

MORE MDA
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"[The report is] one of the priority efforts for our office … to provide updated goals, objectives, and desired effects not only to guide the activities and investments of the department, but to keep us moving forward based on the progress the department has already made," said Doug Wilcox, DoD EAMDA Director of Strategy and Policy. "About 40 different organizations are providing input, so it's something we continue to work on."

SEA CHANGE

Although maritime domain awareness has evolved considerably in the past decade, gaps remain. Filling them will require a sea change in three principal areas: data collection, processing, and sharing.

>>Data Collection

Together, space-based AIS and radar are a powerful means of collecting maritime information. But combined adoption is scant. As of 2013, only 15 commercial and government satellites were orbiting the earth with AIS receivers, according to Thomas.

"Use of satellites for maritime applications is still very limited," Surly said. "When you speak with navies, they still use vessels for monitoring wide areas, which is not very effective."

Along with more AIS-equipped satellites, a major priority is more coverage.

"One of the key capabilities that needs to be better developed is persistence, or at least consistency of surveillance," Belton said.

Although space-based data collection is critical to MDA, its cost and limitations mean a more holistic approach is essential. For that reason, companies such as Boeing and Northrop Grumman are hard at work on air- and water-based platforms that, in collaboration with space, paint a complete maritime picture.

At Boeing, efforts are concentrated in the P-8 Poseidon, a military derivative of the Boeing Next-Generation 737-800. A long-range, anti-submarine warfare, anti-surface warfare, intelligence, surveillance, and reconnaissance aircraft, the P-8 is capable of flying 12- to 22-hour manned MDA missions. It lacks the persistence of a space-based platform but offers many other advantages. Principal among them, for instance, is its response capabilities: While space-based platforms can identify threats, air-based platforms can respond to them.

"The true asset that a manned platform gives you is its crew. You have humans in the decision loop who are on-station in the domain with which you are surveilling, which gives you a rapid response capability—both unarmed and armed," explained James Detwiler, Boeing P-8 business development director, adding that other benefits include all-weather surveillance and ultra-high-

resolution imagery. Boeing, whose P-8 customers include the U.S., Indian, and Australian navies, also has a smaller maritime surveillance aircraft that's not yet operational, and an unmanned underwater vehicle currently in development, which ultimately will be able to monitor sub-surface maritime threats by collecting acoustic intelligence and detecting biological or chemical agents indicative of everything from terrorism to illegal dumping.

"We're working to link all these platforms through various data transmission paths so you have a true family of manned and unmanned systems that give you a full maritime-domain-awareness picture," Detwiler said.

Northrop Grumman's MQ-4C Triton UAV will offer another piece of that picture when it becomes operational in late 2017, with the U.S. Navy planning to fly four jets each from at least five land-based locations beginning in 2019.

"Triton gives us long endurance—a 24-hour unblinking eye that can cover some two million square miles in a mission," said Mike Mackey, Northrop Grumman's Triton program manager. "Under satellite conditions, there's a track the satellite follows, which gives you some level of coverage for a specific time, but not a complete time. [Triton] has the ability to move to a specific area that we want, any time of day or night, and stay in that area. In addition to long endurance and detection in vast areas, what that gives you is the ability to track an object of interest until you can bring in other resources, like a manned P-8 platform, which we'll work in conjunction with. It provides a complete operational picture."

The future of MDA is as dependent on sensors as it is on platforms, according to Schgallis, who envisions a slew of maritime sensors—including long-range acoustic sensors to detect vessels, optical sensors to classify them, and multispectral cameras to determine their contents and crew—affixed to a future network of stationary buoys.

"There's no reason why we couldn't have a network of buoys populating wide expanses of water with cameras and radar on them, up-linking their data to a satellite overhead every time they pick up a new contact," he said. "It's a huge undertaking, but it could be done."

POLAR EPSILON delivers space-based, day and night, all-weather maritime surveillance information and monitors vessels within Canadian and international waters using RADARSAT-2, providing maritime surveillance information to decision-makers within minutes.
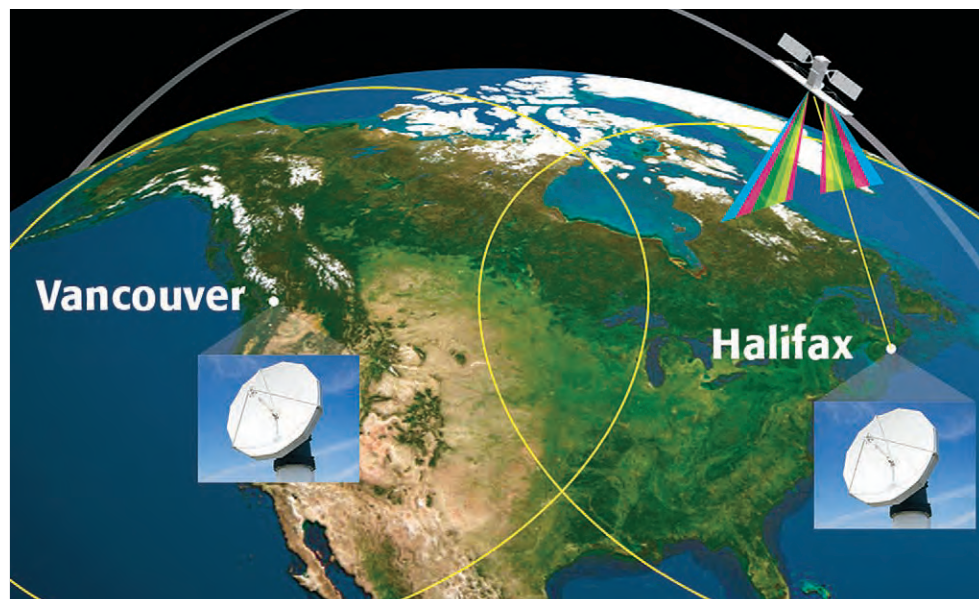
IMAGE COURTESY OF MACDONALD, DETTWILER AND ASSOCIATES LTD.

>>Data Processing

Like most GEOINT missions, the MDA problem set hinges not only on data collection, but also on data processing.

"In the human body we have all these wonderful senses—hearing that is 360 degrees; peripheral vision that is 180 degrees, and the ability to walk over to somebody and question them if they're doing something odd," Schgallis said. "The human brain brings all these senses together in an integrated way so we can evaluate the situation in front of us and make real-time decisions. We need the same decision-making matrix [for MDA]—the ability to get disparate data into one place so one person or one machine can quickly aggregate it and look for anomalous information we can act on."

Unclassified multi-INT solutions such as MacDonald, Dettwiler, and Associates' BlueHawk, which fuses SAR and AIS for automated threat detection, support the decision-making matrix.

"BlueHawk gives operators and analysts tools for detecting suspicious activity, but there are still opportunities to develop additional capabilities to maximize value to decision-makers," Belton said. "We need more sophisticated fusion and analysis tools that can filter out all the noise and help operators focus on which vessels are real threats."

>>Data Sharing

Data sharing is the final piece of the MDA puzzle, according to Mario Garza, deputy chief of the Political Military Affairs Division of U.S. Southern Command (SOUTHCOM), where MDA efforts are focused primarily on drug trafficking and its potential nexus with terrorism.

"The maritime domain is a vast area vulnerable to exploitation by well-funded, creative, and adaptive criminal groups," Garza said. "The U.S. and its regional partners believe the best approach to counter challenges in the maritime domain is to share information and capabilities in order to better understand this operating environment and the threats moving within it."

SOUTHCOM's commitment to MDA data sharing is evident in ongoing efforts such as Operation Martillo,

launched Jan. 15, 2012, to counter illicit trafficking and transnational organized crime in the Central American littorals. By sharing maritime intelligence, SOUTHCOM and its regional partners have observed a significant decrease in drug trafficking via small "go-fast" boats using littoral routes in the Eastern Pacific.

"Central America is a region that experienced sharp increases in drug trafficking and violence following regional successes against transnational criminal networks elsewhere in our hemisphere," Garza continued. "[Operation] Martillo is supported by more than a dozen Western Hemisphere and European partners working together by sharing information and capabilities to deny drug traffickers use of Central American coastal waters."

Despite successes, maritime data sharing presents challenges, such as who owns the data and who pays for it.

"Each country has developed solutions that uniquely fit with its national institution," Surly said. "However, the threats are global because the maritime domain is a global medium … So, the ultimate goal for MDA is really to increase cooperation and interoperability among countries."

Sharing will not be effective without global standards, according to Jay O'Brien, technical director at the U.S. Coast Guard Maritime Intelligence Fusion Center Atlantic in Virginia Beach, Va.

"Looking ahead, it's critical that we focus on standardized sets of data," O'Brien said. "When we typify vessel activity, for instance, is it with the latitude/longitude of the vessel, its name, its IMO number, or its document number? How we typify the vessel to our various agencies' and partners' databases can really be improved by making sure we've got standards and disciplined data labeling."

Data standardization is already a major DoD objective, according to Jaci Knudson, data strategy lead in the Program Executive Office for Command and Control Capabilities of the Defense Information Systems Agency. In collaboration with the Open Geospatial Consortium (OGC), Knudson helped launch the Geo4NIEM initiative in fall 2013, which improved geospatial

standards within the National Information Exchange Model (NIEM) that is used for information sharing across the U.S. government.

Knudson said standardizing maritime location data could eventually result in a direct-usage model for maritime decision-makers.

"We will be able to take the attributes of maritime data that's reported and treat AIS data just like we treat any other kind of transponder data … so you can get actual location," she said.

When advances are made in these three key areas, MDA will do the work of many Poseidons, securing the sea not with spears and high surf, but with GEOINT. ▪

MOBILE MDA

In the digital age, maritime domain awareness (MDA) can be gained not only with satellites, but also with smartphones. Whether you're a commercial enterprise or seafaring tourist, mobile apps can deliver improved situational awareness at sea via valuable maritime capabilities, including:

VESSEL TRACKING: Using real-time AIS signals, apps such as MarineTraffic, Ship Finder, Boat Watch, and VesselFinder allow users to track ships on a map from their mobile device. Several, including "pro" versions of Boat Watch and Ship Finder, offer augmented reality features, allowing users to identify vessels—learning their name, type, and destination—by viewing them through their phone's camera.

CITIZEN REPORTING: Apps such as ShipWatch are designed to combat illegal, unreported, and unregulated fishing by allowing fishermen to report questionable activity to authorities. All a user has to do is take a picture, tag it, and upload it to a central map. A similar tool, called Fish DB, allows fishermen to report illegal fishing activity via SMS text message, in case they lack an Internet connection.

Conve
CON

BY KRISTIN QUINN

ying SEQUENCE

LETITIA LONG REFLECTS ON HER TIME AT THE NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY; ROBERT CARDILLO SHARES HIS VISION FOR THE FUTURE.

For the past four years, Letitia Long led the National Geospatial-Intelligence Agency (NGA) as it matured, delivering on her promise to put the power of on-demand GEOINT into the hands of NGA customers. Under her leadership, the agency gained the national spotlight for its role in the 2011 capture of Osama Bin Laden.

Meanwhile, in the same four-year span, Robert Cardillo, who in 1983 began his career as a Defense Intelligence Agency (DIA) imagery analyst, served as the first deputy director for intelligence integration with the Office of the Director of National Intelligence (ODNI). In this role, he was responsible for leading the integration of the Intelligence Community. Additionally, he delivered the President's Daily Brief—what he liked to refer to as "turning in the IC's homework." Cardillo aims to carry NGA's core mission one step further—beyond contextual content, to conveying consequence.

Trajectory Managing Editor Kristin Quinn had the opportunity to speak one-on-one with both Long and Cardillo shortly before NGA's Oct. 4 change-of-director ceremony. Long reflected upon the evolution of the discipline and the agency, and Cardillo set the stage for an era of increased partnership and measured risk-taking. Both gave a strong nod to the changing GEOINT landscape and competitive marketplace, acknowledging the criticality of teaming with industry to drive innovation.

For the unabridged interview with each, visit *trajectorymagazine.com*.

FORMER NGA DIRECTOR LETITIA LONG

How have you seen GEOINT evolve during your career?

When I began my career 36 years ago, there was nothing called GEOINT. We had imagery exploitation, mapping, and cartographic services, but there was nothing quite integrated as we know GEOINT today. There was no enterprise across the national and allied systems for geospatial intelligence, and there was no real industry associated with GEOINT.

So, in less than a decade, we went from not having anything called GEOINT to a whole community focused around it.

What have been some of the most significant changes in the GEOINT Community during your tenure at NGA?

In the last four years, we have really accelerated the delivery of GEOINT and its significance. It's been a huge evolution. With the rise of GEOINT, we had integrated the imagery and mapping capabilities of the agency, but we were still largely producing static maps, charts, and intelligence products. We had simply digitized our old processes.

In my time as director, NGA really focused on updating the content—imagery and mapping—in an integrated fashion to provide knowledge and services. The agency is driving toward an environment that is truly integrated. We are organizing the agency around object-based production. Everything is located somewhere on the Earth, so it makes sense that GEOINT is the driver. We're giving the Intelligence Community the ability to organize its information—whether SIGINT, HUMINT, or open-source information—in context to our GEOINT. That helps us anticipate what might happen next and leads to better predictive capabilities.

What would you consider NGA's greatest organizational accomplishment during your tenure as director?

It was setting the vision to put GEOINT in the hands of the user, developing the strategy to implement that vision, and then delivering on it. To do that, we had

LETITIA LONG addressed the GEOINT 2013* Symposium audience in Tampa with a keynote speech focused on immersive intelligence.

to do a number of things. First, we had to develop our leaders, so the agency had a leadership team focused on developing the strategy and delivering on it. We also incorporated risk management and developed an environment where our folks felt comfortable taking risks. We introduced agility, and we focused on the customer. Intelligence does you no good if it's intelligence for intelligence's sake.

Of what personal achievement are you most proud?

I would tie that back to the last question. I had a real focus on our leader development initiative. We're still a young agency at only 18 years old. When I came in, I'm not sure folks felt like we always had a seat at the table. We have a seat at the table now. We are a vital component of the Intelligence Community. We have raised the awareness of the GEOINT contributions and are leading the way in so many areas such as driving intelligence integration and taking a leading role in the Intelligence Community Information Technology Enterprise (IC ITE). That's due to the focus we've had in developing our people, individually and as a team, to put the agency and the community before an individual part of our organization or before ourselves. We have focused on succession management to ensure we're developing our folks from a leader development

perspective and from a tradecraft perspective. We are creating bench strength across the agency at all levels. I think folks really believe they're an important part of the organization. It takes all of us to make this agency work.

What are some ongoing challenges facing the agency?

Something unique for NGA in the Intelligence Community is commercial competition. I've seen the community evolve from a commercial remote sensing perspective. It's huge what is out there and available to everyone. There is the rise of social media with all of the photos and videos being geo-referenced and time-tagged, and there are whole industries that have grown up around this to include some pretty darn good analytic capability. So the challenge NGA faces is, 'How do we take advantage of that? How do we harness that creativity in the private sector and put it to work for us?' Not compete, but take advantage of and add to it. That's unique in the community and is certainly one of the biggest challenges.

You spoke about the need for immersive data and intelligence in your most recent GEOINT Symposium keynote address. How do you envision the Community achieving this goal?

IC ITE is the platform that will enable

us to achieve immersion in the data and truly integrate intelligence. That is a necessary but not sufficient condition. We need IC ITE as our backbone to enable us to integrate our information and operate within the cloud. So, as we are all moving toward persistent coverage, we also have to be developing the advanced analytics to handle all of this Big Data. We can't look at every image. We will never have enough people to look at all of the persistent data we collect. Advanced analytics that recognize patterns can point us to data where human analysis is most needed. Using object-based intelligence, from a multi-INT perspective, we can record observations in the cloud from the same object, we can easily integrate our information, and our analysts can become immersed in the data. We're beginning to see some of this come to fruition already.

What are some other emerging trends you predict will proliferate in the GEOINT Community?

Gaming and visualization—the way we visualize and present all of this information. The gaming industry is way ahead of us, so taking advantage of their investments will only help. I really do see gaming and visualization as an emerging area in which we must get our folks comfortable operating. We cannot wait for an email to come into our inboxes or an RSS feed to appear. We must embrace augmented reality as another way of living within the data.

Also, automated tipping and cueing. In the same way advanced analytics can help us recognize patterns and steer us in the direction where we need to focus, automatic tipping and cueing between and among our sensors can also help prioritize our resources. At NGA, we refer to the Next Generation Collection Initiative as one that allows one GEOINT sensor to tip another GEOINT or SIGINT sensor directly if it detects unusual activity. We don't even need analysts in that loop. We have had a number of experiments underway and have just gone operational with one of those.

What advice do you have for young GEOINT professionals?

First and foremost, have courage. Have courage to ask questions, to seek knowledge, to take the assignments you may not think you're ready for. Have courage to ask the question no one else wants to ask but everybody is thinking. Have courage to speak truth to power, which is often passed off as easy to do. It's sometimes very difficult to do, especially if you're not in an environment where you feel safe. It's imperative that folks do that, however. Have the courage to innovate. Folks should always be trying to develop themselves and not only think about the job they're in and what their next job should be, but the job after that.

What's next for you in retirement after you leave NGA?

Well, the first thing I'm going to do is take a break and spend some more time with my family. My husband has been incredibly supportive, and it's time for me to give him a little bit back, along with my daughters, my step-daughter, and granddaughter. I want to spend more time with them and my parents, who are both 88 years old. So, I am going to take a bit of a break. Then we'll see what's next. I want to stay connected to GEOINT, to the

> **"I HAD A REAL FOCUS ON OUR LEADER DEVELOPMENT INITIATIVE. WE'RE STILL A YOUNG AGENCY AT ONLY 18 YEARS OLD. WHEN I CAME IN, I'M NOT SURE FOLKS FELT LIKE WE ALWAYS HAD A SEAT AT THE TABLE. WE HAVE A SEAT AT THE TABLE NOW. WE ARE A VITAL COMPONENT OF THE INTELLIGENCE COMMUNITY."**
>
> — Letitia Long, former director, NGA

As the first woman to lead a major U.S. intelligence agency, do you have any particular advice for young women in the Intelligence Community who aspire to leadership roles?

Don't take yourself out of the running. Women have a tendency to hold themselves back. They see a job advertisement or an opportunity to volunteer and often say, 'Oh, I'm not qualified' or 'I'm not the most qualified. I don't have every single experience listed in that job announcement.' Whereas men say, 'I'm only 50 percent qualified, but I'm putting my name in the hat.' I tell women, 'You don't actually know what the selecting official is looking for. They're building a team. If it's something you want to do, and you have the ability to do it, go for it.'

That's my biggest piece of advice for women in the community and young women in particular. They are so qualified, and they need to have the courage to take the risk to put themselves out there.

Intelligence Community, and the larger national security community. I'd like to stay connected in leadership development programs and with women in STEM because that is an area where we absolutely need more women.

Do you have anything else you would like to discuss?

I have been so incredibly fortunate to have the opportunities I've had throughout my career. I can honestly say every job was better than the one before it. I've had so many people mentor me, guide me, and help me along the way that I'm looking forward to giving back. I have mentored folks along the way, and I look forward to doing more. It is all about the people, and I have certainly tried to take care of the people. If you take care of the people, the people will take care of the business. And while it's mission first, it is people always.

NGA DIRECTOR ROBERT CARDILLO

LONG FORM
Read the full-length interviews online at *trajectorymagazine.com*, or download the free *trajectory* tablet app.

How does it feel to return to your imagery roots?

I think my history has advantages and some potential drawbacks, and I'm still working my way through what goes into which category. I was born into this business—my first full-time position, first professional development experience, etc. It will certainly be interesting to have been the most junior employee in this business and to now see the organization as its director. And I'm passionate about this business, so I don't need to be talked into it or wonder what the power of geospatial intelligence could be. I've been able to experience that inside and out.

On the challenges side, it's not 1983 anymore. Even since 2006, when I left NGA to go to the Defense Intelligence Agency (DIA), GEOINT is a different business. I have to be mindful that while I am proud of and lean heavily on that history, it also isn't today. I encourage all of the professionals in our business to remember that the key to success is self-awareness—being confident and proud of their contributions to any conversation or partnership—and being equally comfortable knowing that their contributions are limited. I think if I can balance those two, I will have a better shot at taking advantage of the positives and not getting tripped up by the negatives.

How do you plan to carry on intelligence integration in your role at NGA?

A benefit of moving to DIA in 2006 was my ability to see and work with NGA from DIA's perspective. When you go to DIA and look back at NGA, it looks different. It was hugely valuable. Then, when I went to ODNI, I was sort of a partner, but more of a demander. I was: 'I need X at this time frame or the world's going to spin off its axis and crash into the moon or something.' Everything was a crisis, and I needed it immediately. So I went from an internal leader to an external partner to a senior demander. Now that I'm back inside, my approach to instilling this sense of integration is to try to see everything we do through the lens of consequence. There's a reason I use that word. Consequence is whatever a customer decides is mission success.

We create content at NGA. We place that content into context for a living. That's what a map is. A map is a contextual, visual depiction of a geographic area. We do the same thing with imagery products. We don't just tell them what happened overnight. We tell the customer what happened over the past 10 years, and we project that history forward to tell them what's going to happen tomorrow, next week, next year. It's necessary for us to create that content. It's necessary for us to create the context around that content.

However, it is insufficient if we stop there. And we must integrate. We must—and another sequence in my C-construct is—convey that information. Content and context must be conveyed to get to consequence. We contextualize with multiple sources. All of that is integration, and it sets the conditions for customers to achieve their consequence.

Take whatever you're doing, flip the lens, and look at it through the eyes of your customer. When you do that and you can see the potential consequence on that side, you're good. If you do that and you can't see consequence, maybe we're doing legacy things that aren't as consequential as they used to be. We should question those things. Especially in this budgetary environment, we've got to ask those hard questions. I'm going to use this construct of consequence to create this lens.

In what ways do you believe your experiences at ODNI will influence your leadership at NGA?

It's another doubled-edged sword. I need to be careful and mindful. We have many people who are doing 7/24 work, supporting Central Command, in a clearly tactical dynamic. I don't believe the director of NGA should be in that dynamic. I want to be aware of those activities, but I don't want to be in the way of them. There might be a person or two in the organization a little worried or maybe a little excited—depending on their view—that I'm going to move into the NGA Operations Center (NOC) and sit in the 'Captain Kirk' chair and start spinning myself around saying, 'Point the satellite. Take the picture.' I was 'Mr. Tactical' in my last job, and I used to make those phone calls to the NOC, but not now.

I had the privilege the last four years to see and participate in the confluence of intelligence and policy. To be able to see how our customers use our output is invaluable. I would hope I can bring that sense of urgency, and I don't mean in the sense of 'you have to do this in five minutes.' We're involved in a mighty cause, and I need to be able to convey that to the senior leadership team and the work-

force as much as I can—how important their work is. I know they hear that a lot. But, I had the opportunity to sit at the center and see what worked, what didn't work, and how people reacted to certain types of products and services.

Can you elaborate on some of the themes and initiatives you will drive as director?
If you wanted to take an image from outer space in 1985, you didn't have a whole lot of choices. You needed a top-secret clearance and a way to task the U.S. government Intelligence Community. We don't live in that space anymore, and I believe if we don't fully engage in and join that broader community—government, contractor, and academic—in this vibrant geospatial marketplace, it will be to our detriment. I'm not saying, 'Hey, I walked into NGA and they had no idea that all of those things were going on.' But, I'm going to challenge us to strengthen that engagement and those partnerships. I want to take advantage of the power of that vibrancy and energy that's going on out there. And, I think we can benefit richly from that exchange, in an innovation and adaptive technology sense.

Many of our customers have very exquisite questions and operations. There's a time and a place to be in this very narrowly compartmented area, and we have to protect that. And we have to get even better at that, too. So, I do think we have small niches where we need to exquisitely pursue a specific application because of the mission import, or the customer import, or both. But beyond that, I look forward to the competition. I think it is, and will be, constructive. The message I want to send to our workforce and to our partners is that we are open for partnership, and I'd like to constructively compete with you.

Building off that, what will be some of the core elements of your future strategy for the agency?
We have to be a better partner, and we have to find better partners. I hope industry doesn't take that the wrong way, I don't mean we have bad partners right now, but it's a two-way street.

I've been remiss in not mentioning our allies, and actually I think NGA is the model in the consortiums that have been developed and all of the geospatial agreements that exist. Even though we all understand we're the biggest dog and bring the most to the table, my view about those kind of partnerships is it doesn't matter what size you are—if you're a small country with limited resources or whatnot—to me, what you bring to the table goes back to my comment about self-awareness.

I want to instill a sense of acceptable risk. I want the NGA workforce and our partners to know, if you innovate, if you experiment, if you take a couple steps outside the extant policy, and your purpose is to move to a more consequential exchange or engagement or output and it doesn't go well, I'll be your top cover.

What do you think NGA needs most from industry right now?
It's a partner question, and industry is our partner now. And thanks to USGIF, for one, for creating those conditions to further that partnership. I appreciate that we're not alone. The market is crowded, and I'm excited about that crowd. As a culture, we tend to be reactive, at least my generation, and that could very well change. We must create an innovative consortium and benefit from the vast research and development that industry has, and have conversations about needs, desires, requirements, etc. I understand there are ways that you have to have those conversations to create a fair competition for fewer and fewer government dollars. But within that framework, I'm more than open to innovative solutions.

So here's a specific challenge to industry: I know, given our customers and our adversaries, that we must be agile. If we're not agile, we're not relevant. If we're not relevant, we're not needed. We need industry to help us with that agility. We don't need to own all of the parts to the solution, but we do need to own and be responsible for the output. When we turn it over to a customer, we stand behind it. Whether it's a navigation tool, a targeting solution, or a long-term geospatial study of the Arctic, we fully stand behind it. And we are very comfortable locking arms with industry and allied partners on the way there.

How will GEOINT credentialing better the community and advance tradecraft?
To me, this is a win-win. As I step into the position of NGA director, I will have functional management responsibilities for this profession inside the government, and I take those very seriously. And I know I need help to do that. I want and need USGIF's dedicated assistance in crafting, refining, and developing these credentials. My concept of operations is, we work on them together, because USGIF as an organization has great access to credentialing expertise. So, I want to blend our expertise to create the set of credentials that helps my workforce both ground and grow their profession. I want those credentials to be available and apply to contracted services, and USGIF can help in doing that.

Is there anything else you'd like to add?
The competition I described a number of times, that's not just a geospatial issue, it's an IC issue. In my last job, I ran into lots of principals, at a lot of different venues, at a lot of different times. You've got to compete for their attention. That's step one. You have to find a hook. Once you get their attention, your time is very limited. It's a world full of information. They have choices, and those choices don't have to be us. We need to understand that it is a different relationship, a different equation than it ever has been.

The business the IC is in is storytelling. I know it sounds a bit simplistic or like we're *Entertainment News*. But let's face it, if we don't tell a compelling story—one that informs, alerts, warns, and educates customers to understand their problems in a way they didn't before—we're going to struggle. This is not, 'Oh no, the end is near.' It's rather the opposite. It's, 'Oh yes, look at the heights we can move to.' ⊞

"**SO HERE'S A SPECIFIC CHALLENGE TO INDUSTRY:** I KNOW, GIVEN OUR CUSTOMERS AND OUR ADVERSARIES, THAT WE MUST BE AGILE. IF WE'RE NOT AGILE, WE'RE NOT RELEVANT. IF WE'RE NOT RELEVANT, WE'RE NOT NEEDED. WE NEED INDUSTRY TO HELP US WITH THAT AGILITY."

— NGA Director Robert Cardillo

FUTURE GEOINT LEADERS

MEET THE 2014 USGIF SCHOLARSHIP WINNERS

USGIF awarded scholarships to 22 students in 2014. The USGIF Scholarship Program advances the GEOINT tradecraft by granting scholarships to promising students pursuing degrees in the geospatial sciences or a related field. In total, USGIF has awarded $792,000 in scholarship funds since the program began in 2004.

This year, the Foundation granted scholarships to five Ph.D. candidates, seven graduate students, seven undergraduates, and three graduating high school seniors. Each undergraduate, graduate, and doctorate awardee receives $5,000, while high school seniors receive $2,000 toward their education.

All scholarship recipients were selected by USGIF's Scholarship Subcommittee, which evaluated applicants based on academic and professional excellence.

DOCTORATE

TANYA CATIGNANI
George Mason University
Earth Systems & Geoinformation Science

Tanya is developing a geospatial model of ancient Mayan wetland agricultural fields in northern Belize, analyzing the spectral reflectance of wetland soils to identify signatures related to ancient agriculture. She plans to continue researching geospatial modeling and how this technology can be applied to understand relationships between humans and their environment.

KATIE A. CORCORAN
University of Tennessee, Knoxville
Biological Anthropology

Katie's research focuses on the application of remote sensing for human grave detection, facilitating the recovery of missing U.S. military personnel in former conflict zones. Katie earned a bachelor's degree in anthropology from the University of Central Florida and has a professional background in archaeology.

JASON Z. EDWARDS
University of Wyoming
Ecology

Jason's research interests are focused on transportation networks and human/natural system dynamics. His dissertation addresses how timing, amount, and intensity of precipitation, together with land-use changes resulting from government policy, affect soil transport. This research applies remote sensing data in tandem with mechanistic model programming in a GIS framework.

DAVID SHEAN
University of Washington
Earth & Space Sciences

David has spent several years working for Malin Space Science Systems on the Mars Reconnaissance Orbiter science operations team. David's current research relies on satellite, airborne, and UAV remote sensing observations combined with modern photogrammetric methods to study ice dynamics and variability in Antarctica, Greenland, and the Pacific Northwest.

AMANDA ZIEMANN
Rochester Institute of Technology
Imaging Science

For her master's thesis, Amanda developed a tool for automated large-area search in multi-spectral imagery with applications to change detection analysis. Her doctoral research with RIT's Digital Imaging and Remote Sensing Laboratory focuses on developing graph theory and manifold learning-based target detection algorithms for hyperspectral imagery.

GRADUATE

JULIE BAER
Harvard Graduate School of Education
*International Education Policy*

Julie's primary research interest focuses on mapping international educational data to assist policymakers. Through aggregating and displaying this material, Julie hopes to provide insight on how countries can better apply resources to increase educational attainment. Julie received her undergraduate degree in financial economics from Centre College.

SEAN DOLAN
George Mason University
Geoinformatics & Geospatial Intelligence

As a geospatial analyst with Booz Allen Hamilton, Sean is versed in cartographic design, GEOINT analysis, and geospatial production. He is passionate about the integration of GIS technology with law enforcement, particularly to analyze and predict criminal behavior. Sean also holds a bachelor of arts in Spanish from Wake Forest University.
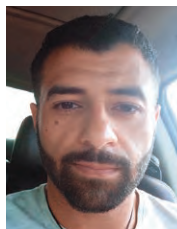
NOUMAN HUSSAIN
Penn State University
Geographic Information Systems

Nouman is currently a GIS analyst for the Department of Defense. He began his career in GIS after achieving a graduate GIS certificate from Penn State in 2012. His interests are spatial analysis, cartography, and, most recently, 3D visualization of spatial data and geographic points.

SETH W. LEMASTER

Penn State University
Homeland Security & Geospatial Intelligence

As a member of the Arkansas National Guard, Seth deployed to Afghanistan in 2012 as a geospatial intelligence analyst providing GEOINT support to special operations forces. While pursuing his master's degree, Seth works as the GIS lead for the Arkansas Geographic Information Office.

MEGAN M. G. MILLER

Purdue University
Geomatics Engineering

Megan's research efforts are focused on the advancement of UAV image processing through the development of a completely integrated and rigorous software package that delivers orthoimagery and digital surface models. She predicts this on-the-fly terrain analysis will greatly enhance the utility of UAVs for tactical and disaster relief users.

W. GABE POWELL

University of Mississippi
Geology

With more than 10 years of military service, Gabe has deployed to Iraq and Afghanistan in support of humanitarian relief efforts. While in Afghanistan, Gabe spent a year applying geospatial technologies in support of the war on terror. Gabe's next assignment takes him to the United States Military Academy where he will teach geospatial information science.

ALEXANDER TEDESCHI

New University of Lisbon
Geospatial Technologies

Alexander developed an interest in geospatial science by engaging with topics in political geography while pursuing a master's degree in regional studies. Alexander combined his cartographic skills and interest in history to build an interactive map of imperial Russian transportation routes, after which he assisted a Russian NGO to geocode addresses of political repression in Soviet Moscow.

UNDERGRADUATE
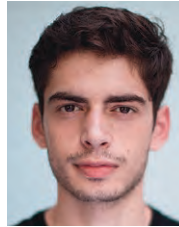
XHULIO BINJAKU

University of Florida
Geography & Architecture

After emigrating from Albania to the United States with his family, Xhulio learned of the immense vastness of land, and the similar patterns within that bring geographies together. Upon completing his undergraduate degree, Xhulio hopes to receive a master's degree in urban planning, and combine his knowledge of geography and architecture.

TIFFANY HUFF

Texas Christian University
Geography

Tiffany is an intern and Stokes Scholarship Program award recipient with the National Geospatial-Intelligence Agency (NGA). Upon graduation, Tiffany will convert to a full-time position with NGA, where she plans to apply her geographic knowledge and analytical GIS skills toward the agency's mission. She is particularly interested in exploring human geography, computer programming, and web-based map services.

ANNA KALINOWSKI

University of Missouri
Electrical Engineering

During the school year, Anna conducts academic research involving image processing and computer vision with university faculty members. On academic breaks, she interns at NGA. Anna looks forward to a career in which she can contribute her skills to the field of GEOINT.

ERIK MUELLER

University of Missouri
Geography & Behavioral Science

Growing up in and around the military drove Erik to pursue a career in the Intelligence Community and Department of Defense. He was fortunate to intern with the federal government this past summer, and plans to further his education and build a long-term career in the Intelligence Community.

TRAVIS STEVENS
Virginia Tech
Geography

Travis is a student veteran and is close to completing an associate's degree in computer science from Cochise College in addition to his courses at Virginia Tech. He hopes to receive full-time civilian employment in the defense industry upon graduation. Travis is a veteran of the Iraq and Afghan Wars, and currently has a job with the U.S. National Guard.

EVERLEIGH STOKES
Penn State University
Geography

Everleigh participated in two GIS classes her junior and senior years of high school, inspiring her to pursue a degree in the field. After graduation, Everleigh hopes to combine GIS and global health by using mapping technology to assist with humanitarian assistance, disaster response, and disease tracking.

MATTHEW VAUGHAN
Virginia Tech
Geography

Matthew's primary interest is in the use of GIS and remote sensing. He has long enjoyed studying both human and physical geography and the interactions between the two. Recently, Matthew has directly applied this knowledge to real-world problems, and plans to do so during his graduate research.

GRADUATING HIGH SCHOOL SENIORS

SCOTT CONSTANTINE
Pope John Paul II High School,
Boca Raton, Fla.
Now attending University of Illinois at
Urbana-Champaign

Scott is pursuing a degree in geography with a concentration in geographic information science. Within the geospatial intelligence realm, he is drawn to remote sensing, mapping, and photogrammetry using airborne platforms. He is also interested in the applications of GIS for geology.

JED DALE
Babylon High School, Babylon, N.Y.
Now attending University of Pennsylvania

Jed interned this summer with the Brookhaven National Laboratory's Nuclear Nonproliferation and National Security Department. He is interested in the application of geospatial technology to study various phenomena, such as the impact of climate change on extreme weather events.

SHAREEF HUSSAM
Westfield High School, Chantilly, Va.
Now attending Cornell University

Shareef began developing ideas for new research projects that combine his interest in urban and regional planning with geographic information systems. Shareef hopes to use the tremendous power of GIS to increase his understanding of cities and their complex development. ▦

STAYING AHEAD OF THE CURVE

BALL AEROSPACE OFFERS CAPABILITIES FOR AN INTEGRATED GEOINT ENTERPRISE

The Ball Aerospace culture is built on solving tough challenges. The company's legacy of successful defense, civil, and commercial missions has created a mindset to support and advance the rapidly changing GEOINT landscape.

"We're collegial, innovative, and collaborative, and that has been a winning combination for nearly 60 years," said Debra Facktor Lepore, vice president and general manager of strategic operations.

RICH HISTORY

Working with DigitalGlobe since the mid '90s, Ball Aerospace has provided four remote sensing satellites for commercial earth observation and geospatial analysis. Most recently, Ball developed and built the WorldView-3 satellite for DigitalGlobe. On orbit since August, WorldView-3 features multi-spectral, high-resolution imaging capabilities for use across a wide range of applications, including defense and intelligence, civil government mapping, and disaster relief and land-use planning.

In addition to building the WorldView-3 bus, Ball also built

the satellite's Cloud, Aerosol, Water Vapor, Ice, Snow (CAVIS) atmospheric instrument. CAVIS will monitor the atmosphere and provide correction data to improve WorldView-3's ability to image earth objects through haze, soot, dust, or clouds.

"CAVIS paves the way for a new age in automated information extraction and change detection," Lepore said.

Ball is also a pioneer in providing persistent surveillance tools.

"We are at the forefront of deriving and delivering unique intelligence information used in military engagements," said Vonna Weir Heaton, the company's vice president and lead executive for information and intelligence solutions. "Fusion of existing data sources, along with our creative processing algorithms and research and development software tools, support a 24/7 operational environment and long-term analytic research."

Lepore attributes Ball's ability to stay connected to changing mission needs to the company's culture of collaboration. An example of Ball's collaborative philosophy involves a triad approach to development programs, using three viewpoints or functional teams: operational users, research and development, and software/systems

engineering. The three combined views tackle customer problems synergistically.

OPEN-SOURCE FRAMEWORKS

In 2007, Ball began expanding its product offerings with Opticks, its first public open-source project that demonstrates an integrated approach to developing solutions using open systems architecture. Used by scientists and analysts within the DoD and Intelligence Community, Opticks analyzes remote sensing data to produce actionable intelligence and supports still imagery, motion imagery, and many AGI data formats. The Opticks platform code was originally developed for the restricted environment and was later transitioned to open source. According to Heaton, Opticks is a catalyst and springboard for others to use the capability.

"As technology evolves, users have the ability to take any component and replace or supplement capabilities, including removing data manipulation or video components and replacing or supplementing them with newer technology," she said.

RAPID DEVELOPMENT

Ball is working on a solution it considers a potential enabler for the future immersive intelligence environment referenced by former NGA Director Letitia Long during her GEOINT 2013* keynote address. The project—a semi-autonomous motorcar (SAM)—would allow a driver to accelerate a vehicle by nodding his or her head and to steer it by tilting his or her neck left or right. Culminating a 12-month development effort, the company demonstrated this capability in May, when quadriplegic race car driver Sam Schmidt topped 100 mph on the Indianapolis Motor Speedway.

"Because warfighters are constantly being asked to do more, carry more, and execute more than ever before, providing machines to relieve their workload has always been a priority for the DoD," said Heaton. "This project is an example of both industry and government rapidly transitioning each other's ideas into useful capabilities."

The SAM autonomy research applies to not only the racetrack, but potentially to the GEOINT Community.

"Imagine being able to access and

IMAGES COURTESY OF BALL AEROSPACE

> "Imagine being able to access and layer data sources by moving your head or waving a hand and not being connected by wires or cables."
>
> — Vonna Weir Heaton, Ball Aerospace vice president and lead executive for information and intelligence solutions

layer data sources by moving your head or waving a hand and not being connected by wires or cables," Heaton said.

Currently, Ball is also developing a data management service for NGA's foundation GEOINT feature data, called the Consolidated Foundation Production Environment (CFPE) program. The project enables NGA's Map of the World by building a core framework of common, shared, and enterprise services. CFPE replaces costly, stove-piped legacy data systems and consolidates them into a one-feature, one-time database with a modular design.

"Our employees are closely aligned with customers to help us better understand their missions, current tools, and limitations," Lepore said. "With that

understanding, we can leverage our knowledge and creativity to offer new products and services."

OVERCOMING CHALLENGES

Ball believes staying ahead of the curve is the main challenge facing the GEOINT Community, and strives every day to stay on the edge of technology.

"It is a combination of understanding the customer needs right now, while also looking down the road to remain ahead of our adversaries' capabilities," Heaton said. "To stay at the forefront, we use a best athlete approach—in our case brilliant scientists and engineers who collaborate to derive the best solutions."

To meet current customer needs for additional collection capabilities, Ball is examining how to use on-orbit assets in new and creative ways. This means providing unique information fused and integrated from national, commercial, and social media sources, then presenting this information in an easily digestible and shareable manner.

"As we work to stay ahead of the curve, we are pleased to work with USGIF to further the dialogue in the GEOINT Community to overcome challenges," Heaton said. "It is all about protecting our nation, our global communities, and the resources of our world."
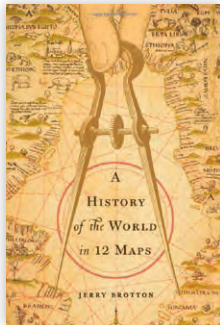▓ JAMIE FRIEDLANDER

HANDS-FREE DRIVING
Quadriplegic race car driver Sam Schmidt tests Ball Aerospace's semi-autonomous motorcar technology, which allows a driver to accelerate a vehicle by nodding his or her head and to steer by a tilt of the head.
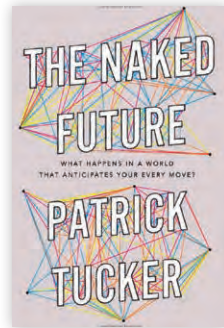
READING LIST

A HISTORY OF THE WORLD IN 12 MAPS
By Jerry Brotton
In this book, cartography expert and historian Jerry Brotton selects and explores a dozen maps that have influenced history and how the world is perceived. From the first cartographic compilation to today's satellite imagery, this collection was curated with map lovers in mind.

THE NAKED FUTURE: WHAT HAPPENS IN A WORLD THAT ANTICIPATES YOUR EVERY MOVE?
By Patrick Tucker
In the next 10 years, humans will not only be able to predict earthquakes, but also individual behavior. Patrick Tucker's book explores how forecasting the future may become both beneficial and detrimental to society.
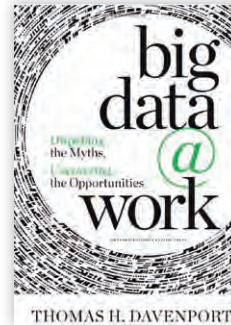
BIG DATA AT WORK: DISPELLING THE MYTHS, UNCOVERING THE OPPORTUNITIES
By Thomas H. Davenport
Thomas Davenport explains Big Data and how it's not just another example of technology hype. The book describes Big Data's opportunities, as well as how it can impact business and lead to a new analytic management approach.

THE CYBER THREAT
By Bob Gourley
In this book, Bob Gourley, former Defense Intelligence Agency Chief Technology Officer and now a partner with Cognitio Corp., helps business leaders understand the relationship between cyber threats and their organizations. Read this book to explore and learn how to defend your company against cyber attacks.

PEER INTEL

The National Geospatial-Intelligence Agency (NGA) appointed **Susan Gordon** to be the agency's next deputy director. Most recently, Gordon served as director of the CIA's information operations center. **John Goolgasian**, former director of NGA's Foundation GEOINT Group, is now the agency's director of Source Operations and Management.

Nicholas Rasmussen, acting director of the National Counterterrorism Center since September, will now lead the center on a full-time basis.

President Obama named **Megan Smith** as the next White House chief technology officer. Previously, Smith was a vice president at Google's research lab, Google X, and formerly led the Google Earth and Google Maps acquisitions.

Oracle recently made several organizational changes. **Larry Ellison**, former CEO, was appointed to the company's board of directors and to the newly created role of chief technology officer. **Jeff Henley**, who previously served as the company's chairman, is now vice chairman of the board. **Safra Catz** and **Mark Hurd** were promoted to chief executive officers.

Paul Ramsey was named Boundless' senior strategist and evangelist. Ramsey has spent more than 10 years in the industry as a programmer and consultant.

LGS Innovations appointed **John Fitzgerald** as the company's executive vice president and chief financial officer. With 26 years of industry experience, Fitzgerald will lead the company's financial organization.

Mercury Systems chose **Brian Perry** as president of its Mercury Defense Systems subsidiary. He will lead strategic electronic warfare, electronic attack, SIGINT, and ISR growth initiatives.
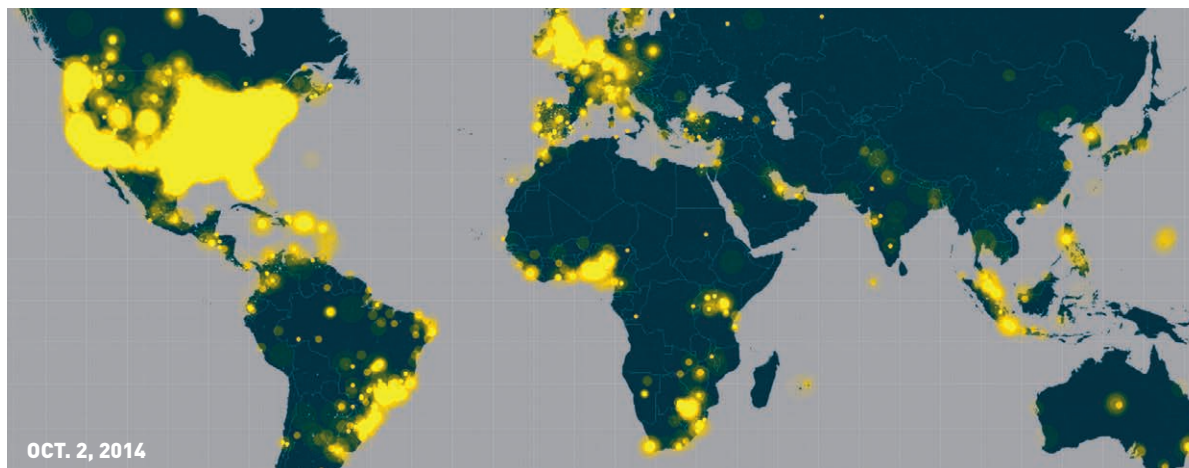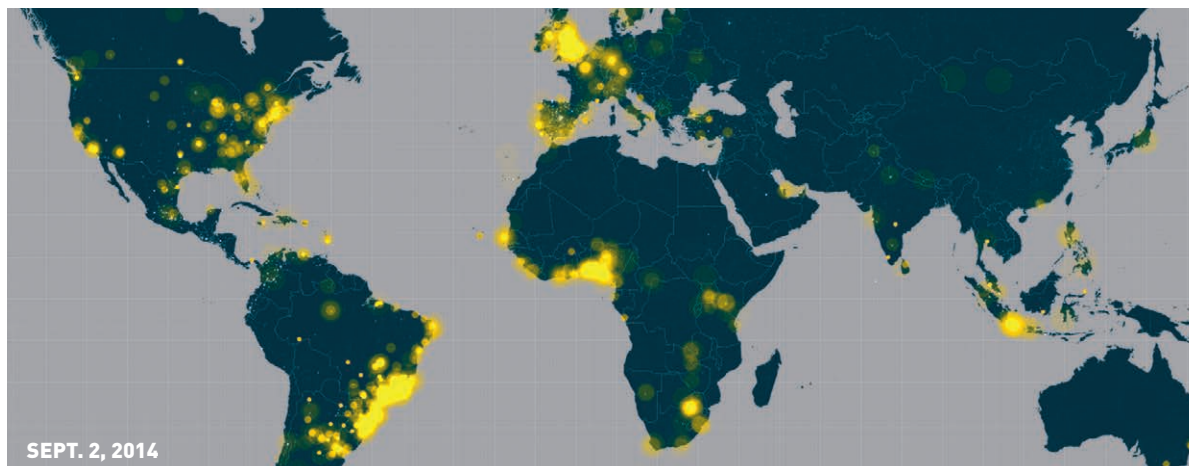
SEPT. 2, 2014

OCT. 2, 2014

PHOTO COURTESY @TWITTERDATA

Mapping #Ebola

The recent Ebola outbreak is being monitored, tracked, and mapped by numerous agencies and organizations across the globe. To name just a few, NGA has created an unclassified mapping tool on Esri's ArcGIS platform and hosted by Amazon Web Services; the CDC is tracking cell phone location data for users dialing emergency call centers in West Africa; and *HealthMap.org* has developed an automated system that monitors, organizes, integrates, filters, and visualizes disparate online data sources to provide a comprehensive view of the current global state of infectious illness. Collectively, these efforts demonstrate the power of current data-mining capabilities and the importance of geography and location for comprehending, containing, and combating this disease.

As global awareness and fears about Ebola grow, social media channels such as Twitter can likewise be used to reveal the timeline of public reaction and discussion. Simon Rogers, a data editor at Twitter, created a heat map tracking mentions of Ebola over a one-and-a-half-month period. The two snapshots above compare the number of Ebola mentions on Sept. 2 with Oct. 2, visualizing the explosion of tweets that occurred after a Liberian man was diagnosed with the disease at a Dallas, Texas, hospital Sept. 30. Ebola-related tweets per minute for most of September averaged between 100 to 200. On Oct. 2, Ebola tweets hit a spike of 6,271 per minute. To view a time-lapse video of the Twitter Ebola conversation, visit *trajectorymagazine.com*.
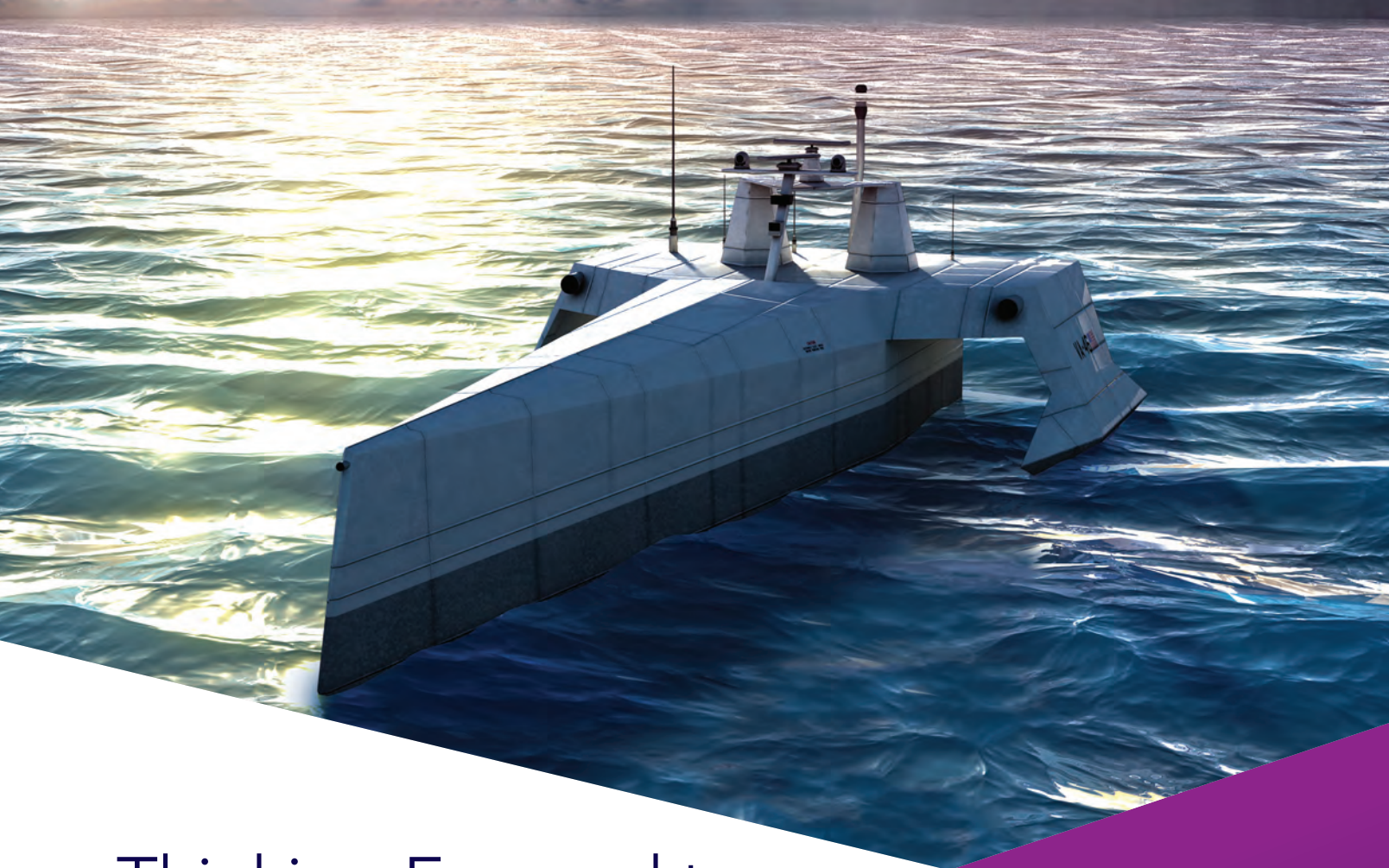
Thinking Forward to Secure our Waters

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