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2014 ISSUE 1

# trajectory

THE OFFICIAL MAGAZINE

OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

## THE DEFINING DECADE OF GEOINT

GEOINT

TRADECRAFT

COMMUNITY

GEOGRAPHY

INNOVATION

INTEGRATION

IMAGERY

INTELLIGENCE

MAPPING

CARTOGRAPHY

USGIF homeland security defense Intelligence Community  
The GEOINT Symposium ABI integration collaboration  
standards Hurricane Katrina Abbottabad predictive analytics  
commercial imagery UAVs Multi-INT ISR persistence  
9/11 Commission ODNI NGA NRO NSA CIA DIA NPIC  
NIMA variability COMCOMs precision engagement Operation  
Enduring Freedom human geography MASINT GEOCELL LBS  
GPS disaster response humanitarian relief accreditation  
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Big Data cybersecurity crowdsourcing OSINT social media  
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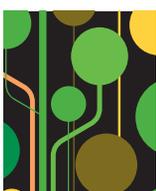
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**Cover image:** Several small satellites, including TechEdSat, are launched from the International Space Station. Photographed by an Expedition 33 crew member Oct. 4, 2012. Image courtesy of NASA.

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### **BONUS CONTENT**

Leaders across the IC share predictions on the future of GEOINT.



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### **PHOTOS**

Check out a slideshow of the soon-to-be demolished NGA Building 213.



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10 YEARS.

Events in Ukraine are unfolding as Managing Editor Kristin Quinn and crew put this issue of *trajectory* to bed, and it's interesting to watch these events play out in real time in the press and on social media. I've been particularly fascinated by the crowd-sourced imagery analysis of military activities in and around Crimea. It's another reminder of just how far we've come in the 10 years since the term GEOINT was coined and USGIF was founded.



Many *trajectory* readers may recall the FY04 National Defense Authorization Act that codified the term "GEOINT," as well as the launch of the Foundation and first GEOINT Symposia in 2004 following the success of an initial gathering held by what would become the Foundation's first member organizations.

USGIF was incorporated as a non-profit educational foundation to support what was then a developing community for a new and somewhat misunderstood term—GEOINT. In the time since, the GEOINT Community has taken on an integral role supporting the safety and security of our nation—and the world.

I'm fortunate to have been associated with USGIF since the very beginning—from helping create the vision for GEOINT at NIMA/NGA, to the alleys of the French Quarter in 2003 and 2004, to sitting on a panel at GEOINT 2006, and finally, becoming a member of the USGIF staff in 2008.

We've witnessed the development and deployment of incredible technologies and capabilities during the past decade, many of which have been on display at GEOINT Symposia and our myriad other events. The explosion of remote sensing and location-based services in the commercial sector has been nothing short of encouraging and inspiring. The GEOINT Community is certain to spark, create, and witness even more remarkable advancements in the next 10 years.

In this issue, we have an article from Matt Alderton that reflects upon the first decade of GEOINT. As an added bonus, we've included thoughts from community leaders on what the next 10 years may have in store. You can also read about a great exemplar of the discipline's advancement in Kristin's cover feature on SmallSats.

However exciting the technological achievements, without the bedrock of the people within the GEOINT Community, it would all be just a bunch of neat gizmos. You—our readers, members, attendees, sponsors, exhibitors, volunteers, academic partners, scholarship winners, certificate holders—make all this possible. Your steadfast support and unyielding commitment to the idea of GEOINT has catapulted the discipline from an unfamiliar term to a full-fledged community.

You've helped us create and expand our events, and you've helped us grow the capacity to support the accreditation of eight university GEOINT certificate programs (with several more in the immediate pipeline). Perhaps most importantly, by the end of this year USGIF will roll out a Certified GEOINT Professional designation to ensure our community has the ability to identify qualified GEOINT practitioners.

Thank you sincerely. With your continued engagement, the Foundation will support the GEOINT Community for the next 10 years and beyond. I look forward to seeing you in Tampa in April, if not before.

**Your steadfast support and unyielding commitment to the idea of GEOINT has catapulted the discipline from an unfamiliar term to a full-fledged community.**

  
**KEITH J. MASBACK** | CEO, USGIF  
 @geointer

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**THE U.S. AIR FORCE ACADEMY** received USGIF accreditation in January 2011. From left to right: USGIF CEO Keith Masback; USAFA Vice Dean Col. Tom Yoder; USGIF Director of Academic Programs Dr. Maxwell Baber.



**SUBMISSIONS**  
Trajectory welcomes your feedback. Send us a letter at [trajectory@usgif.org](mailto:trajectory@usgif.org). Submission constitutes permission to reprint, and letters may be edited for length and clarity.

**TRAJECTORY INSPIRES CADETS**

I want to thank *trajectory* for its continued support of the U.S. Air Force Academy and for sending us hard copies of the quarterly editions of *trajectory* magazine. I provide these to cadets who stop by our department and are interested in GEOINT. These magazines expose our cadets to the diversity and importance of GEOINT in a way that really excites and engages them! Many cadets are simply amazed at the power of GEOINT after browsing through just a few pages of your magazine. Your support is extremely valuable for our ability to attract high-quality cadets into the GEOINT program. Thanks again!

—Lt. Col. Matt Tracy  
Director of Geosciences, U.S. Air Force Academy

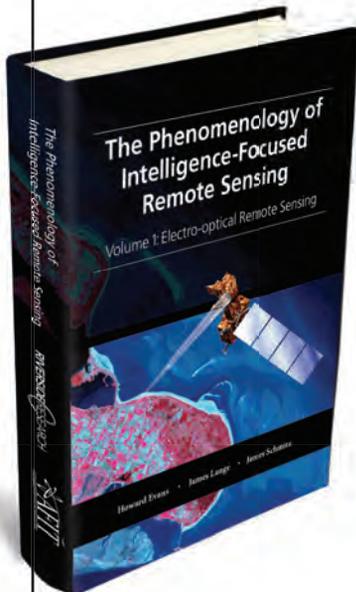
**PHOTO FAUX PAS**

The image on page 26 in the “Augmenting Reality” feature in the Q4 2013 issue is clearly photoshopped. The caption reads, “Thermopylae Sciences and Technology’s Ubiquity mobile framework visualizes

battlefield intelligence using U.S. Military Standard 2525B symbology,” which implies that image to be an actual photograph of the application running on an iPhone. The caption should label the mockup as representative of TST’s software. I think specifying that fact in the caption won’t detract from the great articles you publish. *Trajectory* is a unique and valuable source for this information.

—Joel Lawhead, PMP  
NVision Solutions Inc.

*Editor’s note:* This reader is correct. The image referenced is an artist rendering rather than an actual screenshot of Thermopylae’s Ubiquity software. There are two reasons why some of the images in *trajectory* are artist renderings: often, content in the actual software is sensitive or classified; it is also difficult to obtain a software screenshot at high resolution of at least 300 dpi for proper print quality. This letter is a necessary reminder that *trajectory* should differentiate in its captions whether the image is an artist rendering or capture from the actual software. We will strive to be more accurate in the future.



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# NEWS UPDATES AND HIGHLIGHTS

## BUCKEYE TURNS 10

This year marks the 10th anniversary of the Army Geospatial Center's (AGC) BuckEye program, which collects unclassified, high-resolution, three-dimensional (HR3D) terrain data in support of ground forces. BuckEye's 10-centimeter color imagery and 1-meter, LiDAR-derived terrain data has proven indispensable to soldiers operating within urban and complex terrain. Building off the U.S. Army Corps of Engineers' joint capability technology demonstration efforts in the late '90s, BuckEye was first deployed during Operation Iraqi Freedom to meet the geospatial intelligence needs of U.S. and coalition forces.



IMAGE COURTESY OF USACE

In 2006, the Army recognized the program as a "top 10 invention" of the year, and it also received the USGIF Military Achievement Award. In 2007, warfighters demanded BuckEye coverage over the complex terrain of Afghanistan's Hindu Kush, and in 2009, as International Security Assistance Force Commander, Gen. Stanley McChrystal requested additional BuckEye platforms in support of the surge.

The BuckEye sensor package has flown on helicopters, fixed-wing aircraft, and UAVs in support of theater requirements for SOUTHCOM, AFRICOM, and other CENTCOM priorities.

The lessons learned from the first generation have led to the development of a BuckEye II sensor capability that will be able to collect from higher altitudes (up to 25,000 feet) with higher collection rates (up to 1,000 km<sup>2</sup> per day). The next decade will see the Buckeye program collect HR3D data over enormous swaths of Earth's surface. AGC will host an HR3D session at the GEOINT 2013\* Symposium in April.

**BUCKEYE WAS FIRST DEPLOYED DURING OPERATION IRAQI FREEDOM TO MEET THE GEOSPATIAL INTELLIGENCE NEEDS OF U.S. AND COALITION FORCES.**



PHOTO COURTESY OF DARPA

**DARPA'S TRANSAPPS** effort lets soldiers in the field access tactical apps, such as interactive maps, on secure Android devices.

## MOBILIZING MILITARY MISSIONS

The Defense Advanced Research Projects Agency's (DARPA) Transformative Apps program uses secure applications to deliver high-resolution imagery directly to dismounted troops via handheld Android devices in real-time. The program, known as TransApps, currently has more than 50 apps available, and includes mission-planning tools that can overlay user-defined data directly onto digital maps, allowing soldiers to be up-to-date on any changes in surrounding areas. For example, TransApps can show soldiers if there are any man-made objects, obstacles, or IEDs along their route, along with the locations of previous attacks and planned missions.

"Apps are part of everyday life in the consumer world, but mirroring those capabilities for a tactical user community presents many unique challenges," said Doran Michels, TransApps program manager, during a Dec. 3 media update on the program.

TransApps was deployed to Army personnel in Afghanistan in 2011. During 18 months of field trials, DARPA researchers provided 3,000 hardened Android smartphones and tablets equipped with TransApps to all U.S. Army brigades in Afghanistan.

Army Maj. Tim Terese, who used the program during his most recent deployment, emphasized the importance of data communication and collaboration using TransApps.

"It gives the flexibility a soldier needs," Terese said. "They say a picture is worth a thousand words, and in this case, it truly is."

got geoint? got geoint?

In the U.S., more than **70** companies, **50** universities, and **17** government entities are involved with SmallSats.

## IN MEMORIAM: “THE FATHER OF GIS”

Dr. Roger Tomlinson, often called “the father of GIS,” passed away in February. Tomlinson developed the first geographic information system (GIS) for use by the Canada Land Inventory in the early '60s. This and his continuing contributions led the Canadian government to award Tomlinson its highest civilian recognition, the Order of Canada, in 2001.

Tomlinson began his career as a photo interpreter for Spartan Air Services in Canada. The company had a contract to identify the best location for a tree plantation in Kenya and asked Tomlinson, then a young geographer, to develop a methodology. He tried various manual methods for overlaying environmental, cultural, and economic variables, but all were too costly, so he turned to computers for a solution. Thus, the first GIS was born.

Subsequently, the Canada Land Inventory, which had the responsibility of using data to assist the government in land use planning activities, purchased Tomlinson's GIS. This new system reduced the task from resources totaling three years and eight million Canadian dollars to several weeks and \$2 million.

Tomlinson went on to serve the community in many ways. He chaired the International Geographical Union's GIS Commission for 12 years, where he pioneered the concept of worldwide geographic data availability. He was also a past president of the Canadian Association

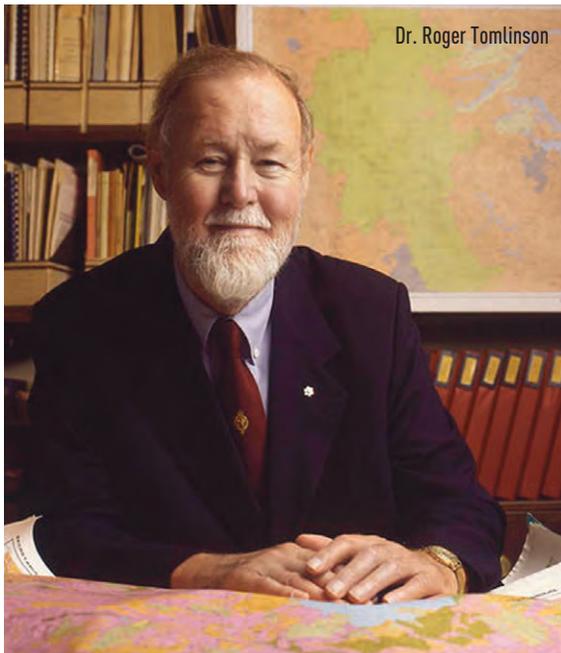
**TOMLINSON TRIED VARIOUS MANUAL METHODS FOR OVERLAYING ENVIRONMENTAL, CULTURAL, AND ECONOMIC VARIABLES, BUT ALL WERE TOO COSTLY, SO HE TURNED TO COMPUTERS FOR A SOLUTION. THUS, THE FIRST GIS WAS BORN.**

of Geographers and a recipient of its distinguished Canadian Award for Service to the Profession.

Tomlinson was also the first recipient of Esri's Lifetime Achievement Award in 1997, and in 2010, National Geographic presented him the Alexander Graham Bell Award for exceptional contributions to geographic research.

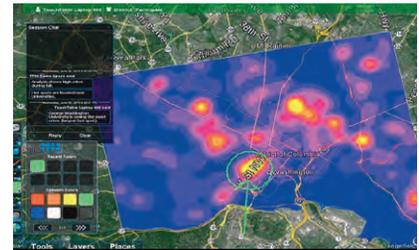
Since 1977, he operated Tomlinson Associates Ltd.,

Consulting Geographer, which advised clients such as the World Bank, United Nations Food and Agriculture Organization, the U.S. Departments of Commerce and Agriculture, U.S. Geological Survey, U.S. Forest Service, U.S. Bureau of the Census, the Canadian Forest Service, and numerous U.S. state and Canadian provincial and municipal government agencies.



Dr. Roger Tomlinson

PHOTO COURTESY OF UCGIS



### TOUCHTABLE REBRANDS

In a move to better reflect its full range of technology solutions, TouchTable recently announced it is rebranding to become TouchShare.

Additionally, the company named Bob Pette as its new CEO and introduced a range of new technologies designed to help with data analysis and collaboration, including TouchShare Mobile Access. TouchShare plans to highlight Mobile Access at its booth at the GEOINT 2013\* Symposium, April 14-17, in Tampa, Fla.

### PROCRASTINATION TOOLS

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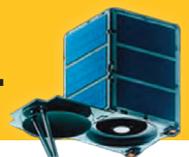
This is a welcome challenge for those who enjoy guessing locations from around the world. Players choose from one of 86 different cities, and the game will show a polygon view of a named neighborhood in that city for players to identify. [www.click-that-hood.com](http://www.click-that-hood.com)

##### MAPFRAPPE

This website allows users to explore countless geographic relationships. Users can draw outlines, compare longitude and latitude points of interest, and overlay a map of one part of the world onto another for comparison. [www.mapfrappe.com](http://www.mapfrappe.com)

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Internationally, more than  universities are in the SmallSat arena.





**ATTENDEES AT USGIF EVENTS** have the opportunity to engage with exhibitors through sessions such as interoperability demonstrations.



**KEVIN MEINERS**, then director of Intelligence Strategies, Assessments, and Technologies with the Office of the Under Secretary of Defense (Intelligence), and now Assistant Director of National Intelligence for Acquisition, Technology, and Facilities, addresses the audience at GEOINT 2004.



**USGIF FOUNDER STU SHEA** presents one of the very first USGIF scholarships. To date, USGIF has awarded \$691,000 in scholarships.

## USGIF CELEBRATES 10<sup>TH</sup> ANNIVERSARY

The Foundation's transformation from concept to community

A decade ago, a small group of professionals collaborated to build a community of interest for the burgeoning GEOINT discipline. They came together with industry, government, and academia to host a small event, which was more successful than they could have imagined. Shortly thereafter, on Jan. 22, 2004, they incorporated the United States Geospatial Intelligence Foundation (USGIF) as a 501(c)(3) educational nonprofit—formalizing their mission to unite all stakeholders to support the growing need for actionable geospatial intelligence.

Ten years later, USGIF has transformed from a budding idea to an integral part of the defense, intelligence, and homeland security communities. USGIF has grown to encompass a world-class symposium, regular networking events, technical workshops, training opportunities, educational initiatives, and much more, all of which build upon the Foundation's three strategic pillars: build the community, advance the tradecraft, and accelerate innovation.

"The GEOINT industry has seen tremendous growth in the last decade," said Stu Shea, USGIF founder and chairman of the board of directors. "University programs are much more prevalent and technology has evolved at a rapid pace. There isn't a day that goes by where GEOINT isn't referenced in the media—we have become more mainstream. GEOINT is a force to be reckoned with. It is now a legitimate intelligence discipline that underpins much of what happens in other intelligence disciplines."

The Foundation has grown from seven founding companies to nearly 240 member organizations. The annual GEOINT Symposium has flourished from a small gathering of senior leaders into the largest intelligence event in the United States.

USGIF plans the Symposium and other events with the help of volunteers from its five committees and nine working groups, which unite community members around specific topics of interest.

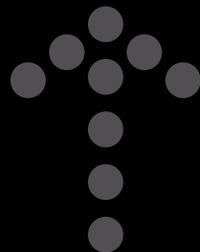
In 2012, the Foundation further rallied the GEOINT Community with the launch of its official magazine, *trajectory*. The magazine positions USGIF as a thought leader on all matters GEOINT, and explores how the discipline is engaged in myriad national security issues.

The Foundation's academic programs include accrediting colleges and universities to grant GEOINT certificates—to date, more than 350 students have earned a GEOINT certificate from one of the eight USGIF-accredited programs. The USGIF scholarship program has grown to award \$100,000 annually to deserving students, and to date, USGIF has awarded nearly \$700,000. Each year, USGIF also recognizes the exceptional work of the GEOINT Community's brightest minds through its USGIF Awards Program.

Over the past year, USGIF has initiated the establishment of an individual professional certification program that will encompass the broad range of geospatial science and technology competencies required of contemporary GEOINT practitioners.

With all the Foundation has accomplished in its first decade, USGIF members, staff, and stakeholders eagerly look forward to what the next 10 years have in store.

"It's been an incredibly exciting and rewarding run for USGIF, growing from a simple idea to a robust organization which has firmly established itself," said Keith Masback, the Foundation's chief executive officer. "What's even more exciting is what the future holds, and how much we're going to be able to accomplish given the capacity we've generated thanks to the enduring support of our members and our talented, dedicated staff."



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## Learning and Growing

The GEOINT Symposium Continues to Thrive in Trying Times

**U**SGIF President Keith Masback took a few moments before the GEOINT 2012 Symposium officially kicked off to discuss what's exciting about this year's symposium, current budget pressures, and his vision for the future.

**Q:** Can you describe this year's theme for the GEOINT Symposium?

**A:** We received a number of suggestions for this year's theme that revolved around austerity and the daunting economic environment. We felt the real focus should be less about what we don't have, and more on what has set America apart for its entire history: innovation. When faced with adversity in the past, Americans have distinguished themselves through creativity and imagination. We want to make sure all of our participants walk away from this week energized with an innovative spirit, and empowered by the knowledge gained and the relationships formed and renewed here in Orlando. [see Learning and Growing, p. 6](#)

## GEOINT FOREWORD

Pre-Symposium Event Focuses on Innovators Expanding Boundaries

**T**he GEOINT Foreword pre-symposium event begins this morning with a day long offering of panels and discussions from a broad range of innovators and practitioners from across the GEOINT Community.

Transformational thinkers, such as IBM fellow Jeff Jones and panels of academic and industry experts, will discuss a range of subjects, including human geography, gaming for GEOINT, lessons from the Arab Spring, and open source software.

"GEOINT Foreword is our exciting pre-conference event," said Dr. Jim Ellsworth, USGIF's chief performance officer and an organizer of this year's event. "It's devoted to professional education and interactions for GEOINT practitioners and innovators, as well as exploring themes and issues shaping the future of our profession. We developed it as a complement to the main GEOINT Symposium, which tends to emphasize executive leadership and policy perspectives." [see GEOINT Foreword, p. 8](#)

Jeff Jones, IBM Fellow

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**JENNIFER VEILLEUX** (right) conducted interviews in Ethiopia for her research on the Grand Ethiopian Renaissance Dam.

## SPOTLIGHT: USGIF SCHOLARSHIP RECIPIENT

From working as an analyst at the National Geospatial-Intelligence Agency (NGA) to winning two USGIF scholarships, Jennifer Veilleux continues to achieve success in her career. Now, as a Ph.D. candidate at Oregon State University, she is furthering her research on water security issues in remote parts of the world.

As a child, Veilleux always enjoyed spending time outdoors and learning about the environment.

“I did a lot of camping and international travel where I had the opportunity to meet scientists working in the field,” Veilleux said. “From then on, I started to think more spatially and started to think about working in environmental studies.”

Veilleux achieved her bachelor’s and master’s degrees in environmental science with a focus in hydrogeology at the University of New Haven. Following graduate school, she worked at NGA for three years as a GEOINT analyst on environmental security issues. Veilleux then took a turn in her career when she made the decision to return to school and pursue a doctorate in geography.

“Both the [NGA and academic research] missions are the same—we’re looking for a way to better manage the world’s resources,”

Veilleux said. “I wanted to do this in an unclassified setting.”

When Veilleux began her doctoral studies, she learned about the USGIF Scholarship Program through her NGA colleagues, who encouraged her to apply. She won USGIF scholarships in 2010 and 2011, applying the funds to jump-start her fieldwork abroad.

“The scholarships were able to take my research to the next level,” Veilleux said.

In 2011, Veilleux took advantage of the complimentary registration she received with her scholarship to attend the GEOINT Symposium, which she said helped her bridge the gap between the classified and unclassified communities.

Veilleux has studied surface and groundwater resources in the U.S., the Bahamas, Hungary, the Republic of Macedonia, Albania, Greece, Ethiopia, and Laos, and recently had one of her research papers published. After Veilleux completes her Ph.D. this year, she plans to tackle a series of contracts specific to water security. Currently, she serves as a water advisor for The Nile Project, a geographically based music exploration program unifying 11 countries surrounding the Nile River.

## DEVELOPING FUTURE TRADECRAFT

As the geospatial profession continues to expand, the demand for entry-level professionals with appropriate skill sets is increasing as well.

In 2010, the Department of Labor published the Geospatial Technology Competency Model (GTCM) to help employers and educators keep pace with changing requirements in the geospatial industry. The GeoTech Center, funded by the National Science Foundation, keeps the GTCM up to date by hosting workshops across the U.S. to determine requirements for entry-level geospatial skill sets.

In late October, the GeoTech Center and Northern Virginia Community College hosted a two-day Developing A Curriculum (DACUM) workshop at USGIF’s Herndon, Va., headquarters. DACUM workshops consist of a panel of geospatial technology professionals whose experiences inform curriculum requirements for contemporary education in geospatial science and technology.

The GeoTech Center has conducted eight DACUM workshops to date. The workshop held at USGIF was in support of national professional development needs, with ancillary benefit to USGIF’s developing Professional GEOINT Certification program.

The panel at USGIF included nine young professionals employed by GEOINT Community companies and organizations, including the Maryland Department of Natural Resources, Dewberry, BAE Systems, and various federal agencies and environmental service firms. Workshop results were compiled into a research chart illustrating the required skills, tasks, and knowledge of tools and software for entry-level geospatial professionals, which have evolved substantially over the past decade.

## DOING (SMALL) BUSINESS WITH DIA

As part of USGIF's Small Business Advisory Working Group luncheon series, USGIF member organizations had the opportunity Dec. 5 to hear from the Defense Intelligence Agency's office of small business programs.

Mike Morales, a DIA small business specialist, discussed 2014 small business opportunities, including the Enhanced Solutions for the Information Technology Enterprise (E-SITE) follow-on contract, which includes a small business track and has a \$6 billion ceiling. DIA expects to release the E-SITE request for proposals in the second quarter of 2014, and more information can be sought by contacting [E-SITE@dodis.mil](mailto:E-SITE@dodis.mil), Morales said.

Chase Fahrner, also a DIA small business specialist, discussed a variety of innovation initiatives at DIA, including Needipedia, a mechanism launched in November to solicit

white papers and promote industry interaction. He added that papers should target innovative methods and processes in addition to technology-focused solutions.

The two also noted DIA has a joint agreement with the National Geospatial-Intelligence Agency (NGA) to expand partnership opportunities in pursuit of innovative concepts. For example, DIA program managers will also review information submitted to the NGA Industry Interaction Program.

The agency has also launched a mentor-protégé program, with partnerships for 2014 recently solidified. The program will allow larger prime contractors or small businesses that have experience contracting with DIA to mentor small businesses new to working with the agency. Fahrner anticipates in the fourth quarter of 2014 DIA will release a request for

proposals to join the program in 2015.

In early 2014, DIA launched an Innovation Gateway, or a virtual agency environment that allows industry to build products on DIA architecture. This will provide for demonstrations in a simulated operational environment and prevent much of the reconstruction currently required to integrate new solutions into DIA systems.

Fahrner encouraged industry to seek out and respond to requests for information.

"[RFIs] tell contracting officers if there is a small business capability out there," he said. "Often, there is a limited response from small business and that justifies full and open competition."

To learn more about USGIF's Small Business Advisory Working Group, contact [smallbusiness@usgif.org](mailto:smallbusiness@usgif.org).

## USGIF'S AFRICA WORKING GROUP HOSTS FIRST EVENT

Illicit trade in wildlife could be a genuine and increasing threat to national and global security, and geospatial technology is playing a large role in assisting African nations and non-governmental organizations in efforts to stop poaching. But more resources are needed and ideas are welcomed.

This was the presentation from the International Fund for Animal Welfare (IFAW) during the first meeting of USGIF's nascent Africa Working Group. The event, called "GEOINT: Beyond the IC," was held Dec. 17 at PIXIA headquarters in Reston, Va.

Beth Allgood, IFAW U.S. campaigns director, and Kelvin Alie, IFAW program director for wildlife trade, presented findings from the IFAW publication, *Criminal Nature: The Global Security Implications of the Illegal Wildlife Trade*. They engaged the audience in a discussion of what current strategies and technologies IFAW uses and how current illicit trade is connected to wars within the continent as well as global networks.

Additionally, Dr. Tom Snitch from the University of Maryland provided a demonstration of a university research UAV deployed in Kruger National Park in South Africa to assist local park rangers in anti-poaching efforts.

"The theme of the event was to look at GEOINT—both in terms of sources and applications of geospatial data outside the DoD and Intelligence Community—as well as to demonstrate how non-traditional GEOINT is making strides in addressing global security challenges in Africa," said Faye Cuevas, co-chair of the Africa Working Group and general counsel at PIXIA.

The Africa Working Group was established to facilitate discussion, promote the use of geospatial solutions, and foster community development to tackle global security issues in Africa.

To learn more about USGIF's Africa Working Group, contact [AfricaWG@usgif.org](mailto:AfricaWG@usgif.org).



USGIF'S AFRICA WORKING GROUP hosts its first event at PIXIA headquarters.



PHOTOS COURTESY OF DEBORAH NEWGAARD/JUSTDEB PHOTOGRAPHY

## VIRTUAL CLASSROOMS EXPAND THE REACH OF GEOSPATIAL STUDIES

Penn State offers a variety of online geospatial courses



**PENN STATE** geospatial science professors Dr. Todd Bacastow (center) and Dr. Anthony Robinson (right) met with international students in Singapore.

PHOTO COURTESY OF PENN STATE UNIVERSITY

**W**ITH A GROWING DEMAND for geospatial professionals and the consistent advancement of technology, online programs are emerging as a popular option for geospatial students. Pennsylvania State University is one of the first and few universities in the country to provide a variety of certificates and graduate degrees in geospatial studies virtually.

“We started offering these online programs because we were responding to the growing need for geospatial professionals,” said Dr. Anthony Robinson, Penn State’s lead faculty for online geospatial education. “These online programs are a way of broadening our audience and creating options for people located beyond our campus.”

Penn State offers four online geospatial programs: a post-baccalaureate certificate in GEOINT applications, a graduate certificate in GEOINT analytics, a post-baccalaureate certificate in GIS, and a master of GIS degree. These programs are offered by the Department of Geography through the university’s John A. Dutton e-Education Institute within its College of Earth and Mineral Sciences.

Both the post-baccalaureate certificate in GEOINT applications and the graduate certificate in GEOINT analytics offer a USGIF Geospatial

Intelligence Certificate upon completion. These programs became USGIF-accredited in 2007, and Penn State is among the eight universities that have achieved USGIF academic accreditation. Penn State was recently joined by George Mason University as the only other USGIF-accredited school to offer an online GEOINT course. The other six USGIF-accredited programs are University of Missouri, University of Texas at Dallas, University of Redlands, University of Utah, U.S. Air Force Academy, and U.S. Military Academy.

The online post-baccalaureate certificate in GEOINT applications consists of 11 academic credits for students with little to no prior knowledge of GEOINT, preparing them for a career as a geospatial intelligence or imagery analyst. The

“This curriculum gives you the latest and greatest options. It really builds the foundation and enhanced my technical skills, and helped conceptually strengthen my knowledge.”

—Vanessa Damato, analyst, DigitalGlobe

**APPROXIMATELY  
48,000  
PEOPLE FROM  
MORE THAN  
150  
COUNTRIES  
ENROLLED IN  
THE FIRST  
MASSIVE ONLINE  
OPEN COURSE.**

online graduate certificate in GEOINT analytics is a 13-credit program for advanced GEOINT professionals looking to expand their knowledge in topics such as national security, disaster response, environmental resource preservation, and business. Dr. Todd Bacastow, professor of practice for geospatial intelligence, leads these programs.

"This year we have seen many more students enrolling in the post-baccalaureate certificate in geospatial intelligence applications, which shows more students around the world are expressing interest in GEOINT," Bacastow said. "Offering these certificates online is a great way for us to deliver GEOINT education to our students."

In total, more than 5,000 students have participated in all four of Penn State's online geospatial science programs, and around 2,500 of those students have already completed the programs.

Vanessa Damato, an analyst with DigitalGlobe, received a graduate certificate in GEOINT analytics in 2009 and a master of GIS in 2012.

"I had a very positive experience in both programs," Damato said. "This curriculum gives you the latest and greatest options. It really builds the foundation and enhanced my technical skills, and helped conceptually strengthen my knowledge."

Nick Wiley, founder and president of VisiTime, adds that completing the online post-baccalaureate certificate in GIS in 2012 increased his geospatial skill set and benefited his business, an augmented reality touring service.

"I'm definitely proud of my experience with the certificate program," Wiley said. "The more you learn about mapping, the more you learn about its applicability and use in the real world."

Penn State has continued to enhance its geospatial science offerings with the launch of its first massive online open course (MOOC), called Maps and the Geospatial Revolution. The five-week MOOC began in July 2013 and taught participants how to make maps and analyze geographic patterns.

"The MOOC was a way of expanding awareness of what we do and getting people to participate without being required to come to campus or pay tuition," Robinson said. "We had all walks of life enroll in the MOOC, such as people with an

interest in geography, retired individuals, and those who lived outside the United States."

Approximately 48,000 people from more than 150 countries enrolled in the MOOC. Because the course had such a high number of participants and received positive feedback, it will be offered again starting April 30, 2014.

"We're using MOOCs to create gateway experiences in this discipline, and targeting a baseline understanding of what we do," Robinson said. "MOOCs offer a huge outreach strategy for us."

Penn State's geospatial sciences faculty expects the number of students participating in the online certificate programs to continue to increase, further contributing to a robust GEOINT workforce. ■ BY LINDSAY TILTON

## RECOGNIZING ACADEMIC EXCELLENCE

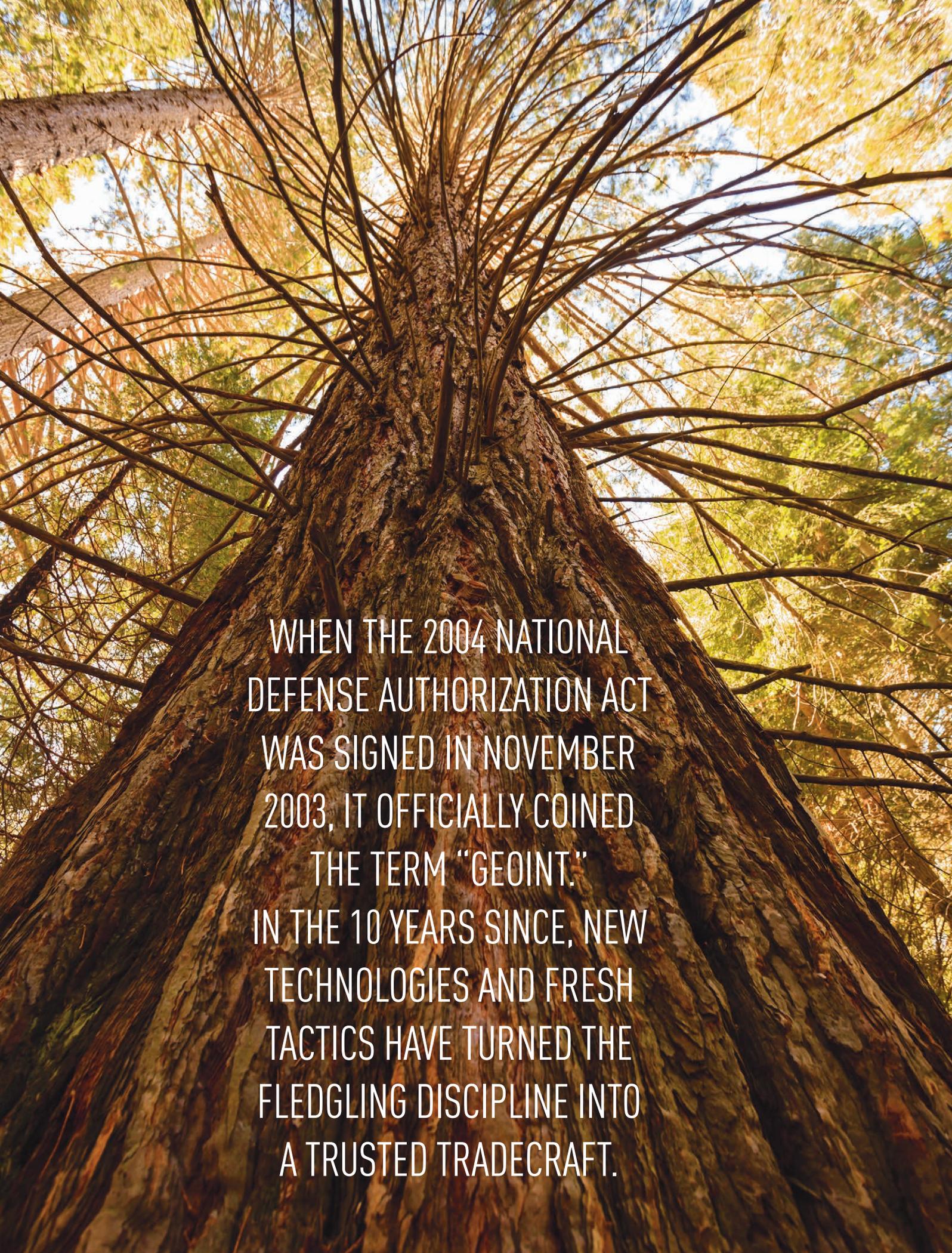


**DONNA BRIDGES** accepts the Lt. Michael P. Murphy Award at GEOINT 2012 presented by Dr. Todd Bacastow and Lt. Gen. Michael Flynn, director of the Defense Intelligence Agency.

Each year, Penn State's geospatial sciences faculty selects a student to receive the Lt. Michael P. Murphy Award. Named in honor of the Navy lieutenant and Penn State alumnus who was posthumously awarded the Medal of Honor, the award recognizes outstanding achievements by a Penn State graduate student who is serving or has served in the U.S. military or with the Intelligence Community. The award is endowed through the contributions of Dr. and Mrs. Todd S. Bacastow, USGIF, the

DigitalGlobe Foundation, and a growing list of other donors to help students continue their GEOINT education.

"Winning the Murphy Award was such an honor," said Donna Bridges, an intelligence analyst with the DoD, recent Penn State master of GIS graduate, and 2012 Murphy Award recipient. "My experience with the entire (Penn State) program has been nothing but outstanding. I have benefited quite a bit from it, and it led to a lot of different opportunities for me that I wouldn't have imagined."



WHEN THE 2004 NATIONAL  
DEFENSE AUTHORIZATION ACT  
WAS SIGNED IN NOVEMBER  
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THE TERM "GEOINT."  
IN THE 10 YEARS SINCE, NEW  
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# THE DEFINING DECADE *of* GEONIT

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BY MATT ALDERTON

The world's tallest living tree is 379.3 feet tall, 74 feet taller than the Statue of Liberty. The location of this impressive, 700-year-old redwood—named after the Titan god of light, Hyperion—is top-secret. Were you to locate and stand beside Hyperion, however, you'd almost certainly feel dwarfed by its towering trunk. In that moment, neck craned skyward, it would be easy to forget that even the tallest timbers were once saplings.

When the National Geospatial-Intelligence Agency (NGA) was established on Nov. 24, 2003, geospatial intelligence (GEOINT) was very much a sapling. Its seeds had been sown decades prior, but the conditions were finally ripe for the discipline to grow and sprout new branches capable of supporting a maturing community practicing a proven tradecraft. A decade later, GEOINT is in full bloom.

“In the early days, people met the term GEOINT with suspicion because they’d never heard it before,” said retired NGA analyst Paul Weise, now GEOINT mission director at Lockheed Martin. “Other intelligence disciplines really didn’t take it seriously. But ... the events that have unfolded in the last 10 years have given huge credibility to the discipline.”

Indeed, it took Hyperion centuries to outgrow other trees, but GEOINT only a decade to match the stature of other intelligence disciplines. The story of how GEOINT flourished begins in the war zone, but reaches far beyond it.

### THE GENESIS OF GEOINT

The story of GEOINT is a tale of two trades. The first—cartography—originated with prehistoric cave drawings of hills and valleys. In Ancient Babylo-

nia, maps carved on clay tablets depicted landmarks and property lines for use in urban planning and land titling. Not long after, the Ancient Greeks began mapping the earth, a tradition continued centuries later by European cartographers who sailed the world alongside Renaissance-era explorers. In the United States, mapping was critical to the colonists’ victory during the Revolutionary War, to the success of the Union Army during the Civil War, and to the westward expansion initiated by Lewis and Clark. As vantage points gained elevation—thanks to horseback, balloons, and, eventually, airplanes—maps progressively improved.

GEOINT’s second progenitor is imagery. In 1858, just 32 years after the first permanent photograph was taken, French photographer Gaspard-Félix Tournachon took the world’s first aerial photograph from a balloon over Paris. From there, cameras were mounted to kites, then pigeons, then airplanes—a practice that evolved rapidly during World War I and reached critical mass during World War II.

Mapping and imagery became even more important during the Cold War, which spawned the CIA’s National Photographic Interpretation Center (NPIC) in

1961 and the DoD’s Defense Mapping Agency (DMA) in 1972. When the Cold War ended in 1989, and the Gulf War began in 1990, it was the convergence of these agencies—or rather, the collision—that would ultimately spawn GEOINT.

“The Intelligence Community at that time realized we had to do something different along the lines of mapping and imagery intelligence,” said Orrin Mills, associate deputy director of the National Reconnaissance Office’s (NRO) Imagery Intelligence Systems Acquisition Directorate.

During the Cold War, targets were mostly fixed. During the Gulf War, however, targets often were mobile and sometimes hidden. Hitting targets required precision-guided weapons that demanded better imagery and current maps, both of which U.S. military commanders lacked.

“We would collect imagery for a six-month period before we even thought about putting it into the mapping process,” recalled Jeffrey Harris, president and CEO of JKH Consulting, who during that time worked at the DoD’s Central Imagery Office (CIO), created after the Gulf War to steward mapping and imagery intelligence. “In this context we asked ourselves, ‘Can the DMA be aligned with the NPIC?’”

The answer was a resounding “yes,” according to William Perry and John Deutch, longtime advocates of precision engagement that became Secretary of Defense and Deputy Secretary of Defense, respectively, in 1994.

In 1995, Deutch became the new director of the CIA, and during his confirmation hearing named as his top priority the creation of what became the National Imagery and Mapping Agency (NIMA).

Lessons learned during Desert Storm had convinced Deutch and Perry that imagery and mapping would work better together than they had apart. The Joint Chiefs of Staff shared this enthusiasm for precision engagement, and in July 1996, led by then Vice Chairman of the Joint Chiefs of Staff Adm. Bill Owens, published Joint Vision 2010 as a strategic roadmap to help the U.S. military get there. Shortly thereafter, the National Defense Authorization Act for fiscal year 1997 established NIMA.

“Consolidating the nation’s imagery and geospatial assets into a single entity



IMAGE COURTESY OF NGA

**CUBAN MISSILE CRISIS** This NPIC image from Oct. 26, 1962, shows Soviet technicians assembling Ilyushin-28 bombers, which had been shipped in parts to Cuba.

# “Developing and organizing a critical mass of geospatial and imagery professionals so they worked effectively under the same agency umbrella was a major achievement that took years and years to accomplish.”

— Letitia Long, Director, National Geospatial-Intelligence Agency

kick-started the creation of the GEOINT Community,” said NGA Director Letitia Long, a former naval engineer who at that time had just joined the Defense Intelligence Agency (DIA) as deputy director for information systems and services.

“Developing and organizing a critical mass of geospatial and imagery professionals so they worked effectively under the same agency umbrella was a major achievement that took years and years to accomplish.”

Although it didn’t yet have a name, GEOINT had been born.

## TWO DISCIPLINES, ONE FUTURE

When NIMA was established on Oct. 1, 1996, it combined DMA and NPIC, DoD’s Central Imagery Office and Defense Dissemination Program Office, and parts of several other federal agencies. It seemed a logical fusion. Logical, however, didn’t mean easy.

“Having the mapping and imagery intelligence people working together was kind of a cultural revolution,” said Don Vance, director of geospatial intelligence programs within Boeing’s Intelligence Systems Group. “There were some rough spots on that road.”

Resentment and turf wars between mapping and imagery experts fueled opponents of the integration, who rallied around the idea of a “NIMA Commission” to review the new agency and, by exposing its dysfunctions, disband it. At the request of Congress, the commission formed in late 1999. The findings it published that December confirmed reports of infighting, but also doubled down on NIMA’s vision.

“The Commission concludes that ... the promise of converging mapping with imagery exploitation into a unified

geospatial information service is yet to be realized, and NIMA continues to experience ‘legacy’ problems,” read the report. “Notwithstanding, the Commission believes that timely development of a robust geospatial information system is critical to achieving national security objectives in the 21st century.”

NIMA didn’t need to be disbanded, the Commission concluded. It needed to be rebooted.

“The NIMA Commission report ... made a very articulate, eloquent case for what came to be called GEOINT, and I was asked to try to bring that to life,” said then Lt. Gen. James Clapper, who became NIMA’s third director on Sept. 13, 2001. “I started two days after 9/11, and it was soon clear that there was actually great functional merit to the notion of marrying up those previously disparate skill sets.”

The NIMA Commission’s recommendations included not only repairing the cultural rift, but also pushing past the individual activities of predecessor organizations, such as map production and imagery analysis, into a more truly integrated approach.

Under Clapper’s direction, NIMA’s senior leadership decided a name change would help it achieve those objectives. With that realization, “precision intelligence” became “geospatial intelligence” and the “National Imagery and Mapping Association” became the “National Geospatial-Intelligence Agency (NGA).”

Said Clapper, who now serves as Director of National Intelligence (DNI), “I sort of posed a question rhetorically: ‘Don’t you think we’ve been singing ‘Amazing Grace’ at the wake of DMA

and NPIC long enough? If we have, and if people see the merit—which was battle-tested in the immediate aftermath of 9/11—then we ought to embrace the concept of geospatial intelligence.”

The name change became official in 2003, when Congress passed the National Defense Authorization Act for fiscal year 2004, coining the term “geospatial intelligence” as “the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth.”

“NIMA’s rebranding as the National Geospatial-Intelligence Agency and creating the concept of GEOINT helped instantiate two essential missing elements: unity of effort and unity of effect,” Long explained. “Although we had brought people together physically, Director Clapper unified our efforts toward a single goal—GEOINT and the positive effects that the integration of geospatial data and imagery could have on warfighting and policymaking.”

Indeed, because the nomenclature included neither the words “mapping” nor “imagery,” it galvanized both disciplines into forming a successful union.

“We were all very proud of our history,” said former NIMA imagery analyst Robert Cardillo, now ODNI’s deputy director for intelligence integration. “If you were an imagery guy, you kind of resented and competed unhealthily with the other camp. By renaming us, we had something to join up with ... and that really was needed because the labels were so powerful.”

Surprisingly, one of the most important elements of the new name was the hyphen in “geospatial-intelligence,” making NGA

a three-letter agency. As NIMA, many felt the four-letter agency was relegated to a supporting role. As NGA, however, it was poised to play a lead.

### THE FOG OF WAR

Lifting the “fog of war” was the impetus for creating NIMA, and subsequently NGA. However, in the wake of 9/11, Operations Enduring Freedom and Iraqi Freedom became critical proving grounds for GEOINT.

Because of the challenging operating environment, these wars demanded GEOINT support in ways previous U.S. conflicts had not.

“We were more focused in urban and complex terrain, which drove us to demand higher-fidelity information,” explained retired Army Chief Warrant Officer Michael Harper, now chief of the Army Geospatial Center’s Tactical Source Directorate. “Because of the tribal nature [of Iraq and Afghanistan], human geography and human terrain also became important. That drove the development of software and systems that could catalog information and rapidly exploit it for commanders.”

Case in point: the GEOCELL. Created in 2004 by the National Security Agency (NSA), the program co-located NSA and NGA analysts at NSA head-

quarters for the purpose of finding and tracking enemy targets.

“The GEOCELL was the initial entrée into fusing GEOINT and SIGINT together as complementary forms of multi-INT,” explained Weise. “The work [GEOCELL] did in prosecuting the Iraq War was unimaginable. The effect they had on intelligence production ... made an immediate impact.”

The effects were such that NGA analysts were subsequently embedded with warfighters in theater and with other analysts at multi-INT fusion hubs such as the National Counterterrorism Center and the National Counterproliferation Center, established in 2003 and 2005, respectively.

“Military commanders would not go to war without [NGA analysts] after the 9/11 timeframe,” said NGA Director of Strategic Operations John Sherman. “[GEOINT] became literally indispensable.”

The advent of unmanned aerial vehicles and persistent full-motion video made NGA analysts even more valuable.

“When the Global Hawk and Predator were deployed to Iraq and Afghanistan, it was a big turning point for the military in terms of making imagery available on demand,” said David Messinger, Ph.D., director of the

Digital Imaging and Remote Sensing Laboratory at the Rochester Institute of Technology’s Chester F. Carlson Center for Imaging Science.

“During the Cold War it was sufficient to do reconnaissance,” added senior NGA official Thomas McCormick, Ph.D., deputy director of the NRO Mission Support Directorate. “In this global war on terror, that’s largely insufficient. We have to do more of a surveillance mission ... because we’re not able to answer the intelligence mail with just a periodic look at a particular target.”

In fact, NGA analysis of surveillance video led to one of the decade’s most significant milestones: the May 2011 takedown of Osama bin Laden.

“I see what happened in Abbottabad as a culminating moment,” Sherman said. “The things that went into that were honed over a number of years in a number of places ... [by] calibrating things that had been great ideas before, but were actually put into practice in places like Iraq and Afghanistan.”

After a decade at war, GEOINT no longer had to fight for a seat at the proverbial table. It had unquestionably earned one.

### A TREMENDOUS REVOLUTION

Although GEOINT originated with the formation of NGA, and subsequently matured at war in Iraq and Afghanistan, the discipline was also influenced by significant advances in commercial technologies such as more sophisticated versions of Esri and Intergraph’s GIS software, GPS, location-based services, and of course, commercial imagery.

“There were several big milestones in the civilian community that pushed [GEOINT] forward,” Messinger said.

When President George H.W. Bush signed the Land Remote Sensing Policy Act of 1992, private companies were allowed to enter the satellite imagery business for the first time. Two of those companies, Space Imaging and DigitalGlobe, launched their principal commercial satellites—IKONOS and QuickBird—in 1999 and 2001, respectively. DigitalGlobe now owns both.

“Companies like DigitalGlobe ... for the first time produced satellite-based imagery of every spot on the world that everybody could see—not just govern-

**A DIGITALGLOBE**  
satellite collected this view  
of the Osama bin Laden  
compound in Abbottabad  
Jan. 15, 2011—less than  
four months before the  
historic raid.



IMAGE COURTESY OF DIGITALGLOBE

ment people,” Messinger said. “That was a game changer.”

In 2000, around the same time IKONOS and QuickBird launched, President Bill Clinton ordered the U.S. military to turn off “selective availability,” which until that point had intentionally degraded the GPS signal available for commercial use. The combination of commercially available satellite imagery and high-fidelity GPS signals created a critical mass for location-based services, including navigation systems.

In 2001, NIMA’s InnoVision directorate collaborated with In-Q-Tel, the CIA’s private nonprofit venture, to fund a start-up called Keyhole, a software development company whose signature application, Earth Viewer, superimposed maps onto satellite images. NIMA immediately employed Keyhole technology to support U.S. troops in Iraq. In 2004, Google acquired Keyhole, and in 2005 re-launched Earth Viewer as Google Earth, which has since been downloaded more than a billion times.

“Google buying Keyhole revolutionized the whole concept of online mapping and made geospatial data ubiquitous in the world,” Vance said.

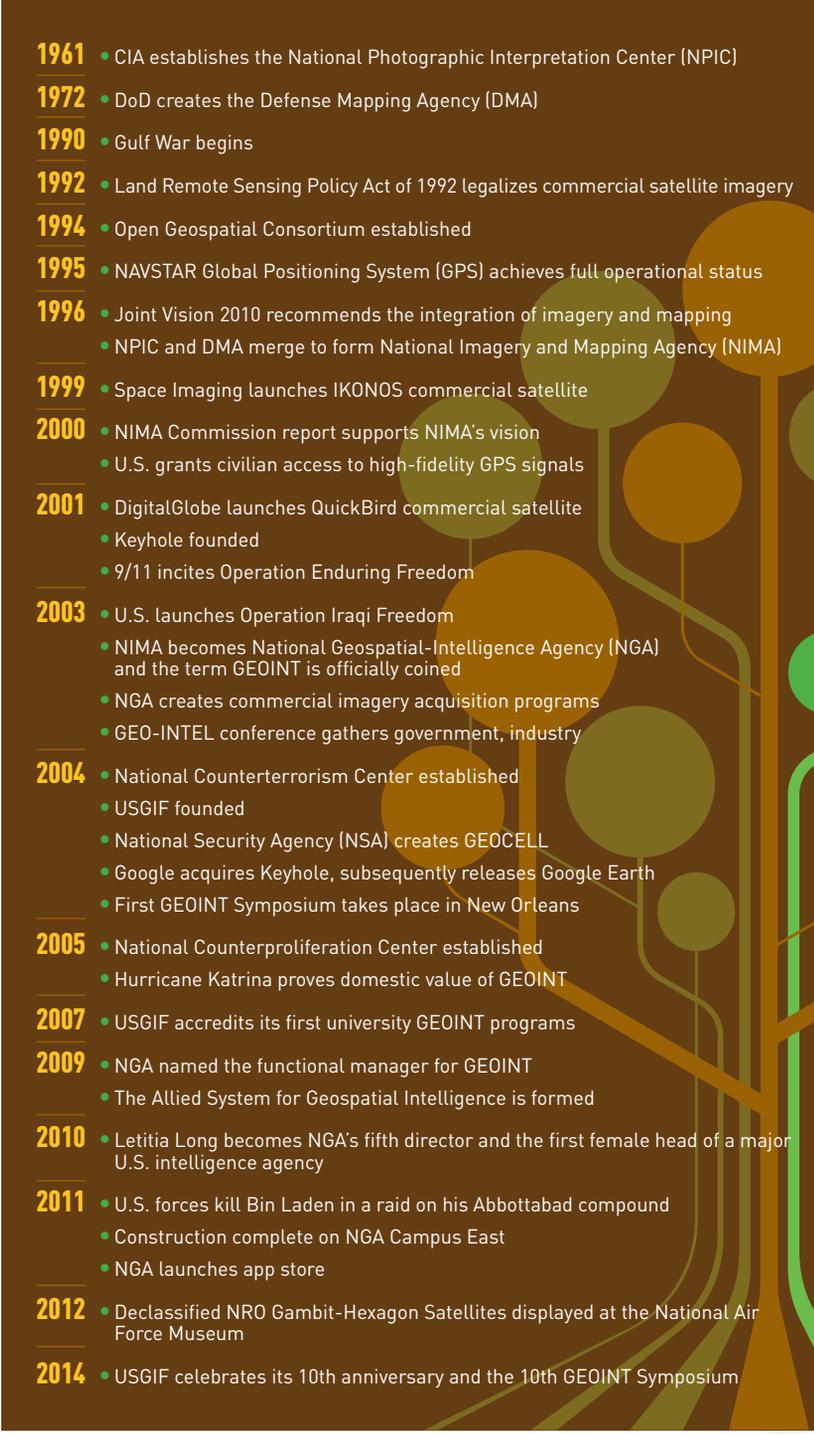
The Open Geospatial Consortium—established in 1994 to develop open standards for geospatial content and services—further enabled such ubiquity.

“The creation of open standards that allow systems to communicate and interoperate is one of the enabling developments that allowed commercial GEOINT and online mapping to prosper,” Vance continued.

That prosperity has helped GEOINT advance at breakneck speeds during its bedrock decade, further intensified by the rapid adoption of geospatially-enabled consumer products. The commercial revolution spread to NGA in 2003 with the creation of the ClearView and NextView commercial imagery acquisition programs. Key to expansion was the availability of unclassified, high-resolution imagery that could be shared for the first time across federal agencies.

“Civilian technology has caused an explosion in both GEOINT sources and GEOINT exploiters,” Long said. “In the past, only DoD and the IC had access to high-resolution imagery and other sources due to their classified nature. Now, anyone

## THE GROWTH OF GEOINT

- 
- 1961** • CIA establishes the National Photographic Interpretation Center (NPIC)
  - 1972** • DoD creates the Defense Mapping Agency (DMA)
  - 1990** • Gulf War begins
  - 1992** • Land Remote Sensing Policy Act of 1992 legalizes commercial satellite imagery
  - 1994** • Open Geospatial Consortium established
  - 1995** • NAVSTAR Global Positioning System (GPS) achieves full operational status
  - 1996** • Joint Vision 2010 recommends the integration of imagery and mapping  
• NPIC and DMA merge to form National Imagery and Mapping Agency (NIMA)
  - 1999** • Space Imaging launches IKONOS commercial satellite
  - 2000** • NIMA Commission report supports NIMA’s vision  
• U.S. grants civilian access to high-fidelity GPS signals
  - 2001** • DigitalGlobe launches QuickBird commercial satellite  
• Keyhole founded  
• 9/11 incites Operation Enduring Freedom
  - 2003** • U.S. launches Operation Iraqi Freedom  
• NIMA becomes National Geospatial-Intelligence Agency (NGA) and the term GEOINT is officially coined  
• NGA creates commercial imagery acquisition programs  
• GEO-INTEL conference gathers government, industry
  - 2004** • National Counterterrorism Center established  
• USGIF founded  
• National Security Agency (NSA) creates GEOCELL  
• Google acquires Keyhole, subsequently releases Google Earth  
• First GEOINT Symposium takes place in New Orleans
  - 2005** • National Counterproliferation Center established  
• Hurricane Katrina proves domestic value of GEOINT
  - 2007** • USGIF accredits its first university GEOINT programs
  - 2009** • NGA named the functional manager for GEOINT  
• The Allied System for Geospatial Intelligence is formed
  - 2010** • Letitia Long becomes NGA’s fifth director and the first female head of a major U.S. intelligence agency
  - 2011** • U.S. forces kill Bin Laden in a raid on his Abbottabad compound  
• Construction complete on NGA Campus East  
• NGA launches app store
  - 2012** • Declassified NRO Gambit-Hexagon Satellites displayed at the National Air Force Museum
  - 2014** • USGIF celebrates its 10th anniversary and the 10th GEOINT Symposium

can purchase high-quality imagery and download limitless GPS-tagged photos and videos for free from the Internet. Anyone can now be a producer, a consumer, and an exploiter—all at the same time.”

The result is a democratization of remote sensing, precision location data, and geospatial information that will have

major implications for future iterations of GEOINT.

### A DEFINING MOMENT

When Hurricane Katrina devastated New Orleans in 2005, the proliferation of commercial imagery in support of rescue, recovery, and relief efforts resulted

in immediate recognition of GEOINT's broader utility.

"The history of NGA shows that few approaches to intelligence offer the kind of universal and informed context that GEOINT can provide," Long said. "For example, in the often criticized federal response to the Hurricane Katrina disaster in 2005, NGA and GEOINT received singular praise in the final assessment for critical on-site support and a common operating picture necessary for sustenance and recovery."

In the wake of the storm, GEOINT yielded a visualization of the disaster that first responders used to assess damage and save lives. As a result, NGA was now focused on the homeland as much as the war zone.

"NGA has repeated these important disaster recovery efforts many times in the years since the New Orleans tragedy," Long said. "The natural disasters affecting Haiti and Fukushima in Japan offer just a couple of examples of the leading role GEOINT and NGA play in humanitarian response to physical and social disruption as well as nuclear contamination."

Other milestones were the Deep-water Horizon oil spill in 2010, during

which GEOINT helped the U.S. Coast Guard place oil booms; Superstorm Sandy in 2012, when GEOINT was leveraged to conduct predictive risk analyses; and the Philippines typhoon in 2013, when NGA maps assisted in the delivery of relief supplies to the most devastated areas. Even the Super Bowl has leveraged GEOINT.

### FROM 'INT' TO 'INDUSTRY'

NGA's achievements at home and abroad constitute the sturdy skeleton around which GEOINT has built its muscle. The discipline's heart, however, is the larger community that has coalesced around it.

"NGA is a foundational member of the GEOINT Community, but for it to succeed ... there has to be a continued focus on driving and developing the tradecraft to support it," said Chris Bellios, vice president of operations for BAE Systems' Global Analysis & Operations group.

Because he understood this concept, Stu Shea—president and COO at Leidos—led the establishment of the United States Geospatial Intelligence Foundation (USGIF) in January 2004. An educational nonprofit that's

dedicated to advancing the industry's tradecraft, USGIF's history is an important thread in the GEOINT Community's fabric.

"USGIF ... has blossomed and matured into something quite effective," Clapper said. "It has done a lot to instantiate and royalize the discipline of GEOINT ... particularly as a tremendous forum for connecting government and industry, which in the rest of the Intelligence Community is a challenge."

The concept of USGIF was born during an industry-led gathering of GEOINT stakeholders in October 2003. Called GEO-INTEL, this initial event was planned by a group that would become the founding members and leadership of USGIF. GEO-INTEL became the precursor to USGIF's signature event, the GEOINT Symposium. However, the industry and government partners who came together in 2003 also knew an annual gathering would not be sufficient to build the community. So, shortly after GEO-INTEL, USGIF was incorporated, and the first official GEOINT Symposium took place in New Orleans in November 2004. In January 2014, USGIF celebrated its 10th

**HURRICANE KATRINA** damage estimates created by NGA gained widespread awareness for GEOINT among the general public for the first time.



IMAGE COURTESY OF NGA



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IMAGE COURTESY OF NGA



**NGA PROVIDED** before and after damage assessments following the 2013 Super Typhoon Haiyan in the Philippines.

anniversary, and April 2014 will mark the 10th GEOINT Symposium.

“There were men and women who risked their lives every day to protect our families, our communities, our nation, our values, and our way of life—and the underlying foundation for all of that security was geospatial intelligence,” Shea said. “GEOINT was where our national security began, and we realized whether we’re fighting the global war on terror, supporting coalition forces in theater, or reacting to worldwide natural disasters, there was always this growing need for actionable geospatial intelligence. That’s the reason we created USGIF, and that’s why we began to bring people together each year at the GEOINT Symposium.”

During this defining decade, USGIF reached throughout federal, state, and local government, as well as to industry and academia, to help the discipline flourish. The Foundation created on top of its three pillars—build the community, advance the tradecraft, and accelerate innovation—a true community. No other intelligence discipline has a dedicated foundation or association—perhaps because GEOINT has the distinction of being ubiquitous in everyday life.

“The unique thing about GEOINT is it exists as a vertical, taking its place alongside the longer-standing traditional

intelligence disciplines, but it also has this horizontal dimension in which it provides the underpinning for operations and intelligence integration,” said USGIF CEO Keith Masback. “Simply put, it brings ‘the where’ to the equation. There has also been a geospatial revolution in the last decade, where it’s exploded on the commercial side.”

### GEOINT: 10 YEARS LATER

In the decade since USGIF’s formation, it’s quite possible more geospatial-intelligence type activity happened in those 10 years than in all preceding decades. The culmination of many conquered obstacles and hard-won achievements is a 10-year-old tradecraft that’s more efficient, effective, and engaged than its forebears could have ever predicted.

And also more global, according to Long, who cited the formation of the Allied System for Geospatial Intelligence (ASG) in 2009 as one of the most significant events in GEOINT’s history.

“Our relationship with the ASG, consisting of the U.S. and our four closest allies, continues to grow in importance as all of us face constrained budgets, increasing demands, and growing threats,” Long said. “Since the purpose of GEOINT is to locate anything and anyone on the globe, collecting and analyzing GEOINT

sources and producing timely, accurate, relevant, and actionable intelligence requires strong international partnerships. We are proving the value of our international partnerships in crises around the globe every day.”

As NGA’s fifth director, Long assumed leadership of the agency in 2010—a year after NGA was named the official functional manager of GEOINT. Her seminal speech at the GEOINT 2010 Symposium introduced a new strategy for NGA centered on two primary goals: creating online, on-demand access to GEOINT knowledge; and enhancing NGA’s analytic expertise. This vision was made official in 2012 when NGA issued “NGA Strategy 2013-2017.”

“Director Long’s vision of ‘putting the power of GEOINT in your hands’ is an acknowledgment that it’s now the users who are driving this community because they can leverage both government and commercial industry,” said former NGA CIO Keith Littlefield, Ph.D., now chief technology officer at TASC.

Although it carries a new set of challenges, Long’s vision presents an exciting turning point for GEOINT at the dawn of its second decade. More agencies throughout the Intelligence Community are beginning to expect GEOINT rather than ask for it as an add-on capability. Large, exquisite satellites continue to be built and launched, while SmallSats are being sent into orbit by innovators at nontraditional, start-up companies. Smartphones and the Wi-Fi-connected everyday devices that are becoming “the Internet of things” have made location so commonplace, we can be sure to see more groundbreaking applications for the power of GEOINT in the years ahead.

“The advances of the last decade are quite remarkable and that’s what makes looking forward to the next decade incredibly exciting,” Masback said. “It remains critically important that we focus on the training and the tradecraft of the people, because even as the technologies change, it’s people who have to operate with and within the technologies and the networks. USGIF will remain laser-focused on the people, because they’re at the center of making it all work. The most powerful, agile processor on the net is still the human brain.” ■

# trajectory

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# FUTURE VIEW PERSPECTIVES ON THE



GEOINT has to be persistent and exquisite. It's got to be advancing the art and exposing new opportunities for understanding nuances ... [GEOINT has] always been good at context, we've always been good at content, and we're getting better at continuity, but we've got to get a lot better on consequence.” — Robert Cardillo, Deputy Director for Intelligence Integration, ODNI



I'd put it in one word: ubiquity. The demand, the drive, the ability for geospatial information to really be the basis for everything that almost everyone does is what the future's going to be. Location-based services, whether it's for industry, or for the general public, or for the military and Intelligence Community, will be the norm and the expectation.”

— John Goolgasian, Director, Foundation GEOINT Group, Source and Operations Management Directorate, NGA



I don't think we've scratched the surface at all, if you think about trying to under a range of technologies that are fundamentally surrounded by GEOINT and the powerful capability for those of us who share this blue planet.” — The Honorable Jeffrey



Promises and challenges born of frequent and rapid geopolitical change, such as the Arab



Spring, turmoil across Africa, and rebalancing toward the Pacific, create significant opportunities for NGA and GEOINT. NGA will pursue these opportunities as they emerge and will continue its constant process of transformation to realize our vision of putting GEOINT in the hands of the user.”

— Letitia A. Long, Director, NGA



Sensors will out sensors. More and more things—the Internet of Things—are going to be geospatially self-aware. And when things are unable to report their own whereabouts (e.g., an old version or a dead battery) ... never fear—other, smarter things that are geospatially aware will notice them and send their coordinates.”

— Jeff Jonas, IBM Fellow and Chief Scientist, Context Computing, IBM



More real-time access. GEOINT on ... the mobile device of our choosing. Not just for navigational purposes, but for intelligence purposes and operational purposes as well ... You're going to see more demand to fuse things like Twitter and social media into GEOINT. It's done now, but with a great deal of force fitting. It will be fused more on the fly in real time.”



— Paul Weise, GEOINT Mission Director, Lockheed Martin



A significant factor shaping the future of GEOINT is the arrival of relatively inexpensive [remote sensing] solutions by companies such as SkyBox Imaging and PlanetLabs, which offer constellations of smaller birds and nearly ubiquitous coverage; and UrtheCast, which offers high-definition sensors on the International Space Station. These will rapidly become indispensable additions to the human security toolbox, because these fresh eyes will be useful for tipping and queuing in cases of civilian displacement due to conflict or natural disasters.



— Jonathan Hutson, Architect, Satellite Sentinel Project



“Tomorrow has started in a big way. This is a focus that [NGA Director Long] has put on conveying GEOINT to the user so that users can tap into GEOINT databases directly. She’s done a lot to lead the effort to make that available at the edge, if you will, to the customer, the user, and the decision maker. I see that as the wave of the future for GEOINT.” — The Honorable James Clapper, Director of National Intelligence



As technology evolves, GEOINT will become an even more relevant source of intelligence, both on its own and particularly in combination with other intelligence disciplines. At DIA, we will continue to work with NGA to better integrate GEOINT tasking, collection, and exploitation capabilities to make the most effective and efficient use of national, foreign, commercial, and tactical resources. At the same time, we will work with the DNI and USDI to improve the integrated application of all relevant collection disciplines and exploitation and analytic capabilities to fulfill our defense all-source intelligence mission.”

— Lt. Gen. Michael Flynn, Director, DIA

stand the planet’s environment and people’s impact on the planet ... It’s a future that I find unsettling, but there are sensing phenomenologies that we do with GEOINT *in situ*—sensors combined with remote sensing—that I think is a very

Harris, President and CEO, JKH Consulting; former Director, NRO



In light of recent reports concerning the NSA’s collection efforts, I predict the collection, use, storage, and transfer of geospatial information will be subject to greater regulation and oversight in the U.S. and abroad, particularly as new technologies (UAVs, the cloud, crowd-sourcing, etc.) become more widespread. As a result, organizations within the GEOINT Community will need to develop operating policies and procedures that take into account the concerns and equities of non-traditional stakeholders.”

— Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy



People don’t realize how broad the GEOINT field is becoming. Whether it’s technology that’s creeping into precision agriculture, or urban planning, or disaster response, there’s a wide range of applications now that have nothing to do with defense and intelligence, and we’re only seeing that more and more.”



— David Messinger, Ph.D., Director, Digital Imaging and Remote Sensing Laboratory, Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology



The inexorable link between geospatial and cyber will grow stronger as human beings and their machines will increasingly be on the grid and interconnected. Activity-Based Intelligence will continue to evolve toward its true potential, far beyond our current neophyte efforts. Leadership and resourcing will determine how rapid the progress. But this brave new geospatial world will not be dominated by automation, as human geography will also come into its own.”



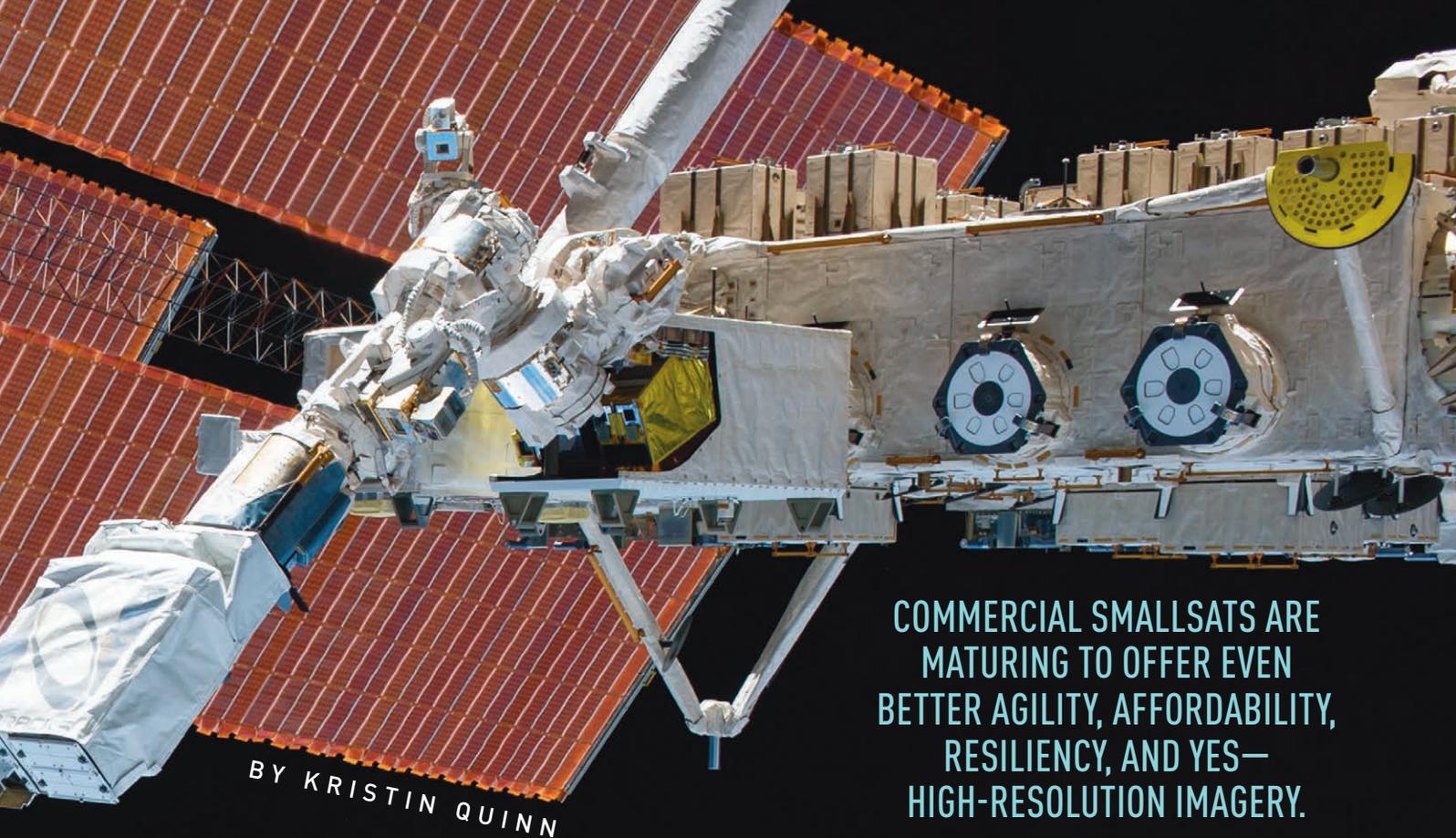
— Collin A. Agee, Senior Advisor for IC Engagement, U.S. Army G-2



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COMMERCIAL SMALLSATS ARE MATURING TO OFFER EVEN BETTER AGILITY, AFFORDABILITY, RESILIENCY, AND YES—HIGH-RESOLUTION IMAGERY.

## A TREMENDOUS PARADIGM SHIFT

is occurring in the satellite industry that harkens back more than three decades to when the personal computer disrupted main-frame computing.

SmallSats, and their most popular sub-classification, CubeSats, hold tremendous utility and potential, not only in the commercial realm, but for the federal government as well.

“The talk you hear from traditional satellite companies is almost word-for-word what you would hear from traditional computer companies back in the early ’80s,” said Peter Platzer, co-founder and CEO of CubeSat provider Nanosatsifi. “People said, ‘You can’t do anything useful with a PC—it’s not powerful enough!’”

Following the successful November launch of SkyBox Imaging’s SkySat-1—a 100-kilogram SmallSat—and the company’s

subsequent production of sub-meter imagery and high-definition video, skeptics are taking notice. Not only has this milestone proven that a small, lightweight, and inexpensive satellite can pack power, it also demonstrates that imagery may just be the killer application for SmallSats.

With SkyBox planning a total constellation of 24 satellites and other start-ups such as Planet Labs—with its flock of 28 “Dove” CubeSats launching from the International Space Station in Q1 2014—the SmallSat boom is just beginning.

The defense and intelligence communities are jumping on the bandwagon as well, with the National Reconnaissance Office (NRO), NASA’s Jet Propulsion Lab (JPL), the U.S. Army’s Space and Missile Defense Command (SMDC), and the U.S. Air Force’s Operationally Responsive Space Office (ORS), among others, deploying CubeSats for research and development.

The Small Satellite Orbital Deployer (SSOD), in the grasp of the Kibo laboratory robotic arm, is photographed by an Expedition 38 crew member on the International Space Station as it deploys a set of Planet Labs “Dove” CubeSats. Image courtesy of NASA.

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a bonus exclusive  
on the challenges  
and opportunities  
associated  
with launching  
SmallSats.

These initiatives are intended to complement, not replace, the capabilities of large commercial imagery providers and national technical means (NTM), as well as to increase global awareness of GEOINT, according to many subject matter experts.

Those who've been in the geospatial industry the longest note the SmallSat topic is not new—it gets revisited about every 10 years. “What’s different this time?” they asked.

SmallSats have been around for more than 30 years. Surrey Satellite Technology launched its first SmallSat in 1981. The Clementine SmallSat mission, led by the late Pete Rustan, then mission manager for the Ballistic Missile Defense Organization, mapped the surface of the moon in 1994. And IKONOS, the world’s first high-resolution commercial imagery satellite, launched in 1999, weighing 720 kilograms—not too much more than some of today’s largest SmallSats. Still, the answer to “What’s different this time?” is “Plenty.”

CubeSats have garnered popularity far beyond university labs. The on-demand access to geospatial information now available on smartphones has brought the value of commercial imagery into the public eye and piqued the interest of many diverse industries. The price of entry to space and cost per kilogram for hardware has plummeted. Meanwhile, imaging payloads have become more sophisticated and lighter in weight, in addition to the proliferation of technology that can be leveraged from other sectors. In short, the satellite industry is in the midst of welcome disruption.

#### WHY DOWNSIZE?

There are many strategic and tactical antecedents to the rise of SmallSats. They offer greater revisit rates, significantly lower costs, the ability to update technology more frequently, and decreased vulnerability to attack.

Surrey Satellite Technology has launched 41 SmallSats since 1981, but the recent sea change the company has witnessed is improvements in technology driving down price performance points, according to Dr. John Paffett, CEO of the British-based company’s U.S. subsidiary.

For example, Surrey is currently developing three 1-meter resolution, earth observation satellites weighing 400 kilograms each for its spin-off company Disaster Monitoring Constellation International Imagery (DMCii). The total cost for the three spacecraft, including launch, insurance, and operations for seven years, will be around \$160 million, Paffett said.

For comparison, DigitalGlobe awarded \$307 million worth of contracts in 2010 to build WorldView-3, and NTM satellites can reach price points reportedly in the billions.

The shorter development cycle and lifespan for smaller satellites also make it quicker and less expensive to get the latest capabilities into space.

“Instead of being stuck with an iPhone 3G for years, you can go through iterations quicker to the 5S,” said U.S. Air Force Maj. David Illsley, chief of NRO’s overhead solutions branch.

On Jan. 8, Gen. William Shelton, commander of U.S. Air Force Space Command, in a speech at George Washington University, addressed the increasing vulnerability of defense satellites in a future space conflict and cited a shift to SmallSats as potential preemptive action. Not only did China demonstrate its ability to destroy a satellite in orbit by targeting one of its own systems in 2007, but space debris is a growing concern as well.

In the event of such an attack, SmallSats are more difficult to hit, easier to replenish, and provide a cost-benefit equation that works in favor of the U.S. One missile used to shoot down a satellite costs considerably more than one SmallSat does to build, and a nation with only a few exquisite satellites is easier to cripple than one with dozens or hundreds of SmallSats.

SmallSat proponents don’t deny the systems also have limitations. Perhaps the most noticeable trade-off is sacrificing higher resolution for a greater revisit rate, according to Andre Doumitt, founder and CEO of Digital AdopXion, which identifies and evaluates emerging technologies that meet the needs of the DoD and Intelligence Community.

“Can we trade exquisite type imagery for a better revisit rate?” Doumitt asked. Certainly, depending upon the

mission. “Maybe I’m happy with 1-meter resolution every six hours rather than 5-centimeter resolution every three days,” he added.

Illsley revisited his smartphone analogy, comparing a digital SLR camera to an iPhone.

“They both take pictures,” he said. “One is good for posting pictures to Facebook when you’re with friends at a concert, but the other would be better for wedding pictures.”

The U.S. Army may be willing to make this compromise to better support soldiers at the extreme edge, according to John London, SmallSat program manager with SMDC.

“What we’re talking about is not necessarily quality but more quantity and timeliness,” London said. “We’re hoping that we can provide medium-resolution imagery to a warfighter [via a mobile device] within one to two minutes of when he or she requests it. That’s game-changing.”

SMDC has a joint capability technology demonstration in process to explore the viability of the concept London described using its Kestrel Eye Block 2 CubeSat.

But the promise of high revisit rates is spurring interest far beyond the defense and intelligence communities.

“You can imagine how this increased revisit rate could drive innovation in areas that might not be obvious to us now,” Doumitt said. “It’s another part of why you’ll see investors putting in lots of venture capital to SmallSat companies.”

#### JUNKSATS GROW UP

While the mainframe vs. PC debate raged in the ’80s, SmallSats were still being referred to as “JunkSats.” In the late ’90s, Stanford University’s Bob Twiggs was inspired by a four-inch plastic box used to display the then mega-popular Ty Beanie Babies. Twiggs used the display box as a model to develop a CubeSat, and in 1999, in collaboration with Jordi Puig-Suari at California Polytechnic State University, developed what is now the CubeSat standard: 1U, or 10x10x10 centimeters. Historically, larger companies and economies were the only actors in space, but today, the CubeSat is largely responsible for changing this norm.

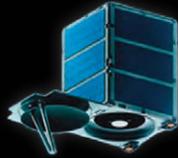
# UNDERSTANDING SMALLSATS

“SmallSat” is an arbitrary term for a class of smaller satellites. There are differing opinions for how large a satellite can be and still classify as a “SmallSat.” For example, NASA’s Small Spacecraft Technology program caps SmallSats at 180 kilograms, while some in industry are building what they deem SmallSats at up to 400-500 kilograms.

There are also further classifications within the SmallSat arena. These are often used interchangeably as well, but NASA describes commonly accepted terms for small spacecraft as the following:

## MINISATS: 100+ KILOGRAMS

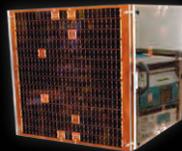
Pictured: SkyBox’s SkySat-1



size comparable to a kitchen oven

## MICROSATS: 10-100 KILOGRAMS

Pictured: Surrey’s NigeriaSat-X



size comparable to a mini refrigerator

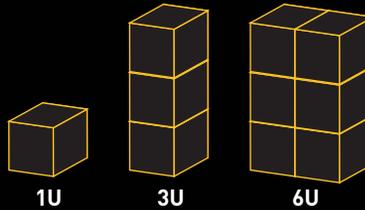
## NANOSATS (CUBESATS): 1-10 KILOGRAMS

Pictured: Nanosatifi’s ArduSat

>>**CUBESATS** are a category of NanoSats that adhere to specific dimensions. A CubeSat unit (1U) has dimensions of 10x10x10cm. CubeSats can be built in 1U, 1.5U, 2U, 3U, and 6U sizes, with 3U and 6U—two 3Us side by side—being the most popular.



A 3U is comparable to a loaf of bread



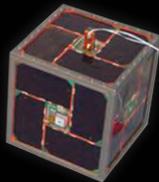
1U

3U

6U

## PICOSATS: 0.01-1 KILOGRAM

Pictured: Texas A&M University’s AggieSat-2



size comparable to the palm of your hand

## FEMTOSATS (CHIPSATS): 0.001-0.01 KILOGRAM

Pictured: Cornell University’s Sprite



size comparable to a postage stamp

\*1 KILOGRAM = APPROXIMATELY 2.2 POUNDS

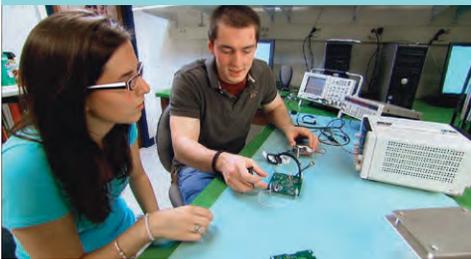
# CUBESATS AND UNIVERSITIES

## SmallSats are helping to bolster the country's STEM pipeline

When the National Science Foundation (NSF) first launched its CubeSat program in 2007, it received 27 proposals, including those from prior skeptics who said they could never scale their payload to be small enough to fly on a CubeSat.

"They were the some of the first to try," said Therese Jorgensen, program director with NSF. "Since then the interest has only grown and we've been very successful beyond expectations."

To date, the NSF program, which primarily funds university projects, has launched six CubeSat missions with four



Jennifer Williams (left) and Robert Carroll test an early prototype of Siena College's Firefly photometer.

more currently in various stages of development. A new competition is planned for the spring to fund two more projects.

Not only do NSF-funded CubeSats provide data to inform scientific research at universities, they also provide students with valuable hands-on experience.

"Everybody knew CubeSats were good for educational purposes," Jorgensen said. "Asking students to build something real that's supposed to actually work in space and actually launch it, not just pretend—the training that it offers—the value of that nobody disputes. But there was still a thought when we had our first competition that people would laugh. They just never believed CubeSats could be useful and take real data and inform real science."

Andrew Kalman, president of Pumpkin Inc. and director of Stanford University's Space and Systems Development

Laboratory, said CubeSats play a large part in the lab's real-world training for aeronautics and astronautics students. In late 2013, students collaborated with NASA's Jet Propulsion Laboratory (JPL) to upgrade an existing CubeSat design, add a GPS receiver, and demonstrate the system at JPL.

"This plays very well to employers," Kalman said. "We have had undergrads go to work for the National Geospatial-Intelligence Agency based on the work done in this lab."

The Texas Spacecraft Lab at the University of Texas at Austin conducts space missions with SmallSats, including CubeSats, according to Glenn Lightsey, the lab's principal investigator.

The lab conducts mostly government-sponsored research, with the bulk of its funding coming from DoD and NASA, although it does have some commercial partners as well.

"Our students are always hired immediately," Lightsey said. "There's never any issue with placing our students because they have these great hands-on skills."

CubeSats have expanded into high school classrooms as well. In November, Thomas Jefferson High School in Alexandria, Va., made headlines with the launch of its TJ3SAT, a CubeSat designed to increase interest in aerospace technology as part of NASA's Educational Launch of NanoSatellites Program. TJ3SAT was launched from NASA's Wallops Flight Facility November 19, a culmination of seven years of work by more than 50 students, according to the project's website.

Additionally, the National Reconnaissance Office (NRO) CubeSat Program has numerous partners in academia.

"We try to bring [graduate schools] in and bring those folks up to speed to help us going into this next future," said Tina Harrington, director of NRO's signals intelligence systems acquisition directorate. "That provides an opportunity to do things differently than we would with our own programs."

The vision for Skybox began in 2009 when the four founders wrote a business plan as part of a Stanford graduate entrepreneurship course. The company has since raised \$91 million in funding, all from private investors. In 2010, Planet Labs was founded by three former NASA

scientists, and has since collected a total of \$13.1 million in funding from venture capital firms.

With "decreased barriers to entry" and a lower amount of capital required to build a "viable product"—terms investors salivate over—venture capitalists are

more willing than ever to take a risk on SmallSats.

"There is a proliferation of tools and visualization engines out there that allow the average customer and consumer to see the world. This allows people to get an understanding of what could be done with the data," said Robbie Schingler, president and COO of Planet Labs.

Although Skybox and Planet Labs differ in many ways, they both share a vision to shift the industry from mapping to monitoring.

Skybox is focused on feature extractions, algorithms, and specific domain knowledge and toolsets tailored to a range of industries. The goal for its constellation is to yield analysis and insight—rendering the image "almost irrelevant," according to John Fenwick, vice president of flight operations.

"The world is awash in pixels these days," Fenwick said. "Having someone go through and manually look at each one is impossible. In order to truly move from mapping to monitoring, there has to be creativity in how the data is looked at."

Customers without a background in the geospatial sciences may not understand the power in a satellite image. For them, Skybox will go beyond the pixels to provide data streams that can enable decisions using information such as parking lot activity or vegetation health.

For customers who are more geospatially literate, Skybox also offers a service called SkyNode, which allows them to directly task a satellite and download imagery within 20 minutes. Japan Space Imaging was recently announced as the first SkyNode customer, and several more will be announced in the coming months, Fenwick said.

Conversely, part of Planet Labs' strategy is not to task its satellites.

"Our satellites are always on, always taking a picture of the land and transmitting," Schingler said.

Planet Labs data will be online and customers will "pay as they go." The founders believe this approach will allow the company to serendipitously see change, for example, imaging a portion of a coastline long before anyone knows it will be devastated by a major storm.

Both companies have already seen interest from a wide range of customers, including agricultural organizations, relief agencies, corporations, and government entities.

# STAY **AHEAD**

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“There’s a tremendous amount of disruption to the established space programs by these new SmallSats, and there’s a lot of activity in NewSpace,” said Anne Miglarese, president and CEO of PlanetIQ, which aims to launch a constellation of 12 SmallSats as the nation’s first commercial weather satellites.

“NewSpace,” according to Miglarese, a veteran of the National Oceanic and Atmospheric Administration, pertains to tech start-ups that strive to do things differently than the traditional space and defense industrial base.

“NewSpace isn’t ‘Am I a SmallSat?’ or ‘Am I a CubeSat?’” she said. “It’s, ‘Am I coming at this from a totally different direction and innovating?’”

### A SANDBOX IN ORBIT

SmallSats fuel innovation for established space programs as well, albeit in a different way, mainly through the use of CubeSats for research and development.

Take the NRO’s CubeSat Program, which has launched CubeSats on two rideshare missions in two years. In 2012, the NRO launched 11 CubeSats on NROL-36, five sponsored by NRO and six sponsored by NASA; and in December 2013, more than 48 CubeSats vied for 12 seats on the NROL-39 rideshare mission.

“This is a unique opportunity,” said Tina Harrington, director of NRO’s signals intelligence systems acquisition directorate, as the guest speaker at USGIF’s GEOINTeraction Tuesday networking event in November. “With CubeSats, we have the opportunity to put some technologies up that might not have been ready for primetime.” At a price tag of \$1 to \$3 million, she added, “CubeSats are the place to be adventurous.”

The NRO uses CubeSats to test space weather observations, solar cells, solar sails, batteries, carbon nanotubes, ion electrospray propulsion, and more, according to Illsley.

Government-built or sponsored CubeSats also have the advantage of hitching rides into orbit with a primary spacecraft. In November, the Air Force’s ORS launched 28 CubeSats aboard the ORS-3 Enabler Mission, alongside the much larger Air Force Space Test Program Satellite-3. A wide range of university and federal organizations

provided the 28 CubeSats to support myriad scientific and operational missions.

NASA JPL employs CubeSats to perform scientific measurements that typically couldn’t be conducted using a larger, single system. Technologies of particular interest to the GEOINT Community, according to Dr. Charles Norton, a principal technologist and program area manager with the lab, are new types of high-performance imaging detectors and radiation-hardened flight computers.

The Army’s Kestrel Eye CubeSat holds promise but is currently sitting on a shelf awaiting a ride to space to prove the technology, London said. This is where a strong industrial base is critical.

Industry is lining up to see what’s next for SmallSats, according to Doumitt. Providers of modeling and simulation, engineering, components, communications, telemetry, and launch vehicles all have the potential to benefit, he said.

According to Andrew Kalman, Ph.D., president of CubeSat provider Pumpkin Inc., the government also needs to purchase SmallSats in more significant numbers to maintain a strong industrial base.

“Either the government has to go out and pour money into these companies, or have a more open standard, saying, ‘Hey, we have these CubeSats that can do this, go out and buy those,’” Kalman said. “We have to establish a market for suppliers feeding in at reasonable quantities. That doesn’t exist right now.”

Platzer agreed there is still work to be done to establish a strong supply chain.

“The U.S. was the one that invented the CubeSat standard,” he said. “And today, the U.S. is the least relevant supplier market for CubeSats.”

### THE GENIE IS OUT

The SmallSat supply chain should come into its own as the niche expands during the next decade. In the U.S., more than 70 companies, 50 universities, and 17 government entities are involved with SmallSats, according to Illsley. Internationally, more than 41 universities are in the arena. And all predictions reflect that these numbers will continue to rise.

There’s no way for the trend to go but forward, Illsley said. “It’s kind of like trying to put the genie back in the bottle. Everyone else in the world is on this train with CubeSats.”

Over the next few years, SmallSats will continue to mature in many areas. A major one, according to Norton, is propulsion.

“Most of these are free flyers ... to be able to perform orbit transfers and other activities such as proximity operations, I think propulsion is a big area where we’ll see improvements in the next few years,” Norton said.

Schlinger predicts SmallSats will be used even more for research and development, a concept he calls “agile aerospace.” Planet Labs launched four Flock satellites as tech demos prior to launching its Dove constellation, a practice he believes will become more common.

“The way spacecraft get designed today is one where a design gets locked in really early on with the state-of-the-art architecture at the highest level of heritage possible,” Schlinger said. “SmallSats will change a bit of the posture.”

SmallSats will also begin to fuse data—with other SmallSats, with larger satellites, and with a variety of data sources. Constellations of SmallSats will be banded together to partially compensate for performance or resolution limitations, still at a lower cost than one large satellite. Systems providers and third parties will gain access to disparate data sources and merge them to create more value-added products.

Fenwick said Skybox is actively partnering with other data sources, and sees its capabilities as complementary to established commercial imagery providers such as DigitalGlobe.

“We understand that ours is a very powerful data source, but is not the only one,” Fenwick said.

Schlinger agrees: “When people begin to think about the space segment differently, mission planners and principal investigators will begin to think about them as distributed assets. You don’t need to have one satellite do everything when you can have 30 satellites doing three-quarters.”

This approach enabled by the NewSpace and SmallSat movements will drive a new era of responsiveness and resilience, according to Miglarese.

“It holds a lot of advantages to both the warfighter and the Intelligence Community,” she said. ■

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# WAGONS WEST!

BY ANDRE DOUMITT

## GEOSPATIAL TECHNOLOGY ON THE WEST COAST

*Editor's note: In this guest column, Andre Doumitt, founder and CEO of Digital AdopXion—a Los Angeles-based company that identifies emerging technology to fit the needs of the DoD and Intelligence Community—shares his insight on the geospatial science boom in the Western U.S.*

Commercial geospatial technology combined with university programs and new ways to collect satellite imagery has created a confluence of creativity and opportunity for future programs.

**G**EOSPATIAL TECHNOLOGY is rapidly piquing the interest of businesses in the Western U.S. Location intelligence and location-based services are gaining traction in many industries, and both are especially lucrative for commercial consumer marketing. Los Angeles-based Factual is changing mobile marketing with its location-specific, ad-targeting technology for mobile users. Companies such as Yelp, Groupon, and Samsung use Factual data to create user profiles with demographic, geographic, and behavioral information generated by analyzing geo-behavioral patterns.

Southern California-based CyberCity 3D is creating a real-world picture in a virtual environment, bringing context to mobility by automating the process of generating GIS-quality, 3D building models from satellite and aerial imagery. Meanwhile Telogis keeps track of mobile workforce and fleet assets for enterprise customers. Telogis provides a cloud-based location intelligence platform for companies with mobile workforces that require dynamic routing, real-time work order management, and navigation.

Geospatial technology company Locaid provides Nevada a geo-fencing capability that ensures people who use mobile devices for online gambling are doing so only within state boundaries.

### UNIVERSITY INCUBATION

According to *Forbes*, California companies receive 53 percent of venture capital funding in the U.S. Not surprisingly, many university programs in California also partner with venture capital firms. The University of Southern California's (USC) Viterbi School of Engineering's new Startup Garage is a

business accelerator for early-stage technology companies. Recently, Startup Garage incubated Tilofy, a platform for discovery of global real-time information surrounding any geographic location. USC has also spun out ClearPath, which is developing a navigation system to find the fastest path by analyzing traffic sensor, weather, and accident data to predict traffic behavior. USC also fueled a technology called Strabo, which automatically converts map images into vector data and stores boundaries and map features as complete lines, rather than collections of pixels. The system was recently used to update voting precinct maps for Los Angeles County.

Investor Irwin Zahn funded San Diego State University's Zahn Center, which includes two geospatial technology companies: PathGeo provides web tools for analyzing, engaging, and geo-locating social media for marketing, brand analysis, public opinions, and customer engagement; while Repeat Station Imaging specializes in rapid and automated image co-registration to support real-time change detection onboard an aircraft.

Imagin' Labs, from the California Institute of Technology in Pasadena, focuses on monitoring and quantifying ground surface changes with sub-pixel accuracy. The company provides automatic registration of satellite and aerial images with accuracy one-tenth the size of a pixel, including raw imagery.

### SMALL SATELLITES AND R&D RANCHEROS

Upstream from satellite data analysis is data collection, and in this arena the combination of miniaturizing technology,

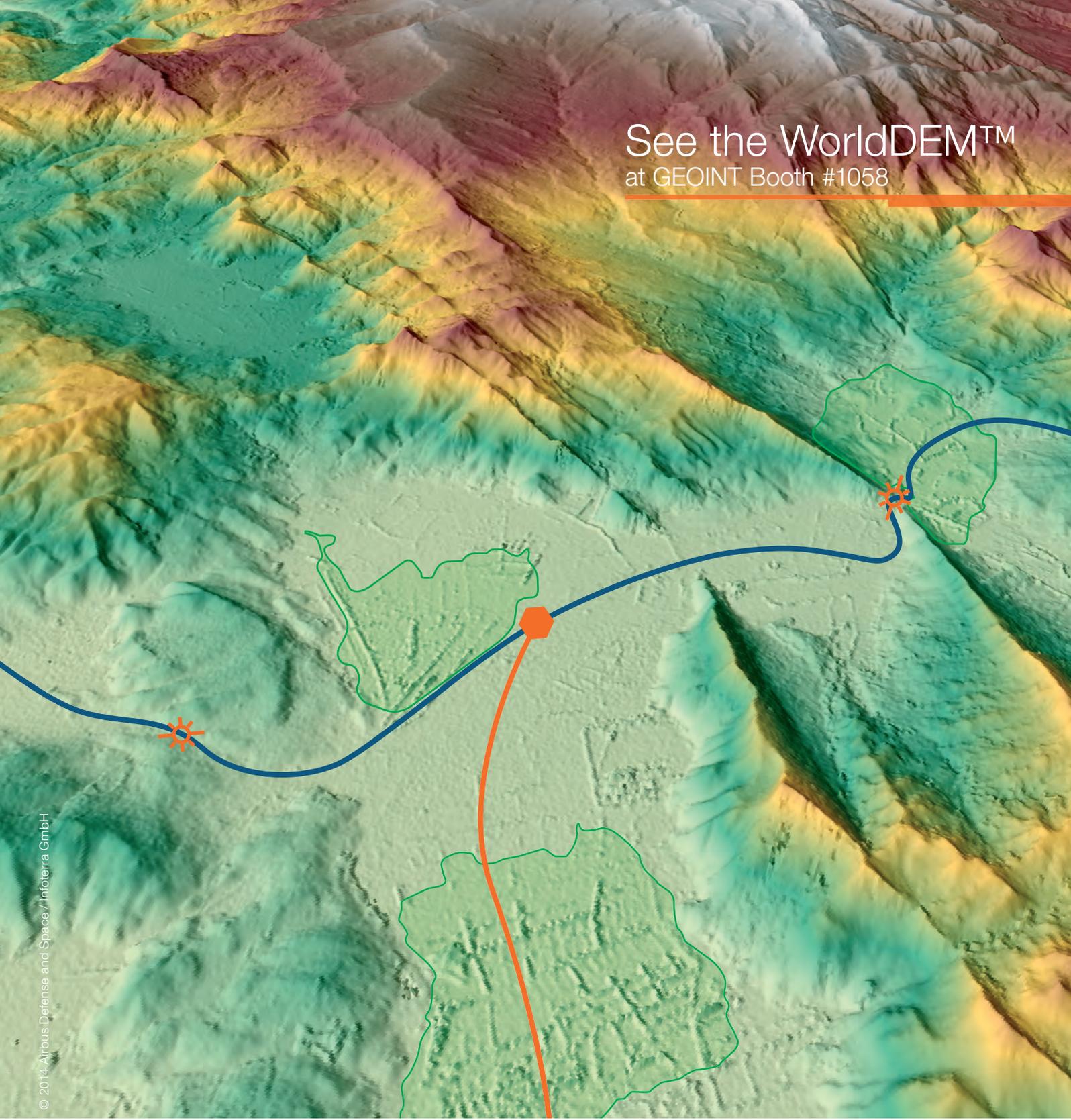
declining prices, and government budget cuts have collided to create conditions where small satellites are poised for a range of new missions.

Companies such as Andrews Space in Washington state bring a range of services and technology to the SmallSat sector, but the heart of capability lies in California. Key founders of the niche include Stanford University, California Polytechnic State University, and federally funded research and development center The Aerospace Corporation. San Francisco and Los Angeles also have SmallSat clusters, with the former boasting Stanford University as well as companies such as SkyBox Imaging, Planet Labs, Pumpkin, and NanoSatsifi.

Also in Southern California are Teledyne Scientific & Imaging (Thousand Oaks) and HRL Laboratories (Malibu), both part of the recently announced Intelligence Advanced Research Projects Activity (IARPA) Knowledge Representation in Neural Systems (KRNS) program designed to uncover new ways to help intelligence analysts probe into images, video, text, and other data sets to refine image analysis with artificial intelligence.

### A PIXELSHED EVENT

Commercial geospatial technology, combined with university programs and new ways to collect satellite imagery, has created a confluence of creativity and opportunity for future programs. The challenge is to understand how emerging capabilities can be applied to deliver value to end-users. Dual-use technology comes with broader market support that usually translates into lower costs. Perhaps it's time to send more wagon trains West. ■

A topographic map of a mountainous region, color-coded by elevation from green (low) to red (high). A blue line traces a path across the terrain, with three orange starburst icons marking specific points. A green outline highlights a specific area in the center, and an orange line connects one of the starburst icons to this area.

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## GROWTH BY DIVISION

### LEIDOS: WHAT THE SAIC SPLIT MEANS FOR THE FUTURE

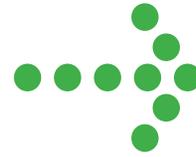
In these tumultuous times for the defense industry, with demands for increased innovation pulling against an anchor of fiscal austerity, Rob Zitz, Leidos senior vice president and chief systems architect for the national security sector, believes solutions cannot be more of the same. You have to differentiate.

Science Applications International Corp. (SAIC) decided differentiation meant reinvention. On Sept. 27, 2013, SAIC spun off its technical, engineering, and enterprise information technology services business, which retained the legacy SAIC name. What remained was a science and technology services company focused on national security, health, and engineering that was renamed Leidos. The creation of two separate companies unlocks potential opportunities for more business by doing away with concerns about organizational conflicts of interest.

“Before the split, SAIC was 1,000 flowers blooming and faced internal competition,” Zitz said. “Leidos now has optimized portfolios, shared resources, and leveraged technology.”

The new name, Leidos, is derived from kaleidoscope, and the company says it is meant to evoke the effort to view problems and offer solutions from different perspectives.

< **THE GEOROVER MOBILE DESKTOP** extension is a plug-in to the commercial Esri ArcGIS desktop application. The toolbar enables users to easily import and export points, lines, and polygons from existing shapefiles. (photo illustration)



**“As a leading provider of geospatial intelligence products and services, Leidos has an enduring commitment to apply our solutions to multiple industries across national security, health, and engineering sectors.”**

— John Jumper, Leidos chairman and CEO

**LEIDOS PROVIDES** real-time views of the battlespace through multi-INT capabilities with the Pursuit and Exploitation System for multi-functional teams.

“When it comes to geospatial intelligence needs, there are many similarities between homeland security users and traditional military and intelligence users,” Zitz said. “Everyone needs geospatial information for planning, situational awareness, and a common operating picture, whether they’re in an operations center or on the ground as a tactical operator or a first responder.”

Often operating in remote land and sea areas, U.S. Customs and Border Protection (CBP), for example, uses GEOINT and Multi-INT technology developed for the defense and intelligence communities, in part by Leidos.

CBP relies on commercial satellites and both manned and unmanned airborne assets to collect imagery, including real-time, full-motion video.

“CBP does coherent change detection,” Zitz said. “It aggregates information along with myriad sources into common operating pictures, it is tipping and cueing across multiple sources, and it is vectoring interdiction assets based on the combined information flow.”

As federal customers gather more and more Big Data, the problems inherent with using, storing, retrieving, and securing it grow as well. Leidos builds

cybersecurity into its system designs from the outset.

“In today’s dynamic GEOINT environment, analysts and operators need to locate critical data fast, see real-time trends across multiple sources, identify behavioral patterns, and discover vital relationships,” Zitz said. “We understand the need to provide ubiquitous access to GEOINT by creating an intuitive, secure, online environment that facilitates effortless and seamless access to data.”

Leidos meets this need with its DigitalEdge platform, which ingests GEOINT and other intelligence and open source data, auto-scales it to handle velocity streaming, and enriches it. DigitalEdge then sends the information to an open source storage platform.

Leidos also offers Scale2Insight for establishing baseline models that can be used to determine behavior deviation and predict future behavior, the essence of activity-based intelligence. Additionally, Leidos’ DigitalEcho solution can search and process data from native language sources.

Leidos tools developed in support of defense and intelligence needs have also proven valuable for health services and disaster relief agencies. For example,

problems such as air pollution and the spread of air-, water-, and soil-borne pathogens can be tracked using cloud computing, web services, GEOINT, and Big Data processing.

“Today’s portable smart computing devices, tied with live GPS satellites, mapping applications, and high bandwidth telecommunications, have greatly enabled the medical community’s first responders,” Zitz said.

The growing number of GEOINT users has driven the demand for open source, open architecture to operate in a plug-and-play environment.

“We are constantly interacting with our government customers, others in industry, and across academia to ensure we understand the gaps and also the potential solutions offered elsewhere, with an aim of teaming with all sizes of companies to bring the best solutions forward,” Zitz said.

Many of those partnerships are forged at USGIF events such as GEOINT Community Week and the GEOINT Symposium.

“USGIF is a great resource for companies to come together for business-to-business relationships,” Zitz said. ■ BY JIM HODGES



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Pass	3	2013-11-13 10:54 -05:00	2013-11-13 11:46 -05:00	Coleman
Pass	1	2013-11-13 10:55 -05:00	2013-11-13 10:55 -05:00	Coleman



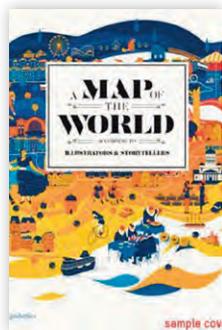
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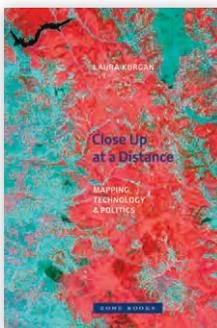
**A MAP OF THE WORLD: THE WORLD ACCORDING TO ILLUSTRATORS AND STORYTELLERS**

by Antons Antoniou, R. Klanten, H. Ehmann, and H. Hellige

This 224-page book contains a collection of compelling and creative maps by a variety of illustrators and storytellers from around the globe. From hand-drawn to 3D, these contemporary illustrations offer a unique view of the world.

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 by Yann Arthus-Bertrand

This book presents a stunning aerial imagery collection accompanied by thoughtful essays written by the famed aerial photographer, offering an exquisite view of our planet.

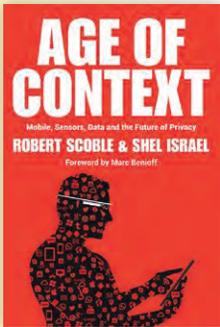
**CLOSE UP AT A DISTANCE: MAPPING, TECHNOLOGY & POLITICS**

by Laura Kurgan

From mobile devices to online mapping services, our lives are increasingly tied to the satellites up above. This book examines what it means when humans view their world from a satellite's aperture.

**AGE OF CONTEXT: MOBILE, SENSORS, DATA AND THE FUTURE OF PRIVACY**  
 by Robert Scoble and Shel Israel

Social media, mobile, data, sensors, and location-based technology are the five converging forces that promise to change virtually every aspect of our lives.



USGIF EVENTS CALENDAR

**APRIL**  
14-17

GEOINT Symposium  
 Tampa Convention Center  
 Tampa, Fla.

**MAY**  
13

GEOINTeraction Tuesday  
 Maggiano's, Tysons, Va.

**JUNE**  
25

USGIF Workshop Series  
 Reston Hyatt, Reston, Va.

28  
 GEOGala  
 Reston Hyatt, Reston, Va.

**JULY**  
8

GEOINTeraction Tuesday  
 Springfield, Va.

**SEPTEMBER**  
9

NGA Tech Showcase East  
 NCE, Springfield, Va.

9  
 GEOINTeraction Tuesday  
 Springfield, Va.

**OCTOBER**  
21

NGA Tech Showcase West  
 St. Louis, Mo.



**EVENTS** For the latest event listings, visit [www.usgif.org/events](http://www.usgif.org/events).

## PEER INTEL

NJVC announced the addition of **Charles "Chuck" McGaugh** as vice president, program management and strategy. McGaugh joins NJVC after a 33-year career with the National Geospatial-Intelligence Agency (NGA), and will be responsible for growing the company's presence in the St. Louis area.

The American Society for Photogrammetry & Remote Sensing announced **Michael Hauck** as its new executive director. Hauck has more than 20 years of experience developing applications for remote sensing and geospatial information technologies.

SRA International announced three changes to its senior leadership team. **George Batsakis** is now senior vice president, national security group; **Paul Nedzbala** was named senior vice president, health and civil group; and Pat

Burke has been appointed CTO.

ManTech named **Paul T. Gentile** senior vice president of its mission, cyber & intelligence solutions group's cyber solutions business unit. Gentile was formerly a senior vice president and deputy business unit general manager with SAIC's integrated systems group.

**Kevin L. Jackson** was named to lead the Network Centric Operations Industry Consortium (NCOIC). He will assist organizations in adopting the NCOIC Rapid Response Capability. Prior to joining NCOIC, Jackson was vice president and general manager of cloud services at NJVC.

Spatial Networks announced the appointment of **Julia Bowers** as COO. Bowers brings more than 14 years of experience from across the defense, intelligence, and GEOINT communities.



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PHOTO BY USGIF

## A Blank Canvas

The U.S. Navy constructed Building 213 in 1944 to store steel blanks for guns. At the time, no one could have foreseen that the building, on the corner of First and M streets at the Navy Yard in Southeast Washington, D.C., would become home to the CIA's National Photographic Interpretation Center (NPIC). But in January 1963, shortly after the Cuban Missile Crisis, NPIC moved into Building 213. The new facility was such an improvement over NPIC's previous home at Fifth and K streets NW that employees nicknamed it "Lundahl's Palace," for Arthur C. Lundahl, founding director of NPIC (the same man whose legacy is honored by USGIF's

Arthur C. Lundahl-Thomas C. Finnie Lifetime Achievement Award). From 1963 until it was vacated in 2011, Building 213 remained a fixture in the Intelligence Community—as NPIC was absorbed into the National Imagery and Mapping Agency (NIMA) in 1996 and even when NIMA became the National Geospatial-Intelligence Agency (NGA) in 2003.

Today, Building 213 awaits demolition, a gradual process that will take place throughout the first half of 2014. Real estate developer Forest City is revitalizing the Navy Yard Park neighborhood surrounding Nationals stadium with "The Yards," a waterfront community of

residences, offices, restaurants, and retail businesses. Throughout November and December, Forest City invited seven local and international artists to use Building 213's facade as a canvas in a project called Art Yards DC. In addition to creating three murals, Art Yards included opportunities for children to draw with chalk in the parking lot and a culminating light show.

Immediately following demolition, parking lots and a trapeze school will be temporarily located at the Building 213 lot. However, the long-term plan is for the site to become home to office buildings and provide a blank canvas for new industries at the historic location.

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