» GEOINT APPS FOR GOVERNMENT » LEARN ABOUT LIDAR » THE TERRAIN OF TERRORISM

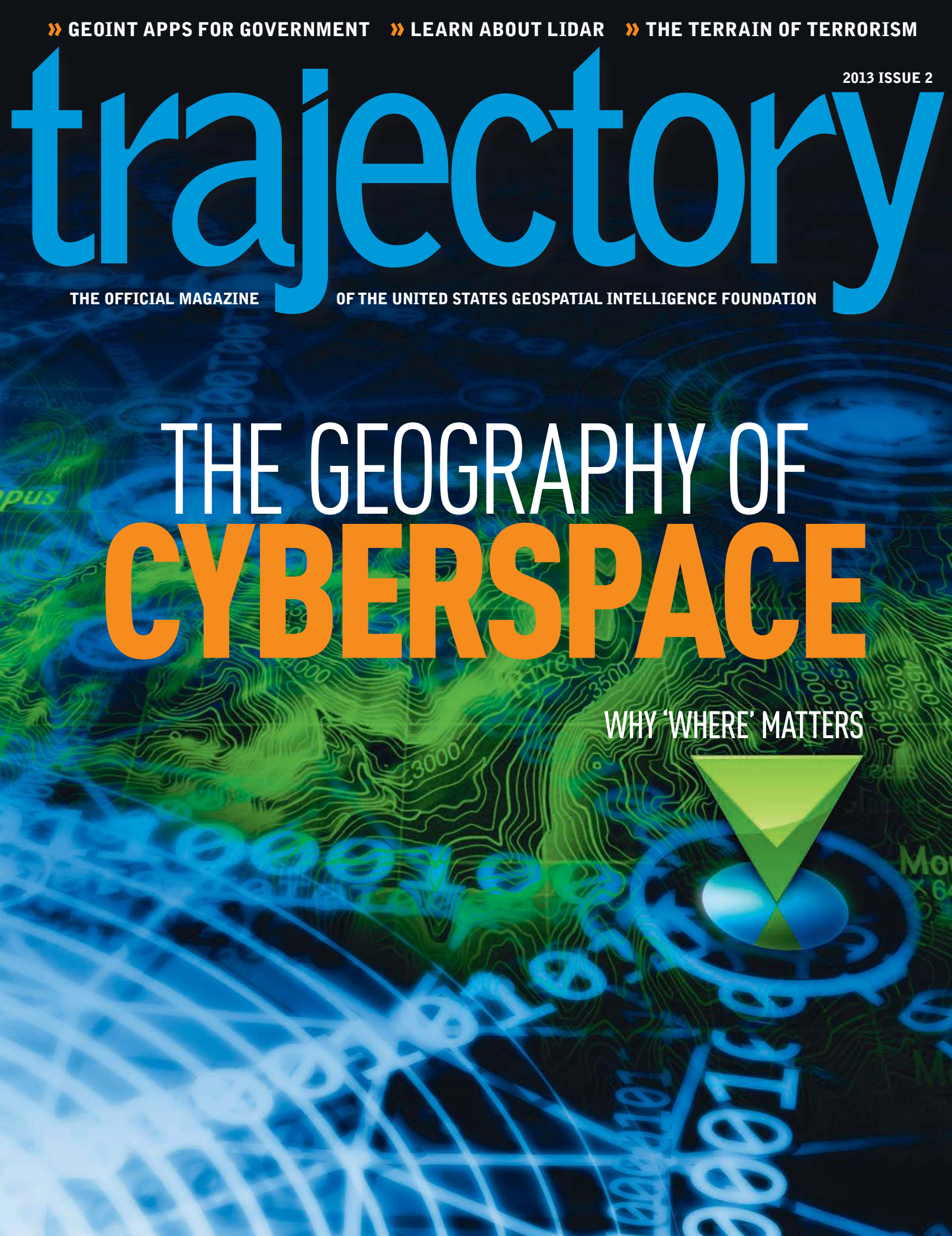
2013 ISSUE 2

trajectory

THE OFFICIAL MAGAZINE OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

THE GEOGRAPHY OF CYBERSPACE

WHY 'WHERE' MATTERS



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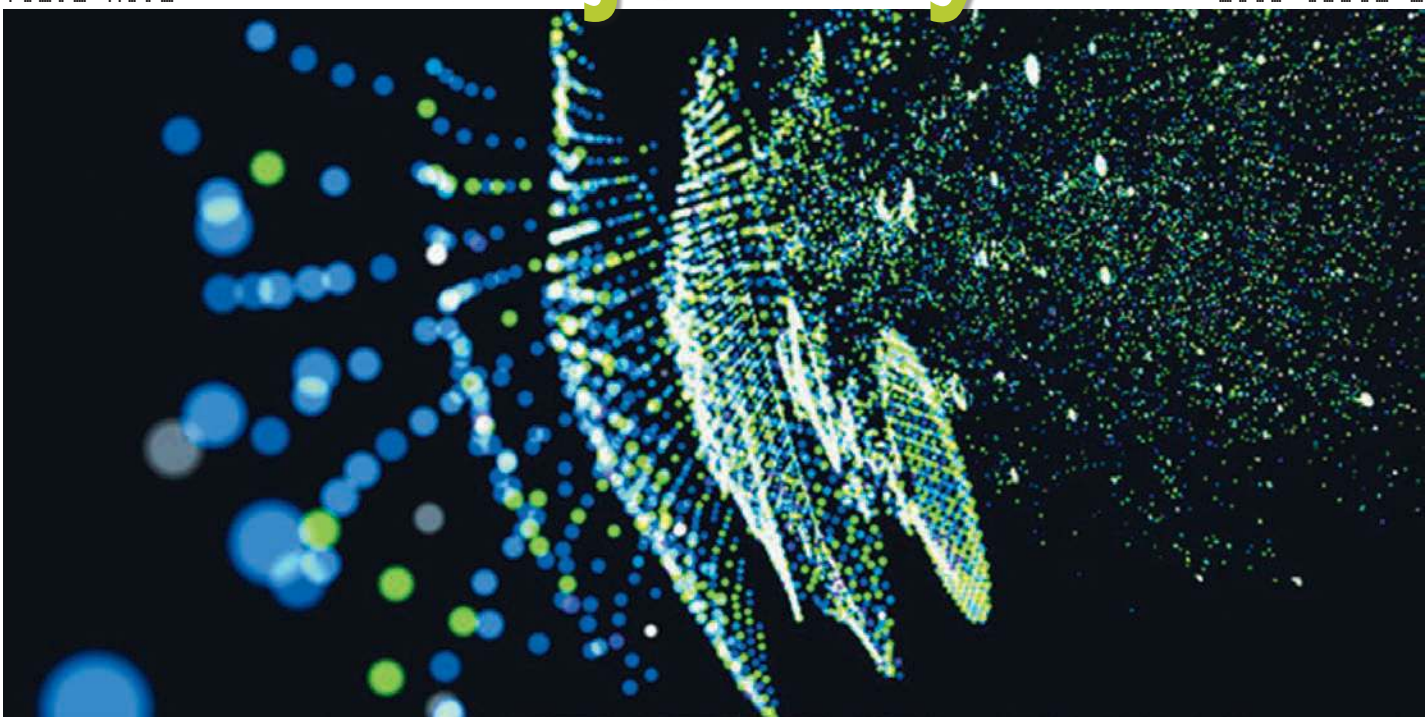

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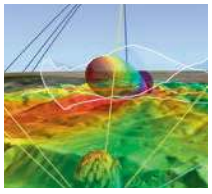

WEB EXCLUSIVE
Read about the challenges of cyber attribution and law.

PODCAST
International law professor Ashley Deeks discusses the geography of cyber conflict.

DOWNLOAD
The digital version of the 2013 USGIF Membership Directory includes a capabilities index.

NO BETTER TIME TO MOVE FORWARD

Many of you have asked how sequestration and the lingering impact of highly publicized problems with several government-run conferences are affecting USGIF and our programs. I'm pleased to report the Foundation is in a strong financial position. We recently released our first annual report, and it presents a compelling story regarding the viability of our organization.

We will conduct GEOINT Community Week 2013, from May 20-23, with some modifications. The Army will not hold its Ground Warfighter GEOINT Conference. Additionally, the classified Tech Showcase East will be one day instead of two at NGA Campus East. We will also significantly increase training and professional development opportunities available during the week.

USGIF determined it would be inappropriate to hold the GEOGala, the annual formal celebration of the GEOINT Community, due to the current environment. Given the specter of government furloughs and corporate layoffs, we will cancel this year's gala and re-evaluate for 2014.

As for GEOINT 2013, USGIF is fully committed to holding our tenth annual symposium in Tampa from October 13-16. DNI Jim Clapper said in his Annual Threat Assessment, "In my almost 50 years of intelligence, I do not recall a period in which we confronted… a more diverse array of threats." Indeed, our Nation and our allies are facing myriad threats, and our economic reality is that we must address them with decreasing resources. The need for meaningful discourse has arguably never been more urgent. Yet, opportunities for the unique types of interaction afforded by the GEOINT Symposium have been drastically reduced as other organizations cancel events.

Over the past few months, I've met with DoD and IC leadership to hear their thoughts regarding GEOINT 2013. There remains strong commitment to the Symposium at the senior levels. However, they certainly concede they will likely not be able to send the same numbers of attendees as in past years.

That said, Tampa is in the backyard of USSOCOM, USCENTCOM, and their co-located international partners. SOCOM leadership has already indicated enthusiasm to participate in GEOINT 2013. I am confident GEOINT 2013 will be another first-class symposium, and will serve as a platform for discussions that are critically important to national security.

Because the Community maintains responsibility for a diverse, demanding set of missions, regardless of budget constraints, USGIF activities will continue to offer unique opportunities to help address challenges. We'll continue to use these pages to highlight how the GEOINT Community is tackling difficult problems.

In this issue, the cover feature, written by Managing Editor Kristin Quinn, takes the often overused and less-understood term of "cyber" and explains why the power of place is so critical in this realm. There needs to be a fundamental understanding of the physical layer of cyber, and the concept of a "Cyber-Location Nexus" will help underpin the GEOINT Community's operations in the cyber domain.

Trajectory contributor Matt Alderton follows up his "Location Nation" article from the last issue with Part 2, focusing on mobile GEOINT for government. Just as with the commercial sector, there are pathfinders in government who have not only recognized the benefits of mobile GEOINT and location-based technology, but are fully embracing and investing in it.

Of course, these features are complemented with interesting news briefs and beneficial business intelligence. We've also reviewed some good books, and included the second installment of our new department, "Need to Know," with a piece on LiDAR.

I hope you continue to enjoy the magazine, and we look forward to your feedback.

KEITH J. MASBACK | USGIF CEO
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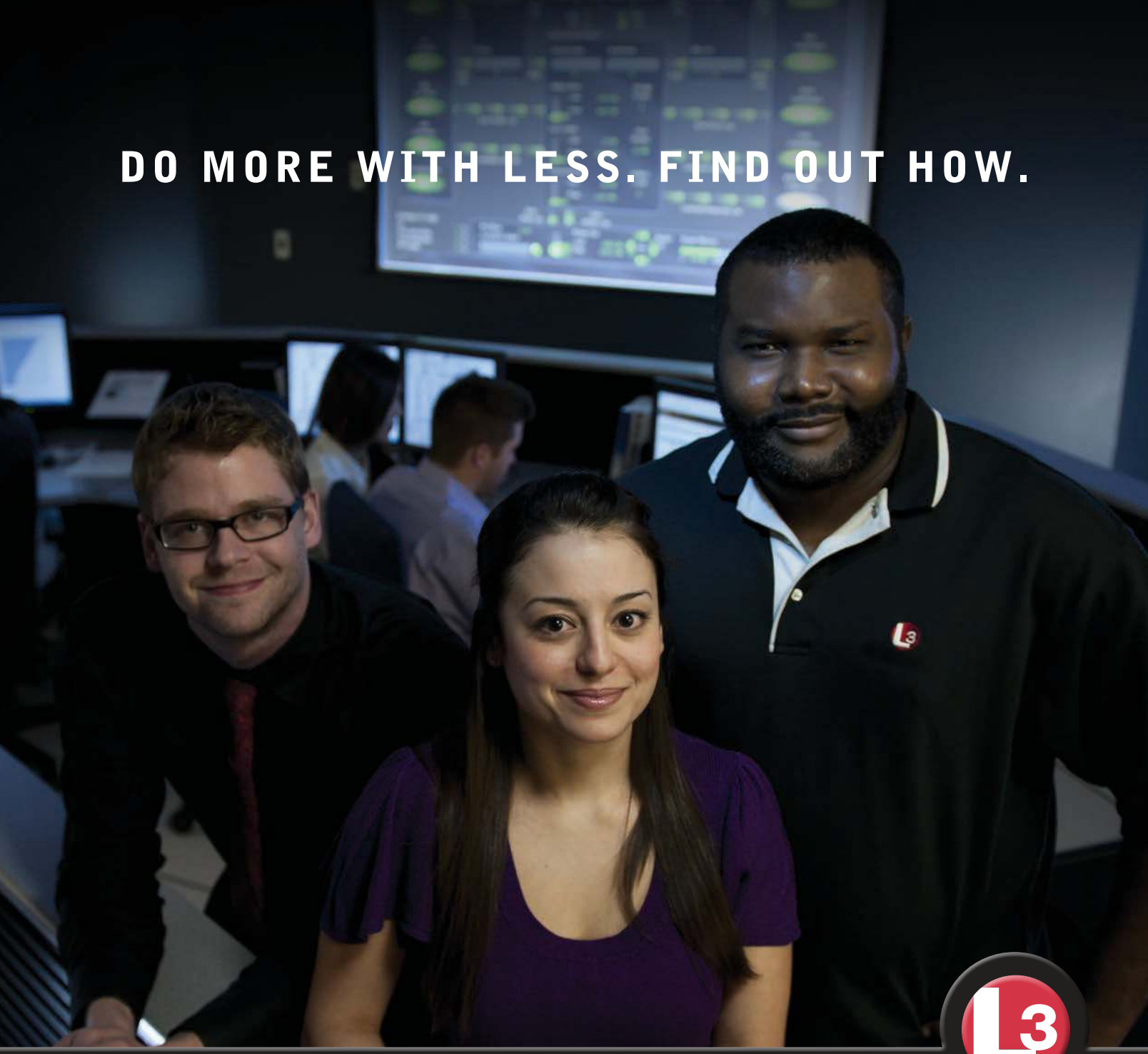

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NEWS UPDATES AND HIGHLIGHTS

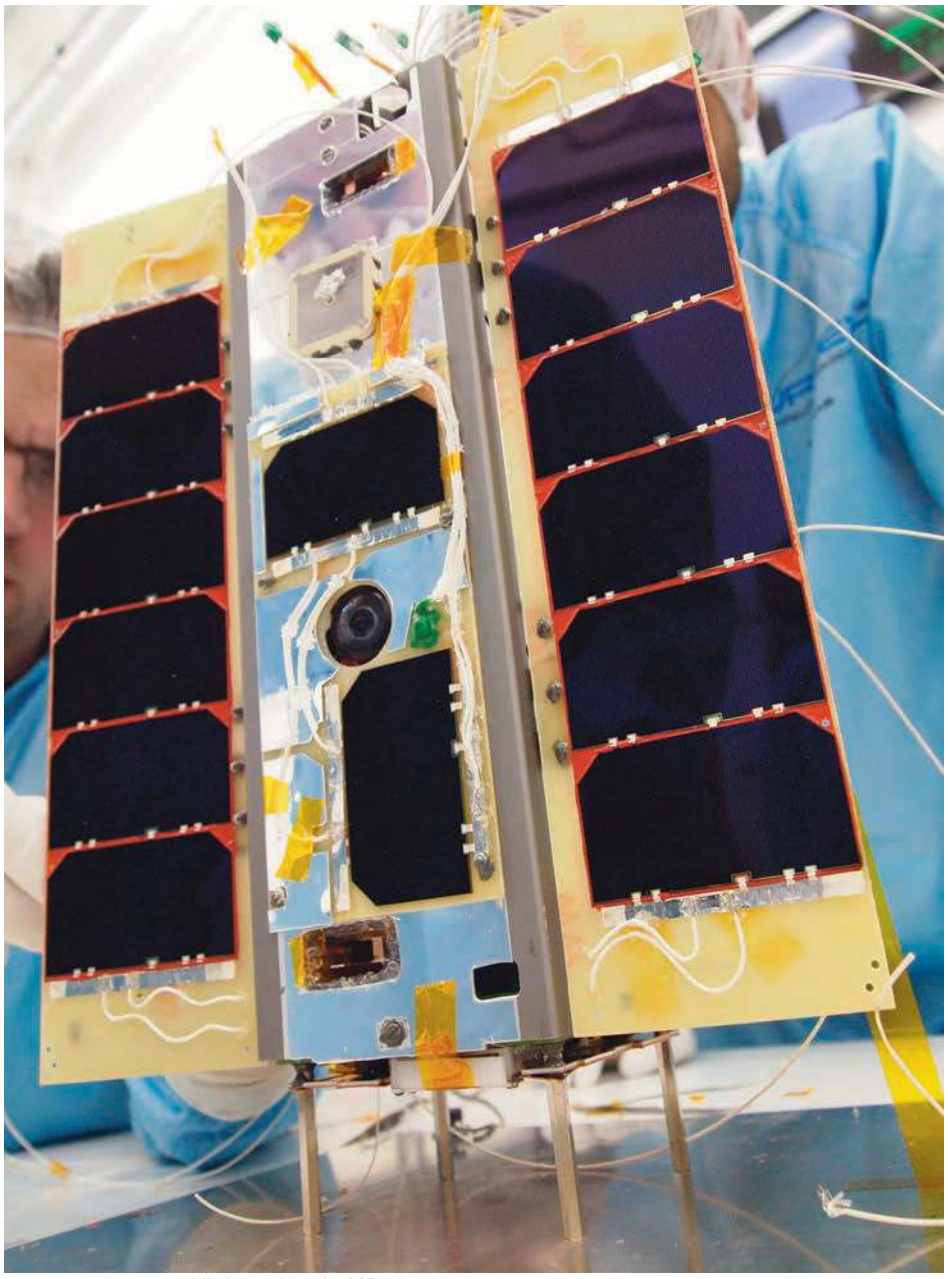

IMAGE COURTESY OF SSTL/SURREY SPACE CENTRE

STRaND-1 is pictured flight-ready in the SSTL cleanroom.

SMARTPHONE CARRIED INTO ORBIT

A nanosatellite named STRaND-1 was recently launched into space carrying a Google Nexus One smartphone. Built by U.K.-based Surrey Satellite Technology and the Surrey Space Centre, this is among the first missions to place a smartphone into orbit. Currently powered by a Linux-based processor, the satellite will eventually be controlled by the mobile device itself. Not only will the smartphone drive the satellite, but it will also take pictures of Earth with its camera via video-streaming apps.

SURREY ENGINEERS ARE ALREADY WORKING ON STRaND-2 AND PLAN TO TEST THE ABILITY OF TWO CUBESATS TO DOCK TOGETHER IN ORBIT USING MICROSOFT KINECT TECHNOLOGY.

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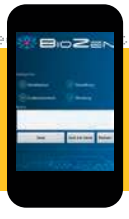
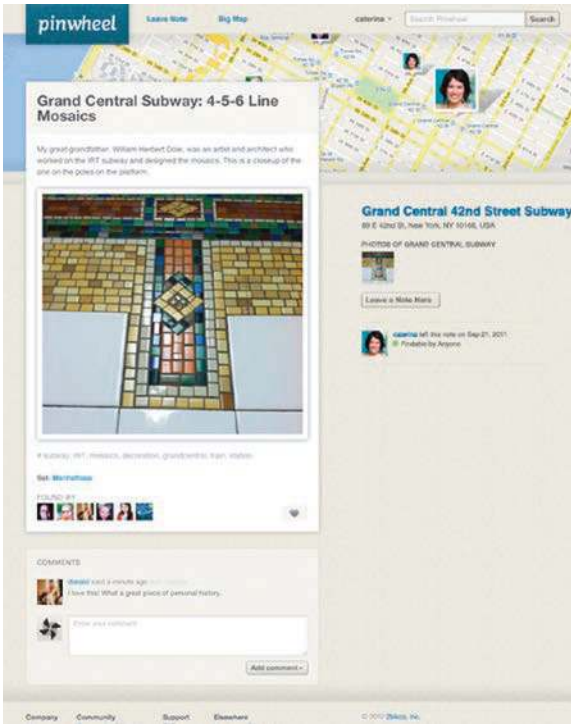


A DoD order for 59,000 devices from Apple reflects the recent change in policy to allow new devices on government networks.



FLICKR CO-FOUNDER LAUNCHES PINWHEEL

After co-founding photo management and sharing website Flickr, and having just departed from her second start-up, Hunch, Caterina Fake is launching a new company called Pinwheel. This service will allow users to tag a map of the world with notes, stories, and photos to share with friends. Pinwheel is currently undergoing private beta testing and will be available to the public later this year.

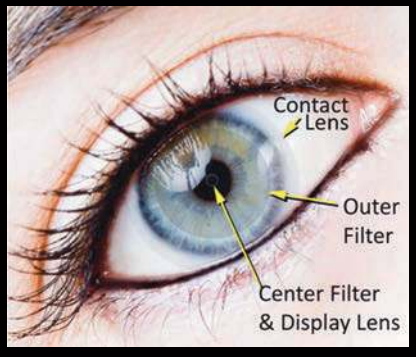
NEW MAPPING UAV TESTED IN SWISS ALPS

UAV manufacturer senseFly announced the first tests of eBee, the newest addition to the company's line of mapping UAVs. This ultra-lightweight system conducted a mapping mission along the Swiss Alps at the Zermatt ski resort. The aerodynamic UAV runs a 45-minute flight time and is equipped for precise 2D mapping and 3D terrain data. Its 16 megapixel, high-resolution camera operates in even the most extreme weather conditions. During testing, eBee was able to sustain altitudes up to 3,000 meters and perform landings in deep snow, all while mapping an entire valley.

COUNTERTERRORISM

DOD EXTENDS SAIC CONTRACT FOR GLOBAL HARVEST

The Defense Intelligence Agency (DIA) extended a contract with SAIC to run Global Harvest, a counterterrorism intelligence program that gathers data on high-value targets and terrorist finance. The SAIC-run Global Harvest program comprises one-third of DIA's threat finance intelligence analysis. The contract, held by SAIC on behalf of the U.S. Air Force Intelligence, Surveillance and Reconnaissance Agency, will be extended on a month-by-month basis.



VIDEO LENSES FOR SOLDIERS

Seattle-based Innovega has developed a video eyewear system for military combat. iOptik acts as 3D display glasses, but in the form of contact lenses. They have the potential to allow soldiers to view virtual and augmented-reality images, while keeping a clear view of their real-world surroundings. In partnership with DARPA, Innovega is currently developing a field prototype, and anticipates iOptik will be available to customers in 2014.

PRINEVILLE, OREGON
Location of a 600,000-sq-ft Facebook data center.

ASHBURN, VIRGINIA
One of the Internet's most important locations due to the number of networks that meet there.

NGA CIO SPEAKS AT GEOINTERACTION TUESDAY

DR. ROBERT LAURINE JR., chief information officer of the National Geospatial-Intelligence Agency (NGA), addressed more than 80 attendees at USGIF's GEOINTeraction Tuesday event March 12.

Having previously been the NGA West senior executive in St. Louis, Laurine described his experience in the Midwest, as well as his vision for innovative ways to move forward at NGA Campus East.

While spending the last three years in St. Louis, Laurine led NGA Campus West in IT transformation and community outreach by adding 5,000 workstations, lighting up the transport layer, and addressing facility issues.

Looking ahead, Laurine said he expects significant changes in workforce culture with the implementation of the Intelligence Community Information Technology Enterprise (IC ITE), an effort to get all agencies on the same IT platform and promote information sharing through a cloud environment.

Laurine also addressed sequestration and urged the GEOINT Community to take advantage of the opportunity to collaborate and innovate during challenging times.

"We all have to work together to ensure we make the proper cuts to optimize and preserve the mission," he said. "Let's keep our eyes and ears open, and let's look for opportunities to drive those efficiencies across the board."

Laurine also addressed mobile GEOINT, proclaiming the end of an era for the desktop PC. Mobile applications that allow Community members to "encrypt on the fly" are the way of the future.

"The next step is to go mobile, and to go mobile as quickly as possible," he said.

He added that as NGA continues to invest in mobile applications, the intention is to make GEOINT apps available across the Community, and not just within NGA.

In closing, Laurine said events such as USGIF's GEOINTeraction Tuesday and NGA's Tech Showcase East and West are great opportunities for networking and bringing the Community together, something that is especially important in an uncertain budget climate.

SPOTLIGHT: USGIF SCHOLARSHIP RECIPIENT

Greg Babonis was awarded a USGIF scholarship in 2007, and has made significant progress toward a career in GEOINT.

Currently, Babonis is finishing up his Ph.D. at the State University of New York at Buffalo while co-instructing graduate-level courses on LiDAR technology and geo-physics.

After receiving both a bachelor's and master's of science in geology and physics, he was granted fellowships with NASA and the National Science Foundation. He was also invited to work with a physical geography group in Swansea, Wales, for six months. Babonis has also served on New York State's Energy Research and Development Authority Technical Evaluation Panel under the Western New York Nuclear Service Center to evaluate companies for LiDAR usage.

"The scholarship certainly assisted me financially, allowing me some freedom to invest time and energy into developing remote sensing skills tangentially related to my M.S. work," Babonis said. "This further helped me in both being accepted to a doctoral program and switching into more focused remote-sensing work."

Upon completing his Ph.D. in the spring, Babonis hopes to find a full-time GEOINT position in either the public or private sector.

USGIF's Scholarship Program seeks to further the advancement of the tradecraft by assisting promising students interested in the geospatial sciences with scholarship awards.

TO DATE, THE PROGRAM HAS APPROVED $84,000 IN SCHOLARSHIP FUNDS.

RECORD GEOINT CERTIFICATES GRANTED IN 2012

USGIF AWARDED 125 GEOINT certificates to students in 2012 through the Foundation's Accreditation Certification Program. This is the highest number of certificates USGIF has awarded since the program began in 2008. In total, there have been 257 certificates granted to students enrolled in USGIF-accredited GEOINT programs.

"USGIF accreditation of collegiate geospatial intelligence programs provides quality assurance to GEOINT Community employers that students are meeting rigorously established standards and competencies," said Dr. Max Baber, USGIF's director of academic programs. "Students who complete USGIF-accredited GEOINT certificate programs have developed valuable analytical skills across a full spectrum of GEOINT technologies."

Accredited colleges and universities carrying the USGIF certification include George Mason University, Pennsylvania State University, University of Missouri-Columbia, University of Texas at Dallas, U.S. Air Force Academy, U.S. Military Academy at West Point, and the newest addition—University of Utah. The Foundation expects a continued increase in the amount of certificates awarded as a result of the increasing demand for professionals in the GEOINT field.

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

USGIF CEO Keith Masback presents a GEOINT certificate to Kristi (Marvin) Burke, a graduate of George Mason University's USGIF-accredited program, who now supports NGA as a geospatial analyst with SAIC.

International Spy Museum in downtown Washington, D.C.

YPG TAKES ON OPERATION SPY

MEMBERS OF USGIF'S Young Professionals Group (YPG) gathered in downtown Washington, D.C., in February to participate in "Operation Spy" at the International Spy Museum, followed by a networking reception.

About 15 attendees took part in Operation Spy, an hour-long interactive spy adventure. More than 30 attendees gathered following the museum experience for a networking reception across the street at Gordon Biersch. Carrie Drake, who coordinates the YPG at USGIF, said the event drew a lot of new faces, including those who were in town for the 2013 Esri Federal GIS Conference.

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

AIRBORNE, SAR & EO TRAININGS HELD IN D.C.

In February, USGIF hosted a three-day workshop series at the Walter E. Washington Convention Center in Washington, D.C. These unclassified workshops aimed to inform participants on the latest developments in commercial airborne imaging and applications, commercial SAR, and electro-optical satellite imaging and applications.

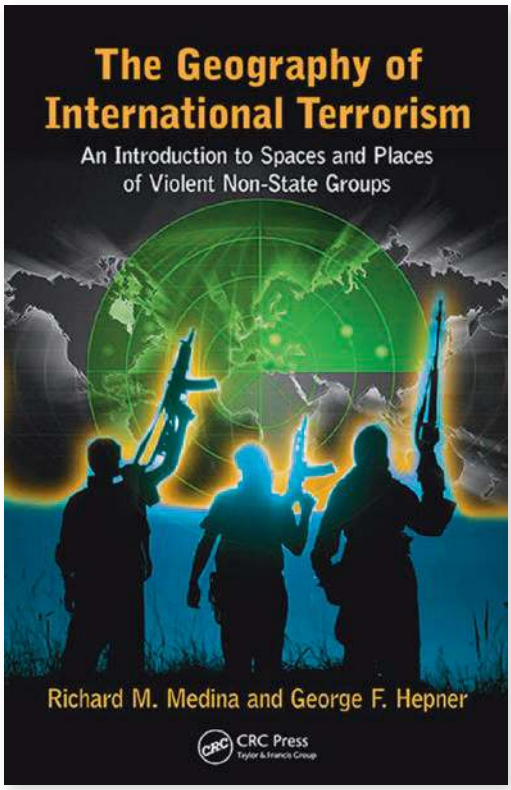
Sponsored by USGIF's Commercial Airborne Working Group, the commercial airborne training was a half-day session providing in-depth presentations introducing various electro-optical, IFSAR, LiDAR, and oblique sensor technologies.

The Commercial SAR Satellite Working Group and the EO Working Group organized those trainings with the support of the National Geospatial-Intelligence Agency's (NGA) Commercial GEOINT Solutions Group, and provided participants the opportunity to gain a certificate of training upon completion.

THE TERRAIN OF TERRORISM

Academics from two USGIF-accredited universities collaborate on new textbook

WHAT DOES GEOGRAPHY have to do with international terrorism? More than one might think. "Oftentimes, poverty is looked at as one of the precursors to people starting terrorist movements; but if that were the case, Haiti [the poorest nation in the Western Hemisphere] would have become a terrorist haven a long time ago," said George Hepner, co-author of the soon-to-be-released book, *The Geography of International Terrorism: An Introduction to Spaces and Places of Violent Non-State Groups*.



According to Hepner, who is also chair of the geography department at the University of Utah, the formation of terrorist groups stems from the fusion of many factors, including political instability, economic and educational discrimination, and in most cases, key individuals who are able to rally people around terrorist philosophies. Once these ideals take root in a region, their sustainability has much to do with geography.

"Take the very small island of Sri Lanka, for example," Hepner said. "There's not a lot of land area, but because of the dense jungle, complex terrain, [and proximity to India], a very active terrorist group called the Tamil Tigers was able to exist until very recently and mount a decades-long terrorist campaign against the Sinhalese government of Sri Lanka."

Prior to writing this book, Hepner created a course titled "The Geography of Terrorism and Homeland Security," which examines the geographic factors that foster active regions of terrorism, and looks at the use of geospatial technologies such as GIS, satellite imagery, and GPS in regard to U.S. homeland security policies.

While teaching this course in 2005, Hepner met Ph.D. student Richard Medina, who would become his co-author for the book. The pair collaborated on research into terrorist networks as complex systems, taking into account geographic, spatial, and social interactions.

Medina, who is now a professor of geography and geoinformation science at George Mason University, developed and teaches a similar course. GMU and the University of Utah both offer USGIF-accredited GEOINT certificate programs, with Utah recently achieving accreditation in 2012.

"The book was a natural progression out of the courses we had been teaching because we have compiled so much information," Medina said. "This is a much-needed area of study, and there's not a lot out there about it."

The Geography of International Terrorism is one of the first books to look at terrorism from a geospatial analysis vantage point rather than through a geopolitical lens. The book's conclusion discusses the implications of two factors that have the potential to drive conflict and impact terrorism: climate change and globalization.

"If we don't understand all the moving parts to the current huge body of complex problems that are creating a greater global environment of uncertainty, we are not going to be able to understand and anticipate these problems in the future, especially problems of terrorism and other forms of conflict," Medina said.

Hepner and Medina said their research into the link between geography and terrorism is, for the most part, uncharted territory in the academic world as well.

"A lot of universities have terrorism classes within their international studies or political science departments, but those classes don't focus on the geographical aspects of terrorism," Hepner said. "This book has the potential to become a textbook for a course about the geography of terrorism or a class related to geospatial intelligence."

BY KATHLEEN HAGAN

"If we don't understand all the moving parts to the current huge body of complex problems that are creating a greater global environment of uncertainty, we are not going to be able to understand and anticipate these problems in the future, especially problems of terrorism and other forms of conflict."

—Richard Medina, professor of geography and geoinformation science at George Mason University

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BY KRISTIN QUINN

CYBER-LOCAT

WHERE DO THE PHYSICAL AND VIRTUAL WORLDS MEET,

On Tuesday, March 12, 2013, the Office of the Director of National Intelligence (ODNI) released its "Worldwide Threat Assessment of the U.S. Intelligence Community," naming cyber the top priority. That same day on Capitol Hill, Gen. Keith Alexander, commander of U.S. Cyber Command and director of the National Security Agency, told the Senate Armed Services Committee cyber threats are becoming more severe. Driving the message home to everyday Americans, evening newscasts reported hackers had gained sensitive financial information about First Lady Michelle Obama, Vice President Joe Biden, senior law enforcement officers, and a handful of Hollywood celebrities.

IONNEXUS

AND WHAT DOES IT MEAN FOR THE GEOINT COMMUNITY?

"We are in a major transformation because our critical infrastructures, economy, personal lives, and even basic understanding of—and interaction with—the world are becoming more intertwined with digital technologies and the Internet," the ODNI assessment read. It also noted there is a remote chance of a major cyber attack against U.S. critical infrastructure in the next two years that could result in a long-term, wide-scale disruption of services.

Alexander shared similar concerns with lawmakers that day, and he appealed to Congress to pass legislation parallel with White House initiatives and facilitate the sharing of information between government and private critical infrastructure operators.

This is only a snapshot of one day in the never-ending cycle of cybersecurity news. It's nearly impossible to peruse the Internet without encountering a glaring headline pondering the possibilities of a cyber Cold War or the looming threat of a cyber Pearl Harbor.

While cyber is on the forefront of almost all government officials' minds, as well as many citizens', it's not always obvious that the new domain isn't just some nebulous creature lurking in the ether of the connected world. Cyber adversaries work from real locations on Earth using tangible hardware; real servers are located in buildings that connect to fiber running through dirt and cement. All "virtual" activities originate from and are made possible by people and objects somewhere on Earth at some point in time. At this intersection is the "cyber-location nexus."

"Cyberspace is just another layer on earth," said Chris Tucker, principal of Yale House Ventures, who coined the term "cyber-location nexus" in 2010. "You need to be able to geo-locate your cyber activity to the actual landscape of the Earth. If there is an attack, I care about the location. If there's a vulnerability to a system, I care about where that system is."

Tucker said the world is experiencing a collision of real-world geography with nearly unlimited connectivity.

"We have an explosion in devices that are IP enabled," Tucker said. "We now have enough address space to enable TVs and refrigerators and make every house smart. We are phasing our entire world to the web. We're entering this world where you're going to connect everything and it's all location-enabled."

Although the cyber-location nexus term is relatively new, the concept is not. Umbrella words such as "cyber" and "cybersecurity" have masked the complexity around geo-location, Tucker said.

But the connections between cyber and location should be obvious: If an agency is hacked, what country should be attributed? If a virus compromises a network, what facility or land did it originate from? If the DoD is interested in acting offensively in cyberspace, what does it know about the locations of the target's cyber infrastructure? And perhaps most importantly, how does a nation identify, map, and defend its cyber infrastructure?

For these reasons, analysts at the National Geospatial-Intelligence Agency

WEB EXCLUSIVE
READ ABOUT THE CHALLENGES OF CYBER ATTRIBUTION AND LAW AT TRAJECTORY MAGAZINE.COM.

A MAP of "what the Internet looks like," via Internet Hosting Company Peer 1's mobile app. The app provides an interactive 3D map that shows links between all the interconnected networks that make up the Internet.

IMAGE COURTESY OF PEER 1 HOSTING

(NGA) have been active in the cyber arena for some time.

"NGA is a player and is going to continue to be a player [in the cyber domain]," said Ellen McCarthy, COO of NGA. She added the agency is "using GEOINT analysis tradecraft to better understand the physical characteristics of cyberspace."

Much like geography, the cyber domain is becoming ubiquitous, which is yet another explanation for why the two are inextricably interwoven.

"Cyber is a domain that's spread across the Earth and geo-location is critical to it," Tucker said.

IDENTIFYING HIGH-VALUE TARGETS

The number of mobile devices coming online is rapidly outnumbering the global population, according to Sean Gorman, a chief strategist with Esri and co-founder of real-time location analysis software provider GeoIQ, which was acquired by Esri in 2012.

"Each of these mobile devices are becoming increasingly location and time aware," Gorman said. "But that's all tethered back into a real, fixed physical infrastructure. We're going to become more dependent on the physical infrastructure as these human sensors continue to grow very rapidly."

Gorman describes mapping a logical network to a physical network as a complex but necessary challenge.

"Multiple physical manifestations can cause issues with your overall cybersecurity, but it's really difficult to understand what those manifestations look like without mapping out the co-location of those infrastructures," he said.

The first step is determining what those critical infrastructures are.

Strategic cyber consultant Melissa Hathaway considers infrastructure such as telecommunications and Internet service providers to be the central part of the cyber-location nexus. Hathaway, who led the Joint Interagency Cyber Task Force within the ODNI during the George W. Bush administration, points out that many sectors are still trying to understand what their dependencies are.

For example, if AT&T were to suffer a disrupted value of service, how would that degrade the financial services sector in New York City? Although cyber experts often ponder the vulnerability of the financial services industry, they should be looking a layer deeper at the telecommunications vulnerabilities, according to Hathaway.

"Pretty much all of what were formerly isolated critical infrastructure are now on one single backbone of the Internet," she said.

This greatly increases the potential domino effects of a cyber attack, while diminishing the number of high-value national security targets, Hathaway explained. In February, the Obama administration took a large, though some would argue overdue, step toward addressing this concern, with the release of an executive order titled, "Improving Critical Infrastructure Cybersecurity."

> **"You've got to have serious game to play in this domain and to have a future in this global environment."**
>
> —Maj. Gen. Suzanne Vautrinot, commander of the 24th Air Force

Suzanne Spaulding, deputy under secretary for the National Protection and Programs Directorate (NPPD) with the U.S. Department of Homeland Security (DHS), said under the executive order, NPPD will apply a risk-based approach to compile by mid-July a list of the nation's most critical cyber infrastructure.

During a speech at a recent cybersecurity conference in Washington, D.C., Spaulding said NPPD has established an integrated implementation task force, drawing experts in both physical and cybersecurity from across DHS.

"We've already been pulling in our cyber folks and our physical experts to do joint assessments—looking at what are the cyber vulnerabilities, what are the physical vulnerabilities, how do they relate, and what are the cascading effects?" she said.

In a separate keynote address at the same conference, Maj. Gen. Brett Williams, director of operations for CYBERCOM, said there are a wide variety of secondary effects that need to be taken into account when operating in the cyber domain, beyond what one has to consider in the physical world. He outlined the multiple layers to cyber operations, adding that in order for CYBERCOM to perform its mission, these shouldn't be considered in isolation.

"In the simplest case there's the physical and geographic layer, there's the logical layer … and then finally there's the human layer," Williams said. "And so you're looking at a very multi-dimensional space that you have to operate in, in which there are strategic operational and tactical [repercussions] that affect the civilian community, the commercial community, the federal government, and other governments."

Jenny Menna, director of stakeholder engagement and cyber infrastructure resiliency within NPPD's Office of Cybersecurity and Communications, and Brandon Wales, director of the Homeland Infrastructure Threat and Risk Analysis Center within NPPD's Office of Infrastructure Protection, are tasked with bridging the gap between physical and cybersecurity experts within the directorate.

"Cybersecurity poses a challenge for thinking about location in that, in the physical sense we are most concerned about natural hazards and [tangible] attacks," Wales said. "But cyber attacks have the possibility to disrupt multiple locations simultaneously. You can have widescale destruction from a single type of attack, and that requires us to understand the infrastructure in a far more detailed way."

A lot of the existing efforts within NPPD are geospatially-enabled, according to Wales. In the case of cyber infrastructure, he predicted there would be a series of fixed locations making up the critical cyber infrastructure list, as well as some broader functions where there could be cascading events. As the list will be updated annually, Wales said its

PROTECTING YOUR CYBER-LOCATION

Keith Filzen, an independent security consultant for the federal government and industry, specializes in location obfuscation. In other words, he helps federal employees and defense contractors mask the geo-location features enabled by a range of mobile devices, such as smartphones or the OnStar system in many vehicles.

It's relatively simple to tie the profile of a person or entity with a virtual location in the form of an IP address and a physical location in the form of GPS coordinates, according to Abe Usher, CTO of HumanGeo. This is a fact government and industry is becoming more acutely aware of.

"Everything that's fantastic about what's going on commercially—turn 180 degrees and that's basically the national security and intelligence perspective," Filzen said. "That's the direction they want to go away from. They don't want you to know there's an FBI agent filling up for gas on the corner of G St. and 1st with a government vehicle. Since he has his personal cell phone with him as well as a government phone, being able to tie those records together in cyberspace isn't that difficult."

Filzen said it's naïve to think your geo-location is secure. He points out if the U.S. has access to this information about its adversaries, they can gain the same information about us. Conversely, if we can mask our true locations, they can as well.

"There's a lot of work going on right now under the guise of privacy that will allow you to mask or obfuscate your location," Filzen said. "This compounds things, because if we're doing it then everybody else is doing it too, including our adversaries."

It's important to find balance in today's highly connected, location-enabled world, Filzen said. Obfuscation allows him to fit in and embrace mobile technology, while still controlling his digital footprint.

Location-based features of social media accessed via mobile devices are also playing a greater role in security, according to David Tohn, executive director of the Cyber Technology Innovation Center for CyberPoint. Whenever CyberPoint gains a new client, the first step toward evaluating the customer's security is attempting to breach its network. Tohn shared an anecdote that clearly depicts the intersection private and professional lives can take in the form of social media.

In one case, CyberPoint drew a network of a company's employees using social media sites such as Facebook, LinkedIn, and Instagram. By looking at photos and other geo-tagged social media posts, CyberPoint was able to pinpoint individuals who were having an affair. The company then posed as human resources and sent an email to the individuals that included an attachment. The startled employees immediately opened the file, and boom, CyberPoint had infiltrated the network.

BUT WHY IS THIS RELEVANT TO THE INTELLIGENCE COMMUNITY?

"Imagine the potential if this were done to government employees," Tohn warned.

This is a concern that will only grow.

"Location has never been as important in computing as it is today, largely because of the proliferation of location-enabled devices," Usher said.

While location-based services today exist primarily on smartphones, experts say in only a few years the technology will infiltrate more consumer devices, such as entertainment centers and kitchen appliances.

"The interaction between the cyber and the physical world is inherent," Tohn said. "It's not an either/or. It just is."

maturation and NPPD's ability to identify specific locations should improve over time.

"One of the key enablers between cyber and location is the physical underpinning of the cyberspace, which really happens throughout the communications sector," he said.

This is a fact Hathaway said many cyber stakeholders do not yet realize.

"There is not a true grasp of how important telecommunications is," she said. "If there were, then we would be seeing legislation in Congress that would focus on the telecommunications backbone as the No. 1 area of interest to solve this problem."

MAPPING CYBER

Mapping the cyber terrain can help facilitate greater understanding about the significance of telecommunications infrastructure locations.

"It's important to have the terrain mapping of the Internet and telecommunications providers and where there are strategic areas of interest from a geographic perspective," Hathaway said.

Mapping the cyber terrain can help identify areas of redundancy, resiliency, and vulnerability.

"You can have a very logically well-structured network with a lot of alternative paths and good security practices against it, but the physical infrastructure could still be vulnerable and all those logical paths could go across the same bridge into Manhattan," Gorman said.

From a logical perspective the computing may look redundant, but if that one physical line fails, then all of the logical redundancies fail as well. This is something that has been seen a lot recently through natural disasters, accidents, and malicious intent, Gorman added.

Maj. Gen. Suzanne Vautrinot is commander of the 24th Air Force, which is responsible for providing CYBERCOM and combatant commands with trained and ready forces to plan and conduct cyber operations. Vautrinot said the nation is just beginning to scratch the surface of the obvious synergies between space and cyber, and that now more than ever is the time to think broadly.

"It used to be people tried to map the network," Vautrinot said. "Our initiative is to map the mission."

Meaning, the 24th Air Force is dedicated to mission assurance as opposed to network assurance, she elaborated.

U.S. AIR FORCE PHOTO BY TECH. SGT. SCOTT MCNABB

THE 24TH AIR FORCE legal team raises awareness on cyber law.

"How do I map my mission dependency and make sure that's what I'm protecting—my ability to do the mission?" Vautrinot said. "Otherwise, you defend everything to do with the network, then you're back to the old adage, 'to protect everything is to protect nothing.'"

Vautrinot described the cyber domain in three layers. The first is the physical network layer, composed of geography such as the land, air, sea, and space where elements of the network reside. Physical network components, or the hardware, system software, and infrastructure that support the network and the physical connectors, are also included in this layer.

The second is the logical network layer, which consists of the elements of the network that are related to one another in a way that is abstract from the physical network, meaning the form or relationships are not tied to a specific individual, path, or node.

The third is the cyber persona layer, which includes the people actually on the network. One individual may have several cyber personas. For example, someone with access to the Internet through a personal laptop, smartphone, and tablet, has three cyber personas. Conversely, an office desktop PC, which exists as a single cyber persona, may have multiple users.

"To have situational awareness, you have to have all of those layers, because they're interacting with each other," Vautrinot said.

She compared not doing so to the difference between a game of checkers or chess.

"If you don't think about all of those layers and the way they interact, then at best you're playing a game of checkers."

Instead, cyber operations require flexibility and a strategic approach that incorporates the multiple layers.

"You've got to have serious game to play in this domain and to have a future in this global environment," Vautrinot said.

Col. Jennifer Buckner, commander of the U.S. Army 780th Military Intelligence Brigade, better known as the Army's cyber brigade, shares the sentiment that geography is critical for cyber mission planning and operations.

"In terms of a cyber common operational picture, geospatial intelligence really continues to enhance situation awareness," Buckner said.

She added that geospatial analysts are an integral part of the 780th, and are actively involved in planning and conducting operations.

CW4 Al Mollenkopf, who serves as Buckner's technical adviser, said the 780th persistently geo-rectifies its information to glean the locations of its computers and underlying infrastructure around the world, and then provides commanders with insight to develop protocol for areas that are vulnerable.

"It's important for us to have a very clear picture of where our information systems are located spatially, logically, and geographically," Mollenkopf said.

Analytical Graphics Inc. (AGI) works in partnership with Scalable Technologies to help the defense and intelligence communities create that clear picture.

"We model the physical world, then we model the cyber world with [Scalable's] partner products," said Paul Graziani, AGI CEO and co-founder. "We then put both of those models into a context that allows you to understand where they meet."

This intersection between the physical world and the logical world where the information is flowing represents the cyber-location nexus, according to Greg Haun, a cyber expert with AGI. Knowledge of that intersection is essential in

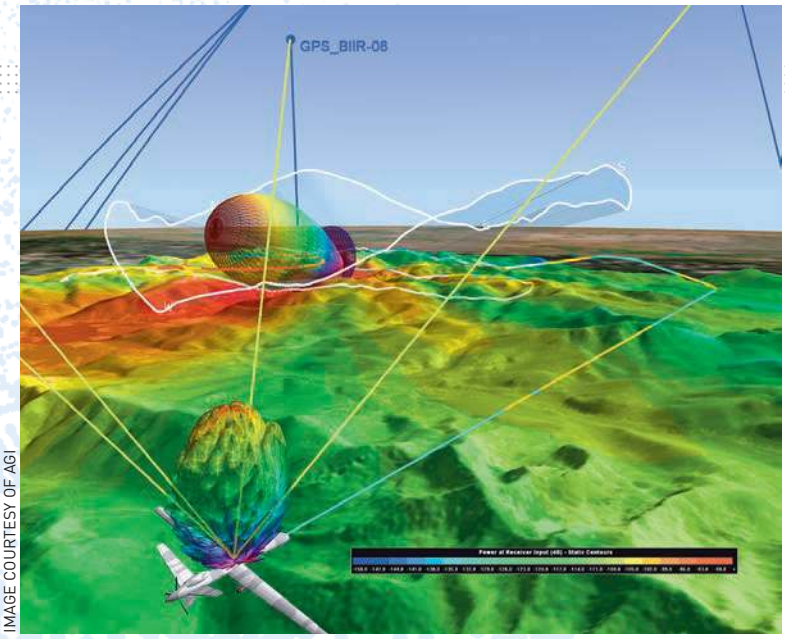

IMAGE COURTESY OF AGI

AGI SOFTWARE models a degraded UAV navigation solution and the impacted locational relevance to the cyber landscpe.

order to impact a location from a cyber perspective.

Hathaway believes mapping the cyber terrain will become increasingly important as the nation evolves to next-generation architecture, and new countries and regions grow more significant.

"Knowing the Internet terrain and how that technology all interoperates is essential," Hathaway said. "From a policy and a legal aspect, at least for the U.S., we are not making progress and addressing solutions because few people understand the terrain and how that technology intersects with the terrain."

TRAVERSING LANDSCAPES

But what comes after the cyber-location nexus is visualized on a map? Information is then used to determine operations.

"Having that map between the two domains, the logical and physical, allows decision-makers to decide where and how to operate," Haun said.

For example, a natural disaster such as Hurricane Sandy can create a massive denial of service without an adversary being involved.

"Many people had trouble communicating and getting access to information," Haun said. "That's based on location phenomena."

The visualization of the terrain is also effective for offensive cyber purposes, such as effecting or denying access to information, he added. To avoid speculation about how the DoD or Intelligence Community might deploy such techniques, Haun paints a scenario of a civilian en route to the grocery store.

"Say you're going to the grocery store and someone is going to send you a grocery list," he said. "If I need to deny you from getting that information, having knowledge of where you are traveling and the infrastructure, then maybe affecting the tower I know you will be near without affecting the whole infrastructure I can deny you that message."

Visualization of the cyber terrain is key, according to McCarthy. NGA is working steadily to address the geospatial analysis of the physical characteristics of cyber in order to provide a better understanding of the domain for analysts across government, she said.

"NGA uses data visualization, which allows analysts to gain insights that will lead to a much more wholesome understanding of what our adversary's cyber capabilities and intentions are," McCarthy said.

She also noted that humans largely rely on visuals, and posited that perhaps the public is having a difficult time wrapping its mind around cyberspace because it typically isn't thought of visually.

"The fact that NGA is there and can actually show this problem in a way that's easily understandable is critical to our government's ability to take this mission on effectively," McCarthy said.

Ret. Army Col. David Tohn, now executive director of the Cyber Technology Innovation Center for CyberPoint International in Baltimore, said where cyber activity occurs has an impact on how it occurs.

"The interaction between place and cyber drive what kind of solution sets you have to put in place," Tohn said. "You are defending against a threat that can come at you from three dimensions."

Tohn said many of his assignments while in the Army were trying to tie insurgents operating on the Internet in Afghanistan to where they were operating physically using precise targeting and geo-location.

"It became really important to identify where someone was posting from," Tohn said. "What Internet café, what set of IPs, what locations they were consistently posting at—to identify where someone was acting physically as they act in cyberspace so that you can tie cyber actions and effects to physical actions and effects."

Tohn uses a generic neighborhood in a Middle Eastern town afflicted by IEDs as a prime example of activities in the cyber landscape transpiring into real activity in the physical landscape.

"If you can identify where someone is posting videos of IEDs going off and say they are typically showing up from this area of town and identify Internet cafés that are there, then you can tie together physical actions," Tohn said. "You can put out searches in those areas around the same time that this guy physically posts. You take cyber and identify enough of the geospatial layer so that you can act physically."

A CRITICAL MOSAIC

The cyber-location nexus represents a complex mosaic of interactions between two realms, beginning with the identification of critical infrastructure, the mapping of this nexus—where the logical and physical meet—and the real-world actions that can be derived from this knowledge.

Tucker said he hopes the Intelligence Community will continue to open its eyes to the breadth and criticality of the cyber-location nexus.

"Cyber is just that extra layer of communication and expression that is mapped onto the world's geography," Tucker said.

Infrastructure holds up just one leg of the complicated cyber-location nexus tripod. There are other aspects to be considered as well, such as the role of location in cybersecurity law and attribution, or lessons learned from the geo-tagged social media capabilities now at everyone's fingertips.

But the bottom line is, everything happens somewhere, even in the mystical cyber domain of ones and zeroes.

"It's about the ability to act. You can do all sorts of things in the cyber world, but they are very ephemeral," Tohn said. "Effects are fleeting, but if you want to act offensively or defensively and to cause change, you have to know where something is." ■

> "Cyber is just that extra layer of communication and expression that is mapped onto the world's geography."
>
> —Chris Tucker, principal of Yale House Ventures

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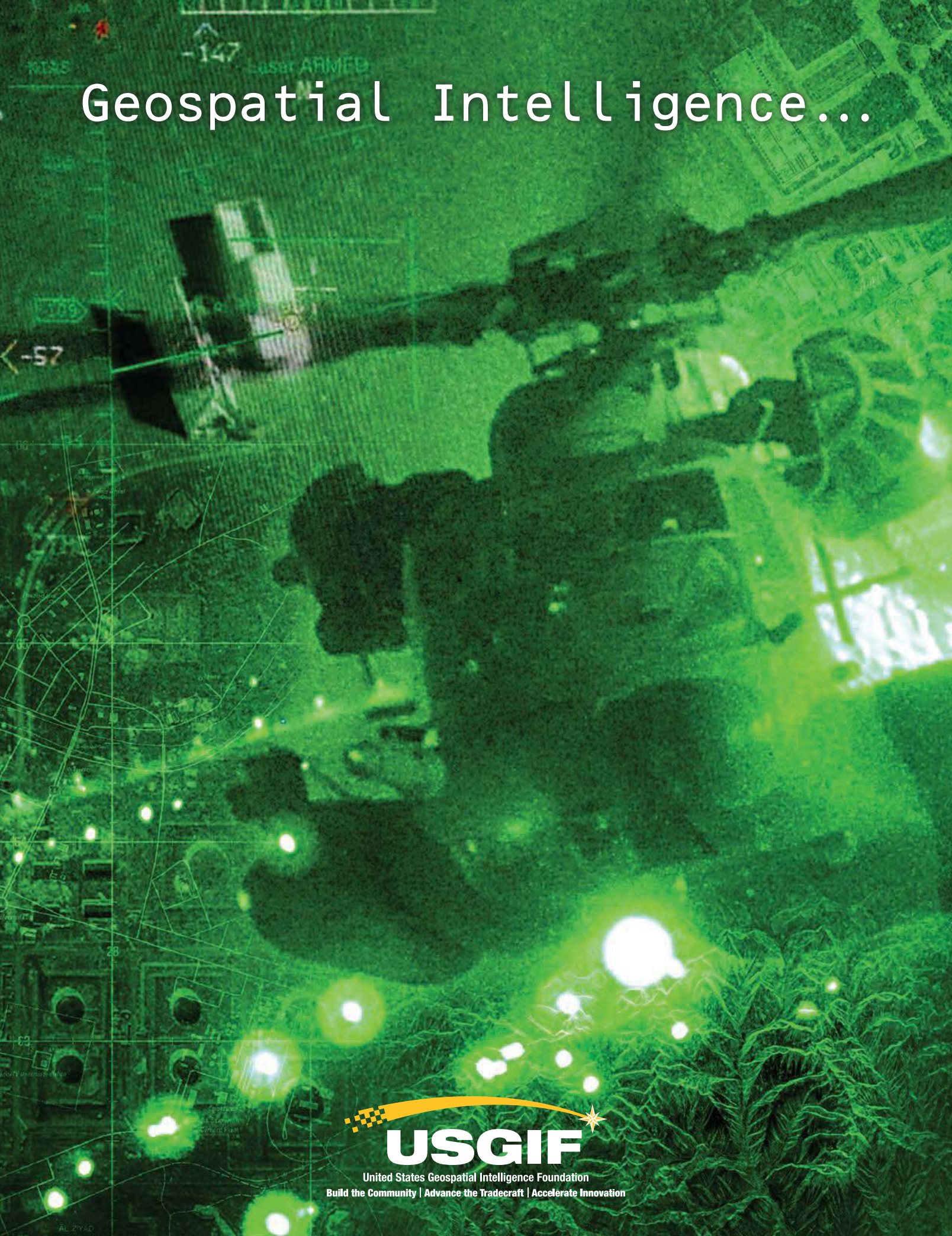
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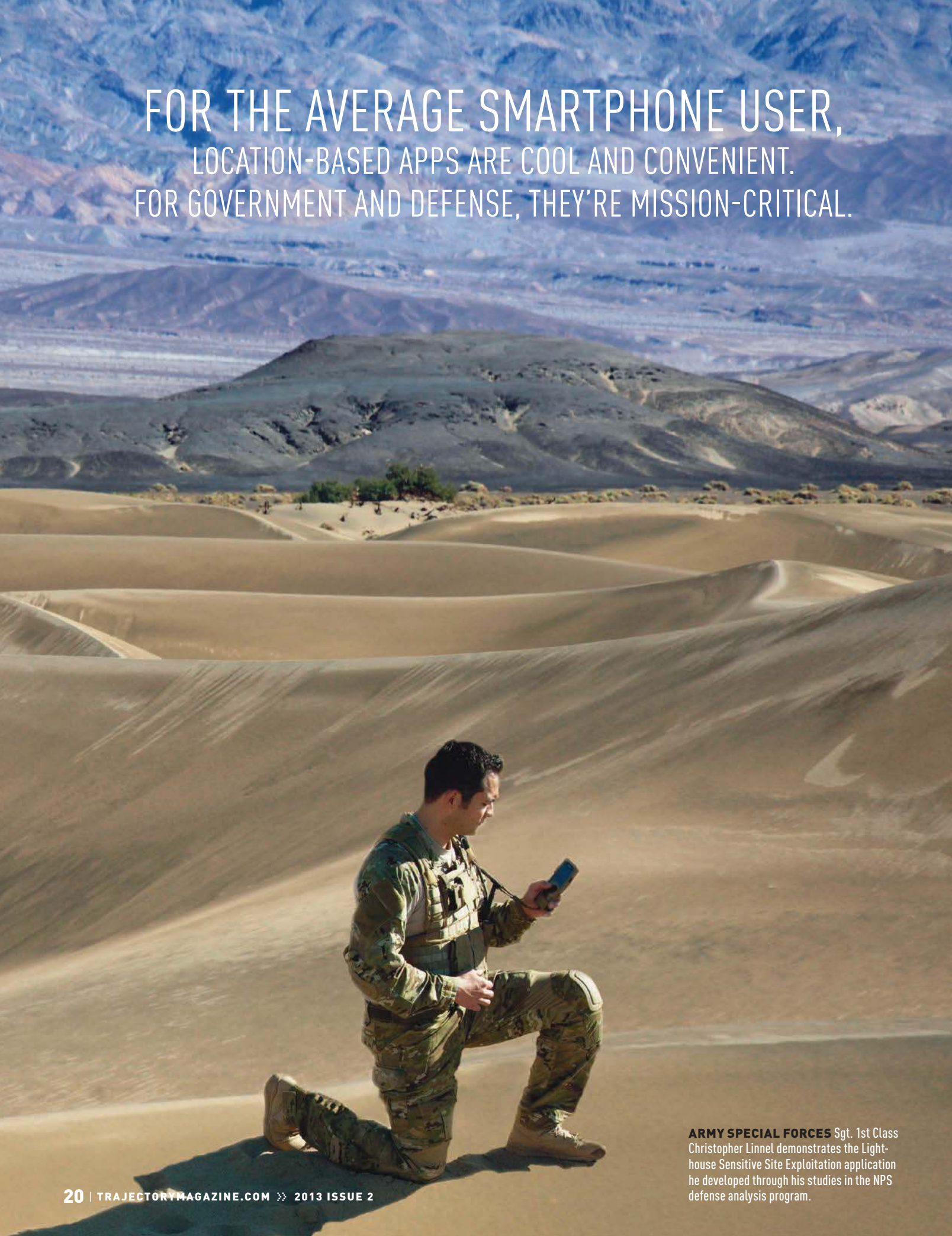


ARMY SPECIAL FORCES Sgt. 1st Class Christopher Linnel demonstrates the Lighthouse Sensitive Site Exploitation application he developed through his studies in the NPS defense analysis program.

mission: MOBILE

BY MATT ALDERTON

It's morning in the new millennium. Jeff, a civilian, wakes up and checks the weather on his smartphone, making a mental note to remember his umbrella. He's out of coffee, so he adds it to his digital shopping list. Later, when he drives past the grocery store, he'll receive an alert reminding him to stop. He starts his day at the gym, where location-aware videos stream serendipitously to his smartphone, demonstrating proper form for each exercise in his workout when he arrives at the corresponding machine. He checks Facebook and sees that his neighbor is enjoying a morning swim, so he stops by the pool to say hello. After showering, he heads to work using whichever route his phone says is fastest—but not before filling his tank at a nearby gas station, which his phone tells him is the area's least expensive.

PHOTO COURTESY OF DVIDS/JAVIER CHAGOYA

On the same morning, a soldier wakes up in Afghanistan. Although her day is nothing like Jeff's, she craves the same access to information. Like Jeff, she seeks mobile tools with which to navigate the people and places around her, maximize her resources, and inform her decisions. Thanks to cutting-edge government efforts, she has some of Jeff's favorite tools at her disposal. Many of them, however, she does not—yet.

"We've seen an explosion in the use of mobile apps," said John-Isaac Clark, chief innovation officer at Thermopylae Sciences and Technology, which provides mobile technology to the federal government. "But when you look at [technology in] the commercial sector and the government sector: Do government users have the same capabilities as civilian users? The answer is no, they don't."

Advocates in both the public and private sectors are working around the clock to change this, developing mobile apps that will one day give government users the same geo-dexterity as their civilian counterparts—in the office, on the road, and even on the battlefield.

A BUREAUCRATIC TECH BOOM?

If the adoption of new technologies were a race, it comes as no surprise: Government would be the tortoise and enterprise the hare.

"The Apps for the Army contest gave you 75 days [to develop an app]. The idea was: Let's see if you can develop something that would be useful in the field, and let's not worry about the bureaucracy it has to go through to get there ..."

—Luke Catania, computer scientist , U.S. Army Topographic Engineering Center

"The public sector as a whole tends to always be a step or two behind," acknowledged Jack O'Byrne, 311/CRM industry specialist at PublicStuff, which develops location-based apps for municipal governments.

Like the fabled tortoise, however, many expect government to eventually catch up with—and perhaps even surpass—the commercial sector. "I think [government entities] are taking a really hard look at how the mobile paradigm can benefit their employees, their agencies, and their missions," said Larri Rosser, chief engineer for Raytheon's Appsmart marketplace, an online shop that provides apps for users in the defense, intelligence, and first-responder communities. "Once they determine the benefits, they will leapfrog the commercial offerings and deploy some revolutionary capabilities."

Although it still has a long way to go toward realizing those capabilities, government already is moving in the right direction. In 2009, for instance, President Barack Obama appointed the first federal chief information officer with the goal of bridging the web-services schism that separates the public and private sectors. That was followed in 2012 by the introduction of the nation's first Digital Government Strategy.

"At a time when Americans increasingly pay bills and buy tickets on mobile devices, government services often are not optimized for smartphones or tablets, assuming the services are even available online," the president said in a 2012 memo. "[The Digital Government Strategy] will enable more efficient and coordinated digital service delivery by requiring agencies to establish specific, measurable goals for delivering better digital services [and] encouraging agencies to deliver information in new ways that fully utilize the power and potential of mobile and web-based technologies."

The impetus for public-sector innovation is coming not only from above, but also from below. "The consumerization of IT is having a major impact in the government," said Melissa Adamson, vice president of advanced technologies at Agilex, which provides technology services to the federal government. "Everybody who works for the government has mobile devices. They might not be able to bring them to work, but they use them in their home. They see the power of what [these devices] can do and that puts pressure on [the government] to move forward."

EARLY ADOPTERS

Among the first government entities to recognize the benefits of LBS were the U.S. Army and the National Geospatial-Intelligence Agency (NGA), both of which have pioneered the adoption of mobile apps for the Department of Defense and the Intelligence Community.

The Army began its exploration in March 2010, when the service launched its "Apps for the Army" (A4A) mobile application-development challenge. Typically, the Army's process for acquiring and developing new software is time-consuming, often lasting several years from conception to implementation. By contrast, approving commercial mobile apps for the Apple and Android stores typically takes just two weeks. A4A helped the Army pilot a similar approach to rapid innovation.

As part of the challenge, the Army invited internal and external developers to submit apps in five categories: morale, welfare, and recreation; Army mission; information access; location awareness; and training. In total, 53 apps were submitted, 25 of which were ultimately certified for inclusion in an Army-specific app store—the U.S. Army Marketplace, which will eventually be part of a DoD storefront that will provide access to app stores across the Department of Defense.

Luke Catania, a computer scientist at the U.S. Army Topographic Engineering Center, was one of 15 winners who received a cash prize for app development. Like Waze, a commercial app that was launched in 2009 to help drivers report and navigate around traffic jams, his "Movement Projection" app for Android devices calculates the best and quickest off-road routes by allowing soldiers to input obstacles and threats.

"The Apps for the Army contest gave you 75 days [to develop an app]," Catania said. "The idea was: Let's see if you can

develop something that would be useful in the field, and let's not worry about the bureaucracy it has to go through to get there … It was a way to get a lot of people together, thinking about what a soldier would want in the field. Sort of like a big brainstorming session."

The acquisition process piloted during A4A would allow the Army and other government entities to imagine a mobile mission capability, then provide public- and private-sector developers 30 days to produce prototypes of appropriate apps. Upon receiving proposals, commanders would vote on their favorite solution and give the developer 60 days to develop the final app to Army specifications. The result: a new solution in three months instead of three years.

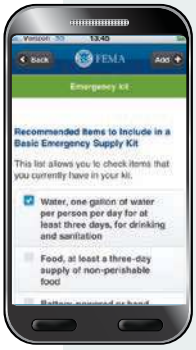
"The government seems to be heading toward a path where they provide a statement of desired capabilities and objectives versus well defined functional and performance requirements, and then look to the commercial marketplace to provide innovative, flexible, and lower-cost solutions that fit the fiscally constrained climate and profile," observed Kevin Brown, senior manager for GEOINT strategy at Raytheon.

Although the A4A project has yet to advance from "pilot" to "program," it was an important first step, as are the

LOCATION-BASED GOVERNMENT

Built into mobile apps for government users, location-based services promise a host of geospatially-aware benefits across the public sector.

"Using location awareness as a part of a mobile app, governments can improve user services and alert citizens to upcoming events," said T.L. Neff, executive vice president of global client services for Verivo Software, which provides enterprise mobility platforms for numerous government clients. "For example, multiple government agencies are developing apps to alert citizens to incoming inclement weather and notify them of pending road closures."



The Federal Emergency Management Association (FEMA), which introduced its mobile app in 2009, is one example among many.

"The FEMA app offers interactive mapping where users can find FEMA Disaster Recovery Center locations and shelters," Neff continued. "This information has the maximum impact because the pointed alerts directly affect the user's current location."

These business cases point to a more engaged government, which can now deliver services that were previously thought to be unachievable, Neff said. Among the many other public-sector applications for LBS:

- **WAYFINDING:** Government agencies can use LBS in much the same way businesses do—to help citizens locate places and things. The National Park Service, for instance, has an app for the National Mall that provides turn-by-turn directions to landmarks and uses augmented reality to disseminate location-aware information. Likewise, Arlington National Cemetery's ANC Explorer app, developed in partnership with Geographic Information Services, Inc. and Army Installation Management Command, offers directions to points of interest within the cemetery, including more than 260,000 gravesites.
- **CIVIC ENGAGEMENT:** Location-aware apps can direct voters to the nearest polling place or help them discover their taxpayer dollars at work. For example, the Recovery.gov mobile app, published by the Recovery Accountability and Transparency Board, allows citizens to discover projects around them that were funded by the American Recovery and Reinvestment Act of 2009.
- **PUBLIC WORKS:** Many progressive cities—including Denver, Honolulu, Boston, Philadelphia, San Francisco, and Chicago, among others—have launched "311" apps that allow citizens to submit geo-tagged reports of hazards or eyesores such as potholes, fallen trees, and graffiti, then track their request from submission to resolution. In Florida, meanwhile, the National Park Service's IveGot1 app allows people to report geo-tagged sightings of invasive species, thereby assisting with eradication.
- **DATA COLLECTION:** The "311" apps being developed by cities improve data collection as much as citizen services. In the case of graffiti reports, for instance, location tracking allows city government to map incidents, and then deploy police officers to high-risk areas for prevention. At the federal level, agencies like FEMA and the U.S. Census Bureau use apps to digitize and geo-tag everything from land surveys to damage assessments to population studies, simultaneously increasing data quantity and quality.
- **WORKFORCE MANAGEMENT:** Location-aware apps can also help governments deploy human resources more effectively. Military and law enforcement agencies, for instance, can use LBS to strategically deploy units to nearby incidents, improving mission speed and response time. Personnel at Arlington National Cemetery are likewise using the aforementioned ANC Explorer app to synchronize the teams involved with gravesite preparation and burials.

efforts underway at NGA, which started developing geospatial apps in 2011. The agency launched three app stores in 2012—one for each of the three intelligence networks on which it operates: unclassified, secret, and top-secret.

"We wanted to leverage the current technology that everyone uses in their private lives, and use that technology to … put the power of geo into the hands of the [government] user," explained Mark Riccio, director of application services within NGA's Online GEOINT Services Directorate, which manages NGA's app stores. "We wanted to make our information and our content as accessible and as extensible as possible, and mobile provides that."

Elsewhere in the federal government, more early adopters are moving ahead with the development of location-aware apps. The Defense Advanced Research Projects Agency launched a Transformative Apps program in 2010 with goals similar to those of A4A, focused on situational awareness for warfighters. The Defense Information Systems Agency is expected to open its own app store this year, and the National Reconnaissance Office's Windshear program integrates biometric and location data for intelligence purposes on soldiers' handheld devices.

NGA'S APP STORES CURRENTLY BOAST SOME

150

APPS, APPROXIMATELY

75

PERCENT OF WHICH WERE DEVELOPED INTERNALLY.

CONFIDENTIAL COMPUTING

What makes mobile development efforts by the Army, NGA, and others so remarkable is how these programs have progressed in spite of considerable challenges, the most significant of which is security.

"The requirement government generally has is that government data—especially anything sensitive—can't be stored outside its own environment," Clark explained. "Mobile phones, because of storage [limitations], tend to send data that's created on the phone somewhere else [for processing]. When you're using location-based apps, your location data is sent over the network to a commercially hosted server that's fairly secure, but still out there on the open Internet. Government can't allow that."

Added Gabriel Chang, senior client IT architect at IBM, "Mobile security is one area which is increasingly important to everyone. In the security spectrum, one item alone—malware—grew 155 percent across all platforms in 2011."

"It's really hard to develop a game-changing app when you can't even connect it to the network," said Tom Suder, president and founder of Mobile Government Solutions, also known as Mobilegov, which develops mobile apps—including LBS—for government clients.

In the case of military apps, especially, a fundamental challenge is network connectivity.

"The No. 1 requirement we hear [from government users] is we can't start on the assumption that we're going to have a solid network connection," said Ben Tuttle, a project scientist with NGA's InnoVision Directorate, which develops apps for the NGA storefronts. "Most of the commercial apps out there don't take that into account, and don't need to. But for us that's a big thing."

Along with connectivity, mobile technology requires agility—which government, unfortunately, lacks.

"[Mobile] capabilities require a more agile acquisition environment that provides access to a broader audience of potential application service developers with a much lower cost of entry," said Joseph Obermeier, vice president of Mission Analysis and Business Solutions at TASC. "The government has yet to develop a market engagement strategy to deal with this new and challenging environment."

Another major hurdle is funding. Government IT budgets are usually limited and restrictively earmarked, but app creation generally is also resource-intensive, requiring not only development, but also testing and deployment to multiple codebases.

"Mobile application development will likely keep pace with—or outpace—any traditionally developed programs in the [government] enterprise, and could easily surpass schedule and budget constraints if you are not careful," Chang explained.

Orwellian privacy concerns pose yet another challenge.

"The expectation of personal privacy has been much debated across the executive, legislative, and judicial branches of the government," Obermeier

3 REASONS TO EMBRACE LBS

1 **EFFICIENCY:** By automating data collection, sharing, and reporting, LBS allows governments to be more efficient and act on information more quickly. Streamlining is especially useful in law enforcement, homeland security, intelligence, and defense, where the distribution of information far, fast, and wide is mission-critical.

2 **COST SAVINGS:** Efficiency leads to cost-savings, another major benefit of LBS. In Philadelphia, the city's "311" app paid for itself within one month, according to Jack O'Byrne, 311/CRM industry specialist at PublicStuff. O'Byrne cited lower transaction costs for requests submitted electronically through the app compared to those submitted using the city's 311 hotline.

3 **BETTER LAWS:** Yet another perk of public-sector LBS is improved policymaking. Understanding what routes citizens drive to work, for example, can help lawmakers optimize decisions about infrastructure spending. "We've always had maps—and pretty good maps, in some respects—to help us understand where things in cities are," said Asif Khan, founder and president of the Location Based Marketing Association, a Toronto-based LBS trade association. "What we have now is the ability to understand where citizens are at any given time relative to those things. There are huge inefficiencies right now in how governments spend money. Those inefficiencies can be lessened if we understand how citizens flow around geo-addressable objects."

said. "However, location-based services bring a whole new level of issues to the forefront that will need to be resolved, such as individuals having some level of privacy expectation related to their location … Many are becoming concerned, some even paranoid, about the potential possibilities which are now available to encroach on an individual's privacy. Consequently, this upcoming set of location-based issues needs to have an open debate across the government."

THE WAY FORWARD

The growing number of apps already permeating local, state, and federal government is proof: The challenges facing LBS adoption in the public sector are temporary and surmountable.

"Where there's a mission that needs these technologies, we see people trying to figure out how to implement them," said Adamson.

So far, the strategy that has advanced the public sector the farthest is interagency collaboration—traditionally rare, given the fragmented nature of government agencies.

"Before, government was in silos," Suder said. "Mobility to a large degree has broken the ice on that. With budgets the way they are, people are more willing to share information. It's changing the way we're doing business in government. It's a little unprecedented."

Catalyzed by the Digital Government Strategy, federal agencies are actively sharing best practices and lessons learned.

"Reaching out to others that have been successful has a lot of legs," Adamson said. "Never before have we seen so much agency collaboration because people really do want to move forward."

NGA, in particular, has embraced collaboration and is working actively to partner not only with other government agencies, but also with the private sector. NGA's app stores currently boast some 150 apps, approximately 75 percent of which were developed internally, with the remaining 25 percent coming from commercial developers. According to Riccio, the agency is in the process of developing a compensation model that would allow it to invert that ratio by paying private developers based on user downloads, thus maximizing creativity and minimizing cost.

"There's a lot of innovation happening in the private sector," Riccio said. "We want to be able to capitalize on that."

NGA's InnoVision Directorate has likewise pursued a public-private partnership through a series of mobile app summits, bringing government developers face-to-face with those in industry and academia.

"No one group is going to be able to tackle and surmount all the challenges that face us," Tuttle said. "So, we're actively growing our community and encouraging folks to talk to one another."

Along with increased collaboration, advocates say the public sector can stimulate LBS adoption by re-allocating IT budgets, educating decision makers, and removing administrative barriers. Ultimately, though, the best way forward is one foot at a time—which explains why NGA has already been building apps for devices that until recently weren't allowed on DoD networks.

"If you don't start building solutions and capabilities today, eventually we'll solve the challenges and there will be absolutely nothing for the user to use," Clark said.

Agilex Chief Technology Officer Tim Hoechst agrees: The only way to reach Destination Mobile is to start moving.

"The question, 'Should I start to go mobile?' is an old question," Hoechst said. "There is no more, 'Should I?' [Mobile] is going to happen in every part of every agency that has information and people who need it." ■

STAFF SGT. REAG WOOD of 1st Combined Arms Battalion, 5th Brigade, 1st Armored Division, illustrates how he uses an iPhone to obtain a visual during a field training exercise at White Sands Missile Range, N.M.

> **"We wanted to leverage the current technology that everyone uses in their private lives, and use that technology to … put the power of geo into the hands of the [government] user."**
>
> —Mark Riccio, director of application services within NGA's Online GEOINT Services Directorate

RISK FOR REWARD

KEYW CORP. FOCUSES ON SELF-RELIANCE IN AN ERA OF BUDGET AUSTERITY

For technology firm KEYW Corp., government budget constraints are not hindering the company's growth, according to Chris Donaghey, vice president of corporate development and communications.

KEYW is leveraging its existing investments in cyber and geospatial by developing new programs based on each customer's needs—essentially building off of smaller programs to create larger ones, instead of starting from scratch.

"We're designing, developing, and evolving the systems specifically to what the user community is asking for," said Donaghey. "We are maximizing data reuse and the systems that are in place to help diminish some of the upfront development costs for the larger systems [our customers] may be contemplating."

Donaghey added that this strategy is possible thanks to KEYW's ability to look at opportunities on both a small and large scale.

"Our most successful programs started out small and went to thousands of users because we focused on what the users were telling us and how the system may or may not fit their needs," he said.

Founded in 2008, the Hanover, Md.-based company supports intelligence agencies and the Defense Department with advanced cybersecurity, cyberintelligence, and geospatial intelligence solutions. In addition to its government customers, KEYW recently expanded into the commercial space.

Donaghey said he finds value in KEYW's membership with USGIF because the Foundation has expanded beyond the geospatial realm into other areas such as cyber and counterterrorism—two additional verticals in which KEYW is active.

"At the end of every cyber problem is a geospatial problem," Donaghey said.

COMPARISON of two KEYW-collected images (left to right): long-wave infrared (LWIR) and high resolution electro-optical.

COMMERCIAL EXPANSION

While KEYW has developed initiatives in the cyber and geospatial worlds in order to grow with the defense and intelligence communities, it is also expanding into the commercial realm.

Though commercial companies may have firewalls, intrusion-detection systems, and any number of point solutions, most do not have the capabilities needed to stop the most serious threats, according to Donaghey.

"[We are] leveraging our Intelligence Community heritage to introduce a cyber defense system for commercial enterprises," he said.

Its commercial expansion initiative, nicknamed "Project G," is well under way, and the new software is expected to be available in the second quarter of 2013.

DISCOVERING NON-STANDARD GEOSPATIAL DATA

In addition to its expansion within the commercial sector, KEYW is also working on developing a system to make non-standard geospatial data easily discoverable. There is an enormous amount of non-standard data now available, such as geo-tagged photos from handheld mobile devices.

"It's really about ingesting what we think are going to be pretty massive volumes of data coming from these non-military type systems and making all that data discoverable to the analysts," said Donaghey, who expects the amount of non-standard geospatial data to continue to grow exponentially over the next several years.

Beyond this initiative, KEYW is also actively developing next generation synthetic aperture radar systems and high-resolution electro-optical (EO) camera systems, such as the EO system for the Army Geospatial Center's Buckeye program.

"In addition to the management and dissemination of geospatial data, KEYW is very active in other aspects of the TCPED process, including sensor development, collection, and processing of various sensor data," said Donaghey.

UNIQUE OFFICE CULTURE

To offset the often serious nature of the work that KEYW's employees do, the company has a strict no-tie policy and a laid-back office culture. CEO Leonard Moodispaw named the company after his favorite vacation spot, Key West, Fla., and created the parrot logo to honor his affinity for Jimmy Buffett. Conference rooms are named after writers who lived in Key West and the office hallways are named after streets in the town.

"In some cases these are very serious missions and we try to offset that intensity on the mission side by creating a culture that is more relaxed and open," said Donaghey.

Though the office culture is relaxed, KEYW employees take their work very seriously. The company also isn't afraid to invest in internal research and development efforts.

"At KEYW, we are willing to take on more risk when it comes to developing new products and services [to meet the] customer's demand by using our own profit dollars instead of waiting for a contract to be awarded," said Donaghey.

BY JAMIE FRIEDLANDER

"AT THE END OF EVERY CYBER PROBLEM IS A GEOSPATIAL PROBLEM."

— Chris Donaghey, KEYW Corp. vice president of corporate development and communications

YOUNG professionals learn about OpenStreetMap at USGIF headquarters in Herndon, Va.

EDIT YOUR WORLD

Young professionals host OpenStreetMap tutorial

USGIF'S YOUNG PROFESSIONALS GROUP (YPG) organized a GeoNova MeetUp event at the Foundation's headquarters in Herndon, Va., on March 14 to learn about OpenStreetMap (OSM). OSM is a global volunteer project that creates a free, open-source map of the world.

Scott Clark, director of Geospatial Programs for LMN Solutions, and Elizabeth Lyon, a geographer with the U.S. Army Corps of Engineers, and a USGIF board member and co-chair of the YPG Working Group, led more than 20 attendees in learning how to use the free mapping platform through a step-by-step tutorial. Participants enjoyed refreshments, pizza, and dessert, and then went to work on their laptops in USGIF's reconfigurable conference room, which had been set up for stadium-style classroom seating.

"The goal of the presentation is to give people exposure to what OSM is and guide them by giving them the tools and resources to edit the maps themselves," said Clark. "We're giving YPG members a frame of reference and an opportunity to find the resources."

The user-friendly OSM tools allow individuals to edit virtually anything and everything. The platform originated in the U.K. in 2004 as a way of simply mapping the country. However, that notion changed years later when the brand started providing free geospatial data for anyone to use.

Use of OSM peaked in 2010 after the Haiti earthquake when thousands of volunteers were editing the map minutes after the earthquake struck. Users were able to edit building and road devastation, and even add refugee camps.

Today, users turn to the tool to update maps of their community or neighborhood. OSM has also developed a smartphone app called Pushpin OSM, which allows users to edit and contribute data on the go.

YPG member Lindy Bersack of Blue Canopy Group said, "I think OSM is very interesting and informative. I learned how to create a footpath in my neighborhood where I walk my dog all the time."

By creating a free account, users can tag points of interest, such as buildings, roads, road signs, and man-made and natural-made areas, anywhere in the world. Not only can users update the map by labeling attractions, but they can also easily find destinations on the map. After an OSM user edits a point on the map, the map is updated within minutes for the entire OSM community to view.

Like many of the attendees, it was U.S. Geological Survey employee Steven Hak's first time using the tool.

"I thought OSM was really neat to learn about, especially how it was used as an emergency response in Haiti," said Hak. "Now that I've learned OSM, I will definitely use it more often and check out its Twitter account for other OSM events going on in the D.C. area."

Although there are maps available online, such as those from Google and Yahoo, legal and technical restrictions limit users from having the freedom to edit points of interest. OSM, which uses satellite images from Microsoft's Bing search engine, allows people to edit maps in a creative and productive way. ■ BY LINDSAY TILTON

To learn more about USGIF's Young Professionals Group, contact Carrie Drake at carrie.drake@usgif.org.

LiDAR

An introduction to Light Detection and Ranging

by Jennifer J. Albert, Army Geospatial Center

LIGHT DETECTION AND RANGING, more commonly referred to as LiDAR, is a remote sensing system in the geospatial intelligence (GEOINT) arsenal that is used to map terrain in high-resolution detail.

LiDAR sensors work like giant laser range finders, scanning the environment with millions of individual laser beams, each of which returns a precise measurement of its range to the target.

Aircraft-mounted LiDAR sensors have become an indispensable tool for mapping purposes. Terrestrial LiDAR sensors are used by engineers to characterize the built environment from both fixed tripod-mounted and mobile vehicle-mounted configurations. LiDAR has even been deployed to space for earth observation science missions. The technology can be designed to measure everything from aerosols in the atmosphere, to interior walls, to high-resolution terrain data on the ground.

It's all about selecting the right laser tuned to bounce off of particular things.

Once processed with location information, these millions of range readings provide a high-resolution, three-dimensional depiction of the environment. The output from a LiDAR is a "point cloud" of laser returns, each point containing an accurate 3D position.

LiDAR processing moves the data from raw sensor measurements (Level 0), to geo-registered point cloud (Level 3), then on to derived products like digital elevation models (Level 4).

Level 3 point clouds provide an exquisitely detailed view of the terrain, and have great utility for understanding features like vegetation and vertical obstructions. Level 4 digital elevation models (DEM) provide the surface for line-of-sight measurements and slope calculations, as well as a base for draping imagery and other geospatial features.

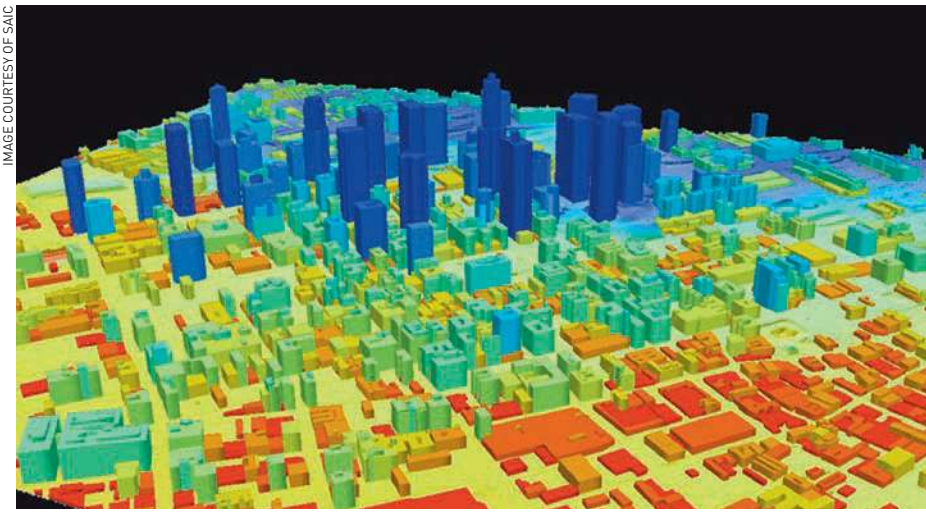
GPS AND IMU

LiDAR's ability to collect geospatially accurate data depends upon the quality of the Global Positioning System and Inertial Measurement Unit (GPS-IMU) that is attached to the sensor. In airborne and mobile collection, in particular, having a high quality GPS-IMU matters. It not only tells the location of the sensor, but also its exact orientation—pitch, yaw, roll, angle of view—which is critical to collect geospatially accurate measurements.

WHICH KIND OF LASER?

Lasers are described in terms of wavelength on the electromagnetic spectrum. Several kinds of lasers are used in LiDAR sensors depending on the application. Near-infrared lasers are widely used for airborne and terrestrial collection. Green lasers can penetrate water to measure bathymetry. Ultraviolet lasers are used to measure the atmosphere.

IMAGE COURTESY OF SAIC



LiDAR processing derives digital elevation models such as this one.

WIDE AREA MAPPING AND MORE

A common application of LiDAR is wide area mapping from an airborne platform. In the United States and other developed nations, civilian agencies commonly use this collection method for urban areas, coastal areas, and flood plains. Typical collection is at one-meter "post spacing," with an elevation reading roughly every three feet. In military applications, this has come to be known as "human scale High Resolution 3D (HR3D) data." It is the minimum resolution that allows mission planners to make essential measurements for ground warfighters to successfully determine mobility and visibility over complex and urban terrain.

LiDAR can also be locked on a target using a gimbal, enabling a more dense collection of LiDAR points from every angle. This can be used to characterize a facility, including all of its facades at a higher resolution, or even to peek through foliage and observe underneath it. But lasers do not go through leaves; they peak through holes in the canopy. The more dense the canopy, the better it is to use a true foliage penetrator such as radar.

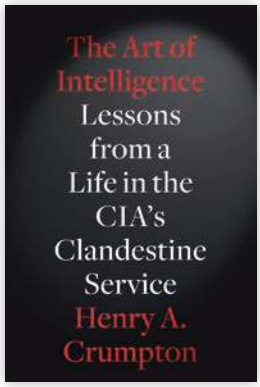
NEWEST LIDAR TECHNOLOGY

In recent years, a new breed of LiDAR has emerged, enabling collection from much higher altitudes and at higher resolutions. Traditional LiDAR is sometimes referred to as "linear mode," where individual laser beams are used to measure range. The term "Geiger mode" is used to describe this new breed of LiDAR, where the sensors do not observe individual laser beam returns, but rather the returns of individual photons. This allows sensors to collect a much higher density of measurements with far less power from higher altitudes, and over larger geographies.

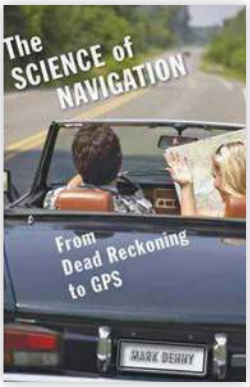
There are several different types of Geiger mode, including Flash, Avalanche Photo Diode (APD), and Photon Counting LiDARs. NASA, DARPA, NGA, the Air Force Research Lab, and the Army Geospatial Center have all experimented with this new breed of LiDAR, and operational experiments have been conducted with several different sensors and platforms.

This technology offers the possibility of someday collecting human-scale HR3D terrain data over massive geographic swaths from as far away as outer space. ■

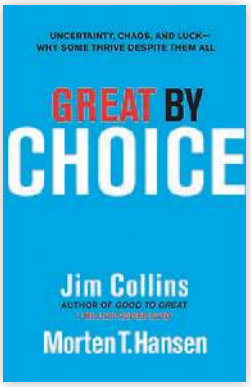
READING LIST



THE ART OF INTELLIGENCE: LESSONS FROM A LIFE IN THE CIA'S CLANDESTINE SERVICE
by Henry A. Crumpton
Told by a CIA spy and counter-terrorism expert, this memoir describes Crumpton's experience and leadership in organizing the Afghanistan campaign days after 9/11. This book not only illustrates Crumpton's espionage and covert action but also the importance of America's intelligence officers and their secret assignments.



THE SCIENCE OF NAVIGATION: FROM DEAD RECKONING TO GPS
by Mark Denny
This book delves into the history and evolution of navigation. From early cartography and the invention of the magnetic compass to discoveries made by famed navigators such as Pytheas and Sir Francis Drake, Denny examines the critical role navigation has played in human survival for centuries.



GREAT BY CHOICE: UNCERTAINTY, CHAOS, AND LUCK—WHY SOME THRIVE DESPITE THEM ALL
by Jim Collins and Morten Hansen
After studying successful leaders whose companies have experienced change, uncertainty, and chaos, the authors found three common traits—productive paranoia, fanatic discipline, and empirical creativity. This book examines principles for building a strong enterprise in fast-moving times.

PEER INTEL

USGIF announced **Keith J. Masback** has been appointed CEO of the Foundation, effective immediately. **Aimee McGranahan** has also been promoted and named USGIF Chief Operating Officer (COO). She was previously the Vice President of Operations for USGIF. **K. Stuart Shea**, previously CEO and Chairman, will remain Chairman of the Board.

TASC has appointed **Keith Littlefield**, former CIO of the National Geospatial-Intelligence Agency, as its new CTO. Littlefield will lead TASC's technology strategy and oversee its research and development and technical fellows programs. TASC also named **Amanda Brownfield** vice president of its Mission Analysis business unit. Brownfield joins TASC after 15 years at SAIC, in addition to serving in the U.S. Army with the Corps of Engineers.

Northrop Grumman appointed retired **Vice Adm. P. Stephen Stanley** as vice president of Cybersecurity/C4. His role will include contributing to the development and execution of the cybersecurity and C4 elements of the company's strategic business plan. Most recently, Stanley served as director for force structure, resources, and assessments for the chairman of the Joint Chiefs of Staff.

Dan Hushon was named CTO at Computer Sciences Corp. (CSC). Hushon previously served as chief technologist at both EMC Corp. and Sun Microsystems. With CSC, Hushon will provide leadership and drive strategy and growth for CSC's product lines.

ManTech International appointed **Louis Addeo** from president and COO to executive vice president and general manager of the company's Technical Services Group (TSG). Prior to joining ManTech, Addeo was CEO of Serco Inc., as well as the president of AT&T. **Daniel Keefe** will succeed Addeo as president and COO for TSG.

Lockheed Martin named **Sondra Barbour** executive vice president of its Information Systems and Global Solutions business unit. Lockheed also appointed **Rick Ambrose** to deputy and vice president of Lockheed Martin's Space Systems unit.

Debra Facktor Lepore was appointed vice president and general manager of Washington Operations for Ball Aerospace. In her new role, Lepore will lead Ball's Washington operations, corporate communications, and strategic planning.

USGIF EVENTS CALENDAR

EVENTS
For the latest event listings, visit www.usgif.org/events.

MAY

8-9
ABI Forum (TS//SI/TK)
NGA Campus East, Springfield, Va.

20-23
GEOINT Community Week
Northern Virginia

21
GEOINTeraction Tuesday
Walker's Grille, Springfield, Va.

JUNE

4
NGA Tech Showcase West
NGA Campus West, St. Louis, Mo.

JULY

9
GEOINTeraction Tuesday
Maggiano's, Tysons, Va.

18-19
Technical Workshop: ADF-C
Denver, Colo.

SEPTEMBER

10
GEOINTeraction Tuesday
Maggiano's, Tysons, Va.

OCTOBER

13-16
GEOINT 2013 Symposium
Tampa Convention Center, Tampa, Fla.

NOVEMBER

12
GEOINTeraction Tuesday
Maggiano's, Tysons, Va.

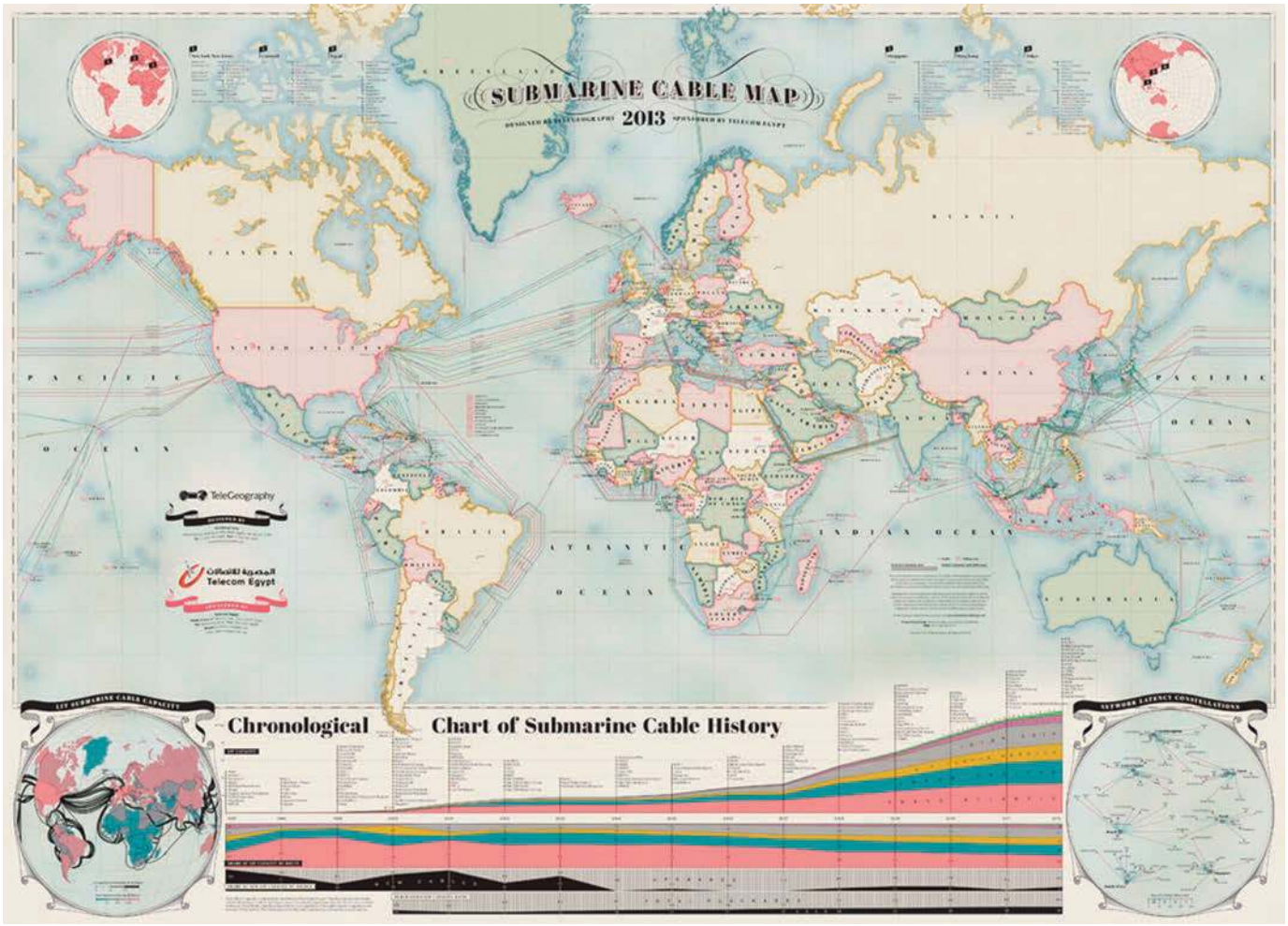


IMAGE COURTESY OF TELEGEOGRAPHY

The Cyber Seafloor

When most of the world thinks of the Internet, they picture intangible data floating through an unseen virtual dimension. Now, an interactive map from TeleGeography allows us to visualize the underwater, high-power Internet cables that span the ocean floor, connecting us all. The map shows different lines of communication in different colors that when clicked, reveals which countries use that cable to communicate. For example, the yellow line that starts in California and spans the Mexican border connects in: Grover Beach, Calif.; Tijuana, Mexico; Mazatlán, Mexico; Fort Amador, Panama; and Unqui, Costa Rica. The average Internet user became aware of these undersea cables last year when a ship's anchor tore through one in the Indian Ocean, hindering the flow of data from Europe to the Middle East. TeleGeography's map will help ships avoid damaging this critical infrastructure, which is extremely expensive to construct, costing between $100 and $500 million per cable. Beyond the cost of repair and replacement, there are bigger risks at stake: When a cable connecting Sicily and Egypt was severed in 2008, huge swaths of the Middle East and Asia lost connectivity, taking computers, electrical grids, and stock markets offline for hours. As discussed in this issue's cover story on the cyber-location nexus, this map is a telling example of why geography is relevant to cyberspace and the global cyber infrastructure.

To learn more about the Submarine Cable Map, visit ***www.telegeography.com****.*

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Delivering information dominance requires both foresight and insight.

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