2020 ISSUE 1

trajectory

THE OFFICIAL MAGAZINE OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

The accelerating pace at which technology is changing the GEOINT tradecraft requires greater flexibility and adaptability than ever before

Evolve

> U.S. Census 2020 > GEOINT Tradecraft Competition > Q&A with NRO Director Christopher Scolese

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FEATURES

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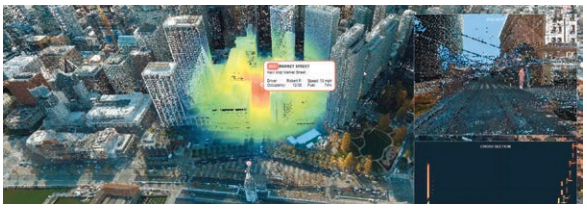

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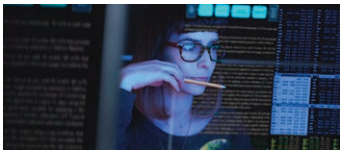

A Sense of Purpose and Focus

On behalf of USGIF and the GEOINT Community, I would like to thank the Honorable Jeffrey Harris for his many years of service and dedication to the Foundation. The USGIF Board of Directors and staff express our tremendous gratitude and respect for all that he has done to further the USGIF mission. We will carry the torch forward and maintain the Foundation's dedication to building the community, advancing the tradecraft, and accelerating innovation.

Sincerely,
Dr. L. Roger Mason Jr.
Interim Chair, USGIF Board of Directors

vir·tu·al – **adjective**: almost or nearly as described—carried out, accessed, or stored by means of a computer... or in the case of April 2020, occurring or existing primarily online.

Today, the GEOINT Community with its unblinking eye on mission realizes we must deal effectively with the challenges and uncertainties of the future. Work has begun to engage and productively network and align our collective thinking to help NGA develop the 2035 GEOINT CONOPS; STRENGTH THROUGH COMMUNITY. This will enable the GEOINT Community to provide distinctive insights with clarity, objectivity, and independence in support of our nation. This requires the National System for Geospatial-Intelligence to assess, collaborate, and improve on interoperability and agility to deliver the most impactful GEOINT support.

"Through our GEOConnect platform, working groups, and workshops... we will continue to advance community building, scholarship, and tradecraft."

As Yogi Berra said, "It's tough to make predictions, especially about the future." This is where the differentiating strengths of diverse thought and debate come together to formulate the right skills, technology, and processes to prepare for future challenges while meeting the increased and rapid demands for enterprise GEOINT. In March, three focus groups aligned in virtual roundtable format to engage the GEOINT ecosystem by gathering a cross section of industry, academia, geography/locations, expertise, seniority/rank, and thought leadership to identify a list of core capabilities and organizational changes that will need to be transformed.

Collaborating with subject matter experts is a core strength of the USGIF ecosystem. We recognize that there is always someone smarter, there is always someone more innovative, there is often someone organizationally senior, and, we recognize when to engage with the competition. This means that we must each be leaders and strive to be the best at connecting people. Socially intelligent people understand that the best problem-solver is a strong network. Cross-domain collaboration can also pique the interest of team members to pursue learning possibilities, which will enhance their skill set.

Through our GEOConnect platform, working groups, workshops, and problem-solving sessions, we will continue to advance community building, scholarship, and tradecraft. We leverage the skills of our volunteers who give of their time and talents to advance our community.

To quote Lt. Gen. Mary Legere, U.S. Army (Ret.), following a 2035 CONOPS session on March 31, "It was inspiring to be included in such a great and accomplished group of SMEs—certainly a great deal of work ahead, but what is clear is that there is no shortage of brilliant minds thinking about it for this great organization!"

THE HONORABLE JEFFREY K. HARRIS
FORMER CHAIR, USGIF BOARD OF DIRECTORS

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USGIF INTERIM CHAIR OF THE BOARD
Dr. L. Roger Mason Jr.

USGIF VICE PRESIDENT OF PROGRAMS
Ronda Schrenk

PUBLISHER
Shameka Jordan
shameka.jordan@usgif.org

EDITOR
Brad Causey
bcausey@glcdelivers.com

ART DIRECTOR
Gretchen Kirchner Rund
grund@glcdelivers.com

EDITORIAL INTERN
Lisbeth Perez
lisbeth.perez@usgif.org

AD SALES
Joseph Watkins
joseph.watkins@usgif.org

USGIF

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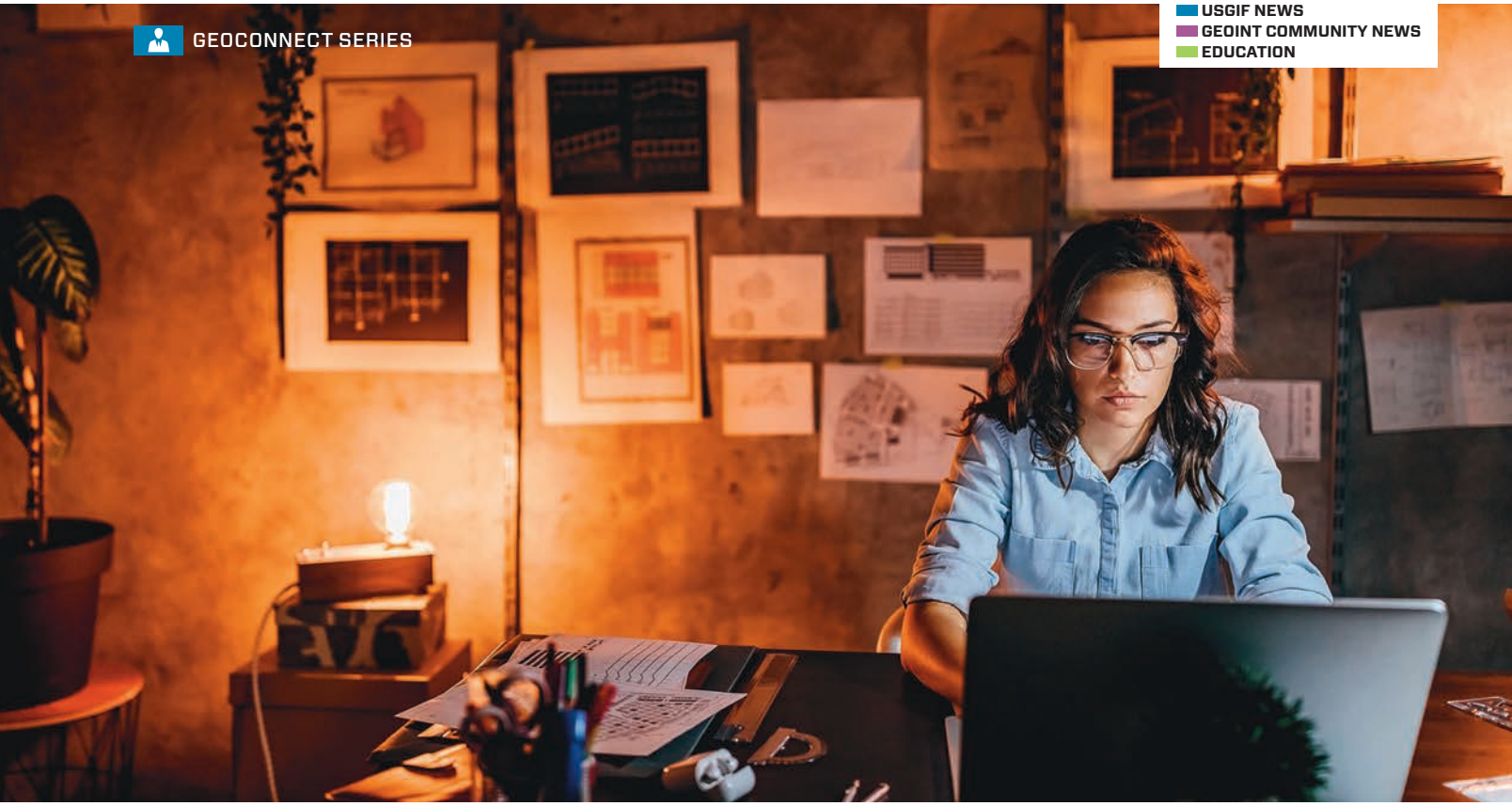


USGIF Launches GEOConnect Series

USGIF CONTINUES ITS MISSION to bring thought leadership, cutting-edge technological presentations, key insights for decision-making, and educational and professional development opportunities to the entire geospatial intelligence, trade, and academic communities. The GEOConnect Series is an accelerated outcome from USGIF's strategic plan to go digital. The GEOConnect Series features multi-session virtual events such as live-streamed panels, webinars, training, a virtual exhibit showcase, and more.

THE FUTURE OF WORK

JULY 22, 2020

On July 22, guests from the National Geospatial-Intelligence Agency (NGA) visited USGIF's GEOConnect Series Virtual Main Stage to discuss their 2020 Tech Focus Area: The Future of Work.

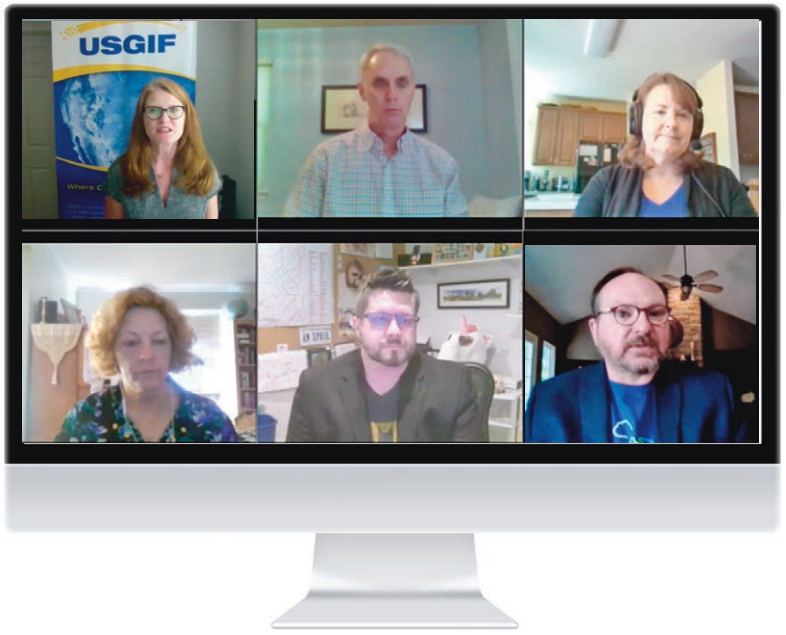
"When we looked at the tech focus areas and how we wanted to convey to industry what we were looking for in terms of technology, we really wanted to make sure that we put some futuristic ideas about what work would look like for the activities, environment, and the people," said Mark Munsell, chief technology officer, NGA.

"We wrote this before the pandemic and as it turns out, it was kind of a script for us moving forward to say, 'Let's practice some of these things that we're looking for,'" said Munsell. "We have this experience with both technology and our workforce, to operate in an unclassified and remote environment. But also, take what we do and move it to the high side, merge those things together, and provide the country the absolute best geospatial intelligence that we can."

During the pandemic, NGA launched a program called Reimaging Unclassified IT to prioritize, sustain, and enhance systems for the future of work, as well as analyze the workflow changes needed.

"We're [also] debating the infrastructure needs and the security implications of that," added Mark Andress, CIO and director, CIO-T, NGA. "We see this as a value proposition in terms of retention, CIO-T, and even in meeting productivity."

Launched on **April 22**, USGIF has already hosted **13** GEOConnect Series events.



Guests from NGA visited the GEOConnect Series Virtual Main Stage on July 22 to discuss the future of work.

MOVING FORWARD IN THE NEW NORMAL

According to Matt Conner, chief information security officer (CISO), Director of Cybersecurity Office (TS), NGA, the agency has always had a "let's go succeed in the open" mentality.

"We've had little moments where we were doing things like this, but I don't think anybody could have forecasted where we are now," Conner said. "[But] I'm very confident that despite the crisis-driven actions, we've been very judicious… Leadership within the agency understands that we have to apply appropriate controls to balance risk."

As services are deployed, for example, to enable greater access to email, Conner's team used the agency's co-operative hacking team or penetration testing team to kick the tires and assume an adversarial posture for those kinds of services before they exposed them to risk.

"I can imagine a future where NGA is working on essentially any iPad, any tablet, any phone. Our future doesn't look anything like it does now, and for that reason, we have to sort of get past the idea of our perimeter or boundary," said Conner, adding that the data experiences and computer experiences should be contextually based on where you are, not just who you are, and what access you have.

A DATA-CENTRIC AGENCY

"When we really think about the future of work, we're thinking about a data-centric agency," said Munsell.

For the last few years, NGA has recruited and hired individuals who are skilled in data management. It has also trained employees on the use of data to develop a level of data literacy for a data environment. And the agency has seen the future of data.

But, according to Kim Thompson, director of Human Resources, NGA, in order to thrive in this data environment, NGA will need people with "soft skills."

"We think about IT as being this deep knowledge, and you've got to be very technically focused. But you also have to have the soft skills—understanding, emotional intelligence, being able to lead, and innovative," Thompson said. "Those are the things that are harder to identify, but that we need to look for in the individuals we hire and develop it to a greater extent within our own workforce."

RESOURCES

In case you missed it, video recordings of GEOConnect Series events can be found at **bit.ly/2DC797m**.

Read full coverage of each GEOConnect Series event at **trajectorymagazine.com/news**.

PAST GEOCONNECT SERIES EVENTS

Utilizing Unclassified Data
April 22, 2020

NGA's 2020 Technology Focus Areas
April 29, 2020

Software Is Core to NGA's Mission
May 13, 2020

The Geospatial Intelligence Hub of the Nation
May 20, 2020

An AI Revolution
May 27, 2020

GEOINT-Enabled Cities
June 3, 2020

NGA Publishes First-Ever Technology Strategy
June 10, 2020

GEOINT From Your Basement
June 17, 2020

Data: A Strategic Asset
June 24, 2020

A Path to Becoming the Global GEOINT Hub
July 1, 2020

NGA: Future of Work
July 22, 2020

LIFETIME ACHIEVEMENT AWARD

A Lifetime Career in Intelligence

Arthur C. Lundahl and Thomas C. Finney were GEOINT trailblazers and long-standing federal professionals whose decades of service helped build the foundation of geospatial intelligence. The Arthur C. Lundahl-Thomas C. Finnie Lifetime Achievement Award celebrates their accomplishments—in imagery analysis and mapping, respectively—and their legacies within the GEOINT Community. This distinguished award annually honors an influential member of the geospatial intelligence community who has dedicated much of their life's work to the tradecraft. The recipient is nominated and voted upon by USGIF's Board of Directors. This year's winner is the Honorable Sue Gordon.

"I've had the good fortune of having my career intersect with Sue's over the years, and I could go on listing [all of her] accomplishments. But her greatest qualities are her humanity and genuine love of the workforce," said Dr. L. Roger Mason Jr., USGIF interim chairman of the board, during the GEOConnect Series Virtual Main Stage where the award was announced. "Sue [has] taught us how to be better intelligence officers, better colleagues, better leaders, and better followers."

With nearly three decades of experience in the IC, Gordon served in a variety of leadership roles spanning numerous intelligence organizations and disciplines. She was sworn in as the fifth principal deputy director of National Intelligence (PDDNI) on August 7, 2017. As PDDNI, Gordon assisted the DNI in leading the Intelligence Community (IC) and managing the ODNI, particularly focused on advancing intelligence integration across the IC, expanding outreach and partnerships, and driving innovation across the IC.

She also served as the deputy director of the National Geospatial-Intelligence Agency (NGA) from 2015 to 2017. In this role, she helped the director lead the agency and manage the National System of Geospatial Intelligence. Gordon drove NGA's transformation to meet the challenges of a 21st century intelligence agency. She also championed agile governance, recruitment, and retention of a diverse workforce, and expansion of geospatial intelligence services to the open marketplace. She is known for her commitment to diversity and inclusion.

Prior to her assignment at NGA, Gordon served for 27 years at the Central Intelligence Agency (CIA), rising to senior executive positions in each of the agency's four directorates: operations, analysis, science and technology, and support. Gordon joined the CIA in 1980 as an analyst in the Office of Scientific and Weapons Research, and went on to serve as the director of the Office of Advanced Analytic Tools, director of Special Activities in the Directorate of Science and Technology, director for Support, and ultimately in concurrent roles as director of the Information Operations Center and the CIA director's senior advisor on cyber. In 1998, she designed and drove the formation of In-Q-Tel, a private, nonprofit company whose primary purpose is to deliver innovative technology solutions for the agency and the IC.

The Honorable Sue Gordon, USGIF 2020 Lifetime Achievement Award Winner.

Gordon has been recognized for her creative executive leadership through numerous awards, including the Presidential Rank Award at the distinguished level.

"I am honored beyond measure and humbled beyond words, to receive the Lundahl-Finnie Lifetime Achievement Award. My thanks go to the board of USGIF [who] thought I might be worthy of the legacy of the visionary leaders who inspired the award, the icons with whom I get to share the recognition, and the women and men of geospatial intelligence whose craft, contribution, and commitment have kept America and her allies and interests safe for generations," said Gordon. "I will treasure this award and moment forever. Thank you so much for the recognition today and for letting me call myself one of yours."

USGIF-CERTIFIED WOMEN

Standards of Excellence

USGIF OFFERS professional certifications in a variety of focus areas. The Certified GEOINT Professional–GIS & Analysis Tools (CGP-G) program provides the knowledge necessary to ensure that the various elements and approaches of GIS and analysis are properly understood in order to successfully capture, store, manage, and visualize data that is linked directly to a location. Women in the GEOINT Community shared their reasons for seeking USGIF certification.

ERICA MCMASTER, CGP-G

McMaster leads a team of dedicated GIS professionals and student interns in her current position as GIS program director at Washington College. She has over 15 years of experience in the GIS field, using Esri and open-source software products.

She was impressed with the concepts tested as part of USGIF's Certified GEOINT Professional–GIS & Analysis Tools examination.

"I will be introducing these concepts into my academic courses and in the GIS apprenticeship program at Washington College. I plan to have my students work toward this certification, setting them apart from other entry-level candidates in the growing GEOINT field," McMaster said.

KARI SIGNOR, CGP-G

Signor is currently completing the Master of Geospatial Information Science and Technology (MGIST) at North Carolina State University. She also works as a geospatial production analyst for Geo Owl, where she is a part of a diverse team conducting feature extraction, quality control, and geospatial data production in support of global humanitarian assistance, disaster response, and policymaking.

"Given the technical and dynamic nature of this field, the opportunities to learn new approaches to solving geospatial problems are limitless. I want to take advantage of every opportunity to improve my skills so that I can make a positive contribution to the GEOINT community and help resolve geospatial issues affecting our communities and environment globally," Signor said.

ANDREA SIMMONS, CGP-R, CGP-G

Simmons is currently an analyst at Maxar Technology, where she works as a full spectrum GEOINT methodologist on a team with multifaceted GEOINT specialties. Simmons is not only a Certified GEOINT Professional in GIS & Analysis Tools, but she also received her professional GEOINT certification in Remote Sensing & Imagery Analysis.

"Getting certified in Remote Sensing and GIS tools & Analysis by USGIF has aided my understanding of industry-wide requirements and expectations, and enabled me to achieve a broader scope of understanding in my disciplines. As a defense contractor, I see these certifications as my way to document and maintain my proficiencies and contribute more to Maxar's customer missions," Simmons said.

SUSAN LYON, CGP-G

Lyon received a bachelor's degree in Geography and a Master of Science degree in Geographic and Cartographic Sciences, both from George Mason University, Fairfax, Virginia. She currently works as a research geographer at the Geospatial Research Laboratory (GRL), Engineer Research and Development Center, U.S. Army Corps of Engineers. She became interested in USGIF's CGP-G GIS Tools and Analysis certification because it fit well with her areas of expertise.

"[Certification] is particularly useful in a field like GEOINT, which crosses so many different disciplines and areas of knowledge. It is also useful in an environment like GRL because we work with a wide variety of government entities. It is valuable to have an easy way to communicate technical and analysis skills, and CGP-G does that for me," Lyon said.

KERRY MAPES, CGP-G

Mapes graduated from the University of North Carolina at Wilmington with a Master of Science in Geoscience with academic honors and multiple awards in research and teaching. While completing her master's degree coursework at the University of North Carolina Wilmington, the university was going through the process of becoming a USGIF-accredited institution.

"I decided to become certified because having the certification and the USGIF name listed on my résumé makes me stand out from others in my field, and is a symbol of the knowledge and expertise I have been accumulating in the geospatial fields," Mapes said.

Visit **trajectorymagazine.com/gis-analysis-tools-certification** for full-length profiles.

SPECIAL EVENT

GEOINT 2020 Innovation Tradecraft Competition

Leaders from the GEOINT Community participated as judges in USGIF's first GEOINT Innovation Tradecraft Competition.

On February 4, USGIF and the Open Geospatial Consortium (OGC) held the first round of the inaugural GEOINT Innovation Tradecraft Competition, propelling forward a conversation on the evolution of the nascent mission analytics tradecraft and the importance of discussing new challenges and strategies to achieve mission success.

"[Regarding] geospatial intelligence—as old as the tradecraft is—there are still things to be discovered. That's exciting because it is in this work that new discoveries will be made," said the Honorable Sue Gordon, 2020 recipient of USGIF's Lifetime Achievement Award.

In the first round, there were 17 presentations from 15 companies on the best practices in data discovery and alignment to address mission problems through visualization, data sharing, and interoperability. Concluding round one, the judges selected Cesium, Deloitte, HawkEye 360, and Sandia National Laboratories to move on to the final round. Pixia and Presagis were selected as runners-up.

On July 29, the four finalist once again shared their innovative ideas for the final round of the tradecraft competition, held on USGIF's GEOConnect Virtual Main Stage.

"It is an unabashed feeling to hear and see, quite frankly, our future," said Robert Cardillo, president of the Cardillo Group and a judge in the first round of the competition. "[The participants] are stretching the bounds of our thinking and reimagining our tradecraft."

YOUSSEF VICTOR, 3D GRAPHICS TEAM, CESIUM, discussed how to automate interoperability of 3D geospatial data and analytics on mobile devices in disconnected environments with on-device analytics using Cesium JS and 3D Tiles to not only empower warfighters but also enhance their decision-making and situational awareness in his presentation, "From Disk to Disconnected."

HAWKEYE 360'S DIRECTOR OF OPERATIONS JAMES DOGGETT demonstrated how to use RF data to discover activity and material that has gone unseen in the middle of a seen area in their presentation, "Invisible Needles."

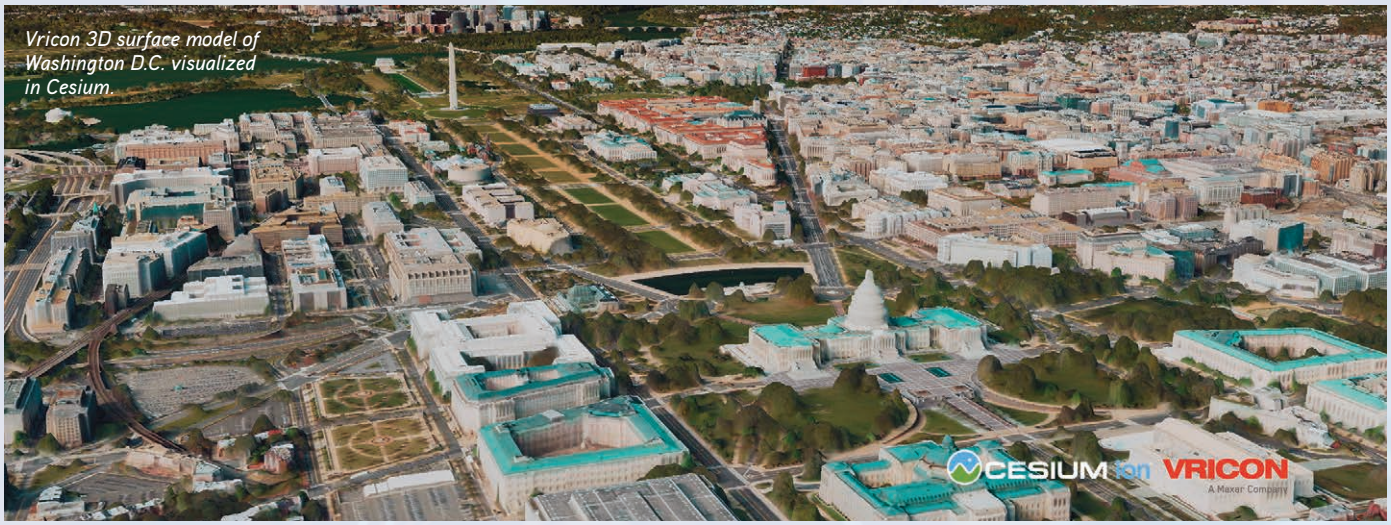
DELOITTE DATA SCIENTIST ALEXANDER PAYNE highlighted the accomplishment of running AI on-device, drastically reducing data streaming costs and reducing the latency of real-time mission-critical alerts in his presentation, "AI at the Edge." He showcased several demos of running AI on $10–$450 computer boards. He also discussed a web-based app developed to remotely command and control these devices while also viewing real-time alerts.

FOREST DANFORD, CRITICAL SKILLS MASTER'S PROGRAM PARTICIPANT OF SANDIA NATIONAL LABORATORIES, showcased a software architecture collaboratively developed by SNL and ARI summer interns at the University of Illinois at Urbana-Champaign in his presentation, "Big Data for Actionable Intelligence." The chief aim was to design a system on natively distributed software that was capable of near-real-time processing and fusion of many disparate data types, resulting in the autonomous generation of actionable intelligence.

"What we saw here was very powerful. It was tradecraft, innovation, and community coming together," said the Honorable Jeffrey Harris, former chairman of the USGIF board, just before announcing the winner of the competition.

In a very close race, Cesium and Victor won the GEOINT 2020 Innovation Tradecraft Competition.

"I am very excited to represent Cesium today, and this victory is a reflection of the work that the Cesium team has put in. We always like to push the boundaries. Everyone on the team has put in a lot of effort into making Cesium the best it can be," said Victor.



Vricon 3D surface model of Washington D.C. visualized in Cesium.

Q&A with Patrick Cozzi

Patrick Cozzi is the CEO of Cesium and the creator of Cesium and 3D Tiles.

Q What does it mean for Cesium to win the GEOINT 2020 Innovation Tradecraft Competition?

Patrick Cozzi

Our goal is to serve the GEOINT community with an open platform that offers increased 3D situational awareness and tools to make faster, more informed decisions, so it's an honor to be recognized for our work advancing interoperability with 3D Tiles. We are very grateful to USGIF and OGC for facilitating because when the community gathers in the spirit of collaboration, we all win.

Q What is 3D Tiles?

3D Tiles is an open specification for streaming and rendering 3D geospatial data, created by Cesium and adopted by the Open Geospatial Consortium. 3D Tiles enables efficient and interoperable workflows from data capture to dissemination over the web, offline, and across devices.

The wide adoption of 3D Tiles has made it possible for the community to share data across government agencies in addition to industrial use cases like smart construction, smart cities, and more.

Q Why does Cesium as a company create and champion open standards such as 3D Tiles?

Cesium has embraced openness because we believe that's the fastest way to accelerate the field. Collaboration in our community depends on interoperability, and in order to have interoperability, we need open standards.

Q How does Cesium empower government agencies like NGA?

The ability to take 3D geospatial data of nearly any kind—terrain, imagery, point clouds, and drone captures—and create a highly accurate scene for a geospatial intelligence product and then share it with just a URL is crucial. Good intelligence requires effective communication to be of value, and we need new ways of presenting information that take advantage of 3D's benefits. Our Cesium Stories offering was created with this need in mind—a format for conveying information using time-dynamic 3D that can be easily shared without writing code.

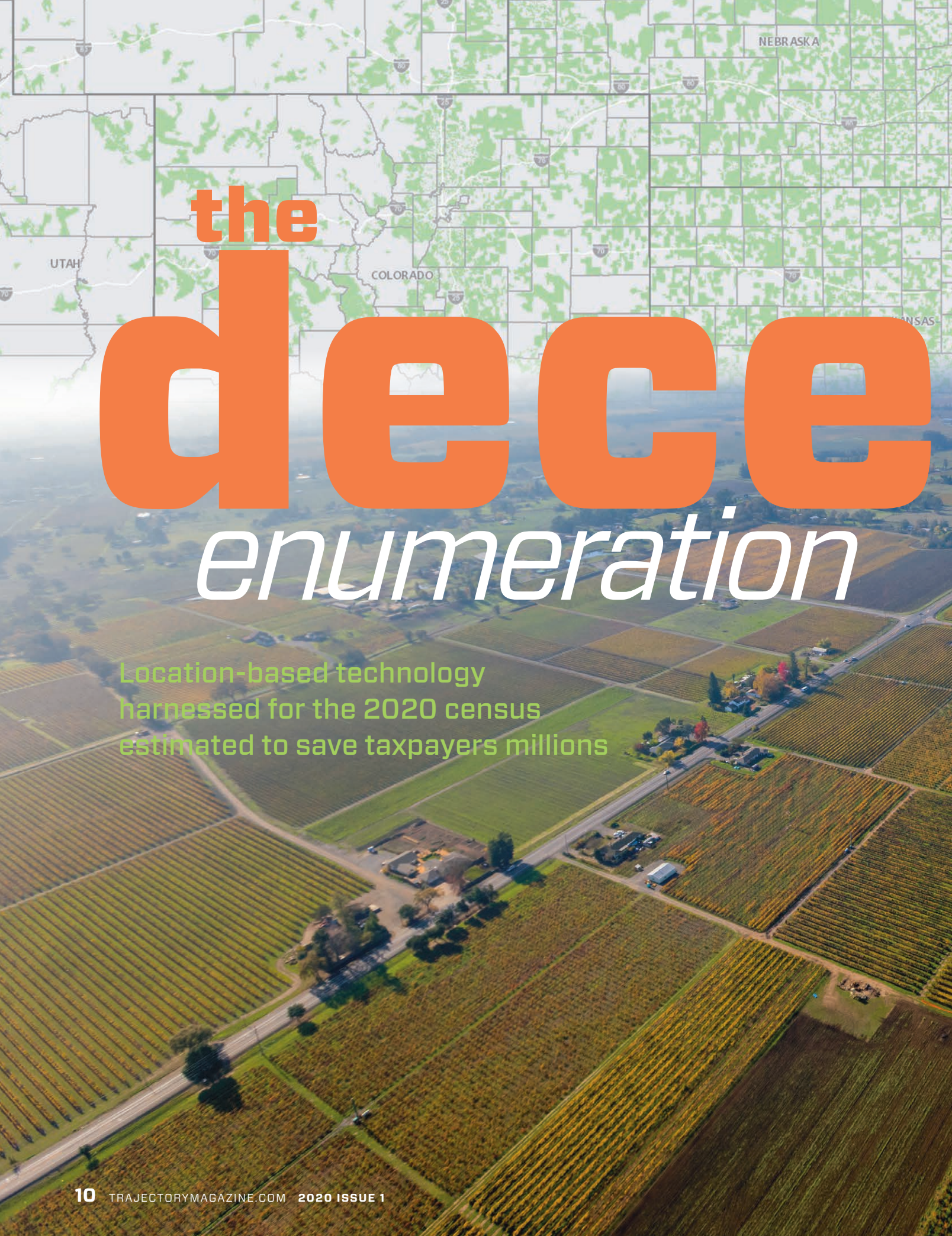
Contact hello@cesium.com to discuss how Cesium can accelerate solutions to your GEOINT challenges.

Q What's next for Cesium?

Part of our strategy for advancing the field is increasing work at the intersection of computer graphics and geospatial. One of the most exciting things in this area is our partnership with Epic Games to build **Cesium for Unreal Engine**. This will be the first time a full-scale, high-precision 3D globe is plugged into a leading game engine. By enabling 3D Tiles to be streamed into Unreal for accurate visualization of real-world locations captured by satellites and drones, we'll make strides in industries like autonomous driving, and augmented and virtual reality. For military training and simulation, the ability to train and plan in an environment that is as close to the real thing as possible provides operational and competitive advantages.

the decennial enumeration

Location-based technology harnessed for the 2020 census estimated to save taxpayers millions



nial

MELANIE D.G. KAPLAN

IMAGE: ISTOCK.COM/SPONDYLOUTHESIS

IT WAS JUST A DECADE AGO when the Census Bureau printed 17 million maps and deployed 600,000 census-takers who lugged around satchels weighted down with paper documents. Each morning, the enumerators met in-person with a supervisor to learn their day's route, and they tracked their cases, hours, miles and expenses on paper. >>

ENUMERATORS ACROSS THE CENTURY

IMAGES COURTESY OF U.S. CENSUS

From horseback to iPhones and masks, door-to-door visits by Census Bureau agents remain necessary for accurate data collection.

Since the 2010 Census, technology has exploded. The use of GIS and satellite imaging, information-gathering methods, automation, and in-field applications make this year's census the most robust and high-tech outreach effort in the bureau's history. For the first time, the bureau is collecting responses online, as well as by phone and mail. According to Adobe, which powers the bureau's survey website, taxpayers will save an estimated $15 million for every 1 percent of the population that responds to the census on the internet. Much of the cost and time savings come from the canvassing period, which involved validating, correcting, or deleting existing addresses.

"Approaching 2020, the questions were: Do we physically have to go out, pay people to walk and put eyes on every structure in this country, or are there places where there's a level of stability, where there's not that much growth or change happening?" said Gregory Hanks, the deputy chief of the Census Bureau's Geography Division. "We opted to take advantage of technology to avoid the time and the cost of sending people into the field."

Every 10 years, in what is one of the federal government's largest civilian operations, the Census Bureau sets out to count every person in the country. This year's survey reached about 330 million individuals living in roughly 140 million housing units. Preparing for this event is an enormous undertaking that involves a decade of research and testing, using technology that will inevitably change before the official count is completed.

The increased use of technology became instrumental this spring when the bureau had to react quickly to the pandemic to help slow the spread of the coronavirus. The bureau suspended in-person data collection and set up a callback option in 14 languages to accommodate those dialing into the call center, which was working at reduced capacity due to social distancing. They shifted outreach efforts to virtual engagements and launched a series of new ads in 33 languages aimed at increasing online response (As of July 23, 92 million households had responded, with four out of five doing so online.)

Originally, 350,000 census takers were set to hit the streets this spring, following up with the residents of every household that had not responded via the online or paper forms to collect census information. Instead, the census enumerators began following up with residents in mid-July, each armed with an iPhone and an app to optimize their routes and track their cases, hours, miles, and expenses. They are visiting residences previously verified using satellite imagery and know ahead of time what language the residents speak and when they are likely to be home. Their work will conclude before the end of October.

A DELIGHTFUL STORY ABOUT REUSE

The Census Bureau has been in the geospatial intelligence business for decades. TIGER (Topologically Integrated Geographic Encoding and Referencing), a massive digital geographic database that automates the bureau's mapping and geographic activities, was developed before the 1990 Census. For many years, the bureau has relied on aerial imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP) for correct placement of residential structures, change detection, and digitizing features and boundaries. This decade, the game-changer is the addition of commercial imagery from the National Geospatial-Intelligence Agency (NGA) and a new program that, combined with address data sources, allows reliable detection of housing stability and change. Canvassing of one block, a two-hour job in the field, took about two minutes in the office.

> "It's a delightful story about reuse and return on investment. The imagery is a U.S. Department of Defense investment that's producing real value in the civilian sector."
>
> —GREGORY HANKS, U.S. CENSUS BUREAU, GEOGRAPHY DIVISION

Lorton, Fairfax County, Virginia: BARCA provides reviewers with access to baseline (circa 2010) and current imagery to assess changes within each of the 11.1 million census blocks over time.

IMAGE COURTESY OF LORTON

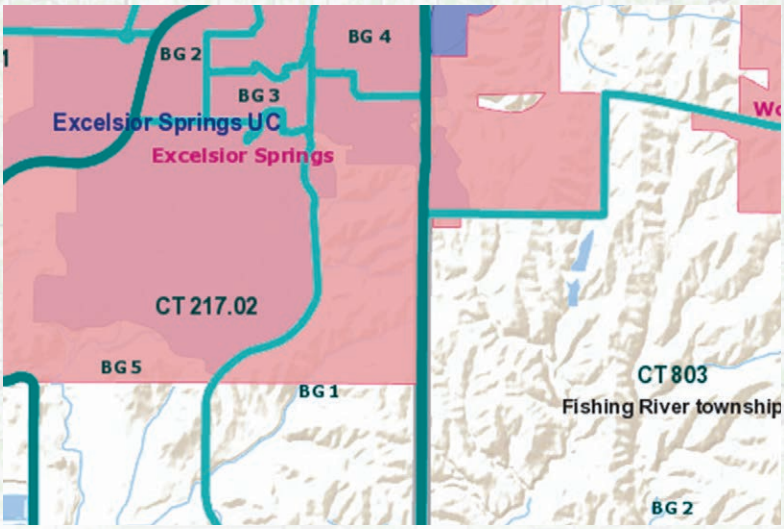


IMAGE COURTESY OF TIGER

Topology relates states, counties, and census tracts with real-world features, ensuring accurate geographic data without any gaps or overlaps.

Block by block, the Census Bureau compares current images with those from a decade ago to detect changes and update their records.

"It's a delightful story about reuse and return on investment," Hanks said. "The imagery is a U.S. Department of Defense investment that's producing real value in the civilian sector."

In 2010, NGA signed a contract with DigitalGlobe, now Maxar Technologies, that made available the entirety of DigitalGlobe's archives (updated daily and dating back to 1999) to the U.S. defense and intelligence communities, as well as to federal civil agencies, humanitarian organizations, and international partners. In an effort to make the archives easily accessible to its partners, NGA manages a program called Global Enhanced GEOINT Delivery (G-EGD), which delivers access to more than 1 billion square kilometers of high-resolution, unclassified imagery.

"Since 2010, the volume of commercial imagery available across the whole of the U.S. government has exploded," said Amy Weaver, NGA's division chief for Commercial Mission Integration. "There are a number of large users, and certainly over the last couple of years, the Census Bureau has seen a huge uptick. They are one of our top partners on the federal civilian side."

In preparation for 2020, the Census Bureau developed the Block Assessment, Research, and Classification

WHY IS THE CENSUS IMPORTANT?

The census aims to count every person living in the United States once, only once, and in the right place. But this decennial event, which first occurred in 1790 and is mandated by the Constitution, is more than a simple headcount. Information gathered from the 2020 Census, based on 10 questions about the people living in each home (participation is required by law), will provide critical data for community funding, congressional representation, emergency management, and more. It will determine the distribution of $675 billion in federal funds, grants, and support to states, counties, and communities, to be spent on schools, hospitals, roads, and public works. In Washington, D.C., for example, the data is used to allocate more than $3 billion annually for federal programs such as Medicaid, SNAP, education grants, housing vouchers, and school lunches.

The census will determine the distribution of $675 billion in federal funds, grants, and support to states, counties and communities.

Answers to the questions allow the Census Bureau to produce a wide range of statistics about homeownership versus renting, and the size of various groups based on sex, age, ethnicity, and race. The 2010 Census, for example, told us that women made up 50.8 percent of the population. These statistics inform planning and funding decisions and can help agencies monitor compliance with anti-discrimination provisions, such as those in the Voting Rights Act and the Civil Rights Act.

The 2010 Census told us that women made up 50.8 percent of the population.

Every decade, the Census Bureau provides population counts to states, which adjust electoral districts according to where numbers have fallen or risen. The census results also determine the number of seats each state will have in the U.S. House of Representatives. Businesses use census data to make decisions about where to open stores and factories, and which products and services to offer. Real estate developers use the data to build new homes and revitalize old neighborhoods.

Local governments use the census for public safety and emergency preparedness. The Federal Emergency Management Agency, for instance, relies heavily on census information for key demographic and housing data that help guide recovery efforts. For example, knowing that a large percentage of residents in a hurricane's path speak Spanish as their primary language helps agencies deploy the right rescue personnel.

Application (BARCA) to enable in-office address canvassing. BARCA sources a collection of imagery from NGA, NAIP, and state and local sources managed on Esri's ArcGIS imagery management platform.

"We had the idea that not every block had to be listed [for field workers] because some blocks haven't changed for 20 to 30 years," said Dan Keefe, the chief for the Census Bureau's Spatial Data Update Branch, which implemented the in-office address canvassing operation. "That's where the commercial imagery was important in comparing current with previous imagery. You could find growth, decline, and coverage issues from previous fieldwork. We were going at it every day from fall 2015 until March 2019."

At the Census Operations Office in Jeffersonville, Ind., just across the river from Louisville, analysts learned how to use GIS tools and swipe back and forth between decade-old and current imagery. Block by block, covering each of the nation's 11.1 million blocks, they compared the two images to detect changes and update TIGER and the Master Address File (comprising data from the 2010 Census, U.S. Postal Service, and GIS files from local governments).

The analysts marked growth—for example, a new subdivision—with a pin and noted blocks that weren't clear (often from cloud cover) for re-review. At times, they would become investigators, zooming in to find out, for instance, that a house-like structure with hay next to it was actually a barn, or a listing of two parcels included one that was just a parking lot. When in doubt, it would get tagged for a field visit. When in-office address canvassing was completed in March 2019, all addresses that needed in-person verification were added to the in-field address canvassing operation, which workers completed in the fall.

Andrea Grace Johnson, the bureau's Assistant Division Chief for Address and Spatial Data Update in the Geography Division, said many of the analysts commented that the computer canvassing was fun. "For them, it was like traveling," she said. For the Census Bureau, the new process significantly improved the workflow.

Before the 2010 Census, the bureau hired 151,000 field staff to canvass 100 percent of the housing units in the country—walking every city block and rural road, every hamlet and holler, and indicating all changes on paper.

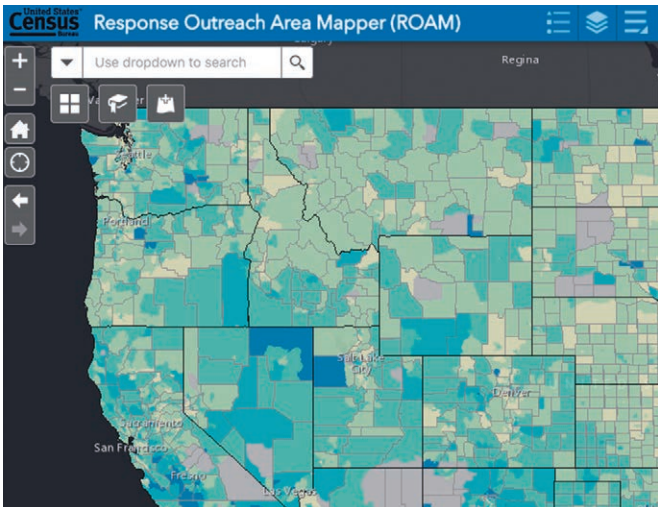


IMAGE COURTESY OF ROAM

Response Outreach Area Mapper (ROAM) application for hard-to-reach areas.

For the 2020 Census, that number dropped to 39,000 because so much of the canvassing was accomplished virtually.

MODERNIZING WITH THE HELP OF COMMERCIAL PARTNERSHIPS

Shortly after the 2010 Census, the bureau partnered with Esri to help accelerate some of the work that had been performed manually.

"We worked with the bureau on how to use geographic technology to identify changes in the landscape of residential property, how to automate the collecting of information and all the geocoding, and how to make sure we're optimizing all the cases to be sent out to the field," said Laura McNulty, manager of Esri's National Government Sciences team. "This is the first census that has been built with geography at the heart of it from the very beginning. All together, these pieces create the most modern census in history."

The bureau has used Esri technology to build BARCA, maintain TIGER, and develop the Response Outreach Area Mapper (ROAM) application for hard-to-reach areas. ROAM allows users to overlay socio-economic data with geographic points of interest in neighborhoods where the bureau anticipates challenges like language barriers, distrust in government, and lack of knowledge about how a census benefits the community. For instance, ROAM would help determine where (and in what language) to hold census educational workshops in libraries or places of worship.

The bureau also used Esri's Network Analyst API and StreetMap Premium to develop MOJO, a navigation-enabled control system for managing fieldwork of cases to follow-up on nonresponders. MOJO, which leverages the cloud and has enormous processing capabilities, updates the case assignments overnight and reassigns individual routes in the morning—based on proximity, language, and availability—through a mobile app called ECaSE (Enterprise Censuses and Surveys Enabling). Through ECaSE, enumerators learned their routes and entered their hours, miles, and expenses. They could also use it for navigation and to collect and encrypt survey data from the responders.

McNulty said her team is already looking to further modernize the next census in 2030. The perpetual challenge is to lock technology in place in time for a census dress rehearsal, years before the official count. "Imagine that today you are trying to define what the technology is for something that's not going to happen for 10 years," she said.

The Census Bureau's Johnson feels confident about the 2030 Census based on progress over the last two decades. In 2010, although the enumerators were weighted down by paper, they did have a GPS-enabled handheld device to verify locations. These devices captured GPS points for each address, which turned out to have enormous value this year.

"The bureau invested in a large, thorough survey for in-field address canvassing of the nation 10 years ago, and we've built on that data collection," Johnson said. "What happened in 2010 paved the way for 2020, and we can generate savings because the lion's share of the in-field canvassing work is done." The good news at the government agency tasked with comprehensive record-keeping, she said: "We never throw anything away."

> "We worked with the bureau on how to use geographic technology to identify changes in the landscape of residential property, how to automate the collecting of information and all the geocoding, and how to make sure we're optimizing all the cases to be sent out to the field."
>
> —LAURA MCNULTY, ESRI

Cloud Computing and Machine Learning at Mission Speed

In the near decade since the intelligence community (IC) first embraced cloud technology, the mechanics of storage and compute, virtual servers and data transfer have become relatively standard and allow customers to solve problems and build faster.

Jen Nelson, Director of National Security Sales at Amazon Web Services (AWS)

But now that customers in every imaginable business segment have adopted the cloud, they are increasingly looking to put the power of artificial intelligence (AI) and machine learning (ML) into the hands of every developer. These technologies are proving transformative, turning keystrokes into market intelligence and driving business processes and decision making to understand data and efficiency like never before.

For the intelligence community, the motivations are different. Faced with increasing threats, proliferating volumes of digital intelligence, and the imperative to find every proverbial needle in the haystack, the IC is turning to machine learning and automation to help deliver significant mission-oriented solutions.

"AWS has been making huge investments in AI/ML for 20 years, and today we're seeing more and more customers building, training and deploying models that can operate at any scale and help accomplish the mission," says Jennifer Nelson, Director of National Security Sales at Amazon Web Services (AWS).

The IC's commitment to the mission aligns directly with Amazon's obsession with its customers and commitment to delivering results. The first of Amazon's 14 leadership principles states that "leaders start with the customer and work backwards," and "obsess over customers." The last principle emphasizes that leaders deliver results, "rise to the occasion, and never settle."

Those principles also apply in the IC, where calculated risks and experimentation are essential but where we face significant challenges and emerging threats globally. In the post-9/11 world, the volume of intelligence data has grown exponentially and the need to share it across agencies has become essential. Being able to correlate, connect, and interpret that data rapidly is critical to accomplishing the mission. Intelligence is ultimately insignificant if it can't be understood and acted upon fast.

Whether it's commercial satellite imagery, proprietary intelligence, social media, or something else, much of today's intelligence is gathered from open sources. This data needs to be sourced, tagged, annotated, shared, and analyzed. Through this process, the data begins to take on new meaning, becoming valuable and useful to more Analysts in the process. It's also how data culled from open sources can quickly become classified, which makes data sharing challenging.

The Office of the Director of National Intelligence's guiding policies on AI, laid out in its Artificial Intelligence Using Machines (AIM) strategy, states that "AI and ML systems [...] must be shared with IC partners to the maximum extent allowable."

Sharing requires earned trust between agencies and vendors, as well as the ability to innovate and build new capabilities. Speaking at the 2018 AWS Public Sector Summit, Sean Roche, Associate Deputy Director of Digital Innovation, CIA, said, "The cloud on its weakest day is more secure than a client-server solution. It's been nothing short of transformational. It has transformed our ability to build new capabilities."

AWS is allowing customers to extend that reach via its AWS Snowball Edge device that enables agencies to deploy the power of the cloud—protected from the elements in a rugged, dust-resistant, water-resistant, blast-resistant box—to the tactical edge, enabling real-time data collection and analysis. That ability, combined with tools like Amazon SageMaker that removes the complexity needed to successfully train, tune, and deploy custom machine learning models, can vastly accelerate the time it takes to turn raw intelligence into actionable information.

"Before you can run machine learning workloads, there's an enormous amount of work that has to be done in order to be able to run the algorithm," Nelson explains. "You have to create an environment for your developers to work in. Amazon SageMaker does that for you. It expedites your ability to actually start building."

This is key: enabling Analysts to run workloads in the most effective and efficient way possible. "Speed matters. We want to ensure we're allowing customers to move quickly. Our tools and services enable those who have the tradecraft to accomplish their missions with improved security, agility and accuracy," she said. "It's very powerful for increasing mission impact."

These tools are also powerful for AWS partners, both systems integrators and new startups, which leverage cloud infrastructure, services and features to develop applications that can help solve problems for IC customers. "At AWS, our focus is on listening to the customer and building on their behalf," Nelson explains. "Innovation is in our DNA and we want to create a community of builders who can help enable the mission and deliver results."

AWS will be demonstrating these tools and new capabilities at GEOINT, sharing knowledge and insights with customers, partners, and interested members of the community.


EVO

The accelerating pace at which technology is changing the GEOINT tradecraft requires greater flexibility and adaptability than ever before

LIVE

BY BRAD CAUSEY

AS A NEW DECADE DAWNS, the geospatial landscape is illuminated with optimism and excitement. The challenges ahead, though monumental, appear surmountable. The defining era of GEOINT has come to a close. Now is the time of its evolution. >>

IMAGE: ISTOCK.COM/IN-FUTURE

"Change is the only constant in life," the pre-Socratic Greek philosopher Heraclitus famously said. The truth of this maxim is hard to dispute, let alone live by. To embrace change as the natural order of things requires adaptability and flexibility—not only to admit what worked yesterday may not be the best way today, but also to proactively seek better methods to refine or streamline one's approach.

Speed is another variable exacerbating the challenge of change. The breakneck pace at which so many things are changing today, driven by technological advancement, makes it difficult to get ahead when it's tougher than ever just to keep up.

To embrace change, be adaptable. To keep pace, be nimble. To evolve, be both. Easier said than done, but it is with these ambitions the GEOINT Community, rooted in a synergistic partnership between the National Reconnaissance Office (NRO) and the National Geospatial-Intelligence Agency (NGA), is poised to go above and beyond and show the way.

To embrace change, be adaptable. To keep pace, be nimble. To evolve, be both.

DRIVERS OF DIVERSIFICATION

Dr. Troy Meink, NRO director of Geospatial Intelligence Systems Acquisition (GEOINT), is responsible for the execution of all national geospatial intelligence satellite systems acquisitions within the NRO.

"Over the next decade, you're going to see a lot of change to how we've done business in the past," Meink said. He identified three challenges motivating this metamorphosis.

First, the NRO is being asked to do a lot more than ever before. Missions are evolving quickly and it is imperative to keep pace. Second, the potential adversaries the U.S. may face in the future are evolving rapidly as well. And third, space is a contested environment.

"These challenges are driving us to be more flexible and look at more diversified architectures," Meink said.

An essential component of that diversification is provided through commercial partnerships. It goes beyond commercial remote sensing though, Meink said. "How do we work with a broader set of commercial partners to integrate the innovative technology we're seeing across the community into our systems? That's where we're headed and that's what we're focused on."

As the NRO is asked to do more, Pete Muend, NRO director of the Commercial Systems Program Office, said, "We're going to be asking the U.S. domestic commercial remote sensing industry to do a lot more as well. We're really excited about the future and how they can contribute to our mission, consistent with our policy of buying commercially wherever we can and then building where we have to in order to meet harder problems."

THE GEOINT SINGULARITY

NGA's perspective on the themes defining the decade ahead resonates closely with that of the NRO. David Gauthier, NGA director of Commercial Business Operations, referenced the "GEOINT Singularity," a concept put forward by Josef Koller in *The Future of Ubiquitous, Realtime Intelligence: A GEOINT Singularity*. In the summary of his exposition, Koller writes:

"A scenario, coined the Geospatial Intelligence (GEOINT) Singularity, is a future where realtime Earth observations with analytics are available globally to the average citizen on the ground providing a tremendous wealth of information, insight, and intelligence... These developments will likely not be contained within the U.S. but will be a worldwide phenomenon."

Gauthier shared his views on the drivers toward this potential singularity. "One is ubiquitous observation, driven by the small sat and GPS revolutions. We're seeing more and more commercial entries into the market. More and more governments are getting involved. And it's all basically pointing toward this idea...that we will be observed every moment of every day from space or from other location services."

Another theme more specific to NGA's operations, Gauthier said, is an increase in ready-to-consume analytic services. "We can no longer be focused on purchasing pixels alone, we need the commercial market to provide analytic services that we can consume."

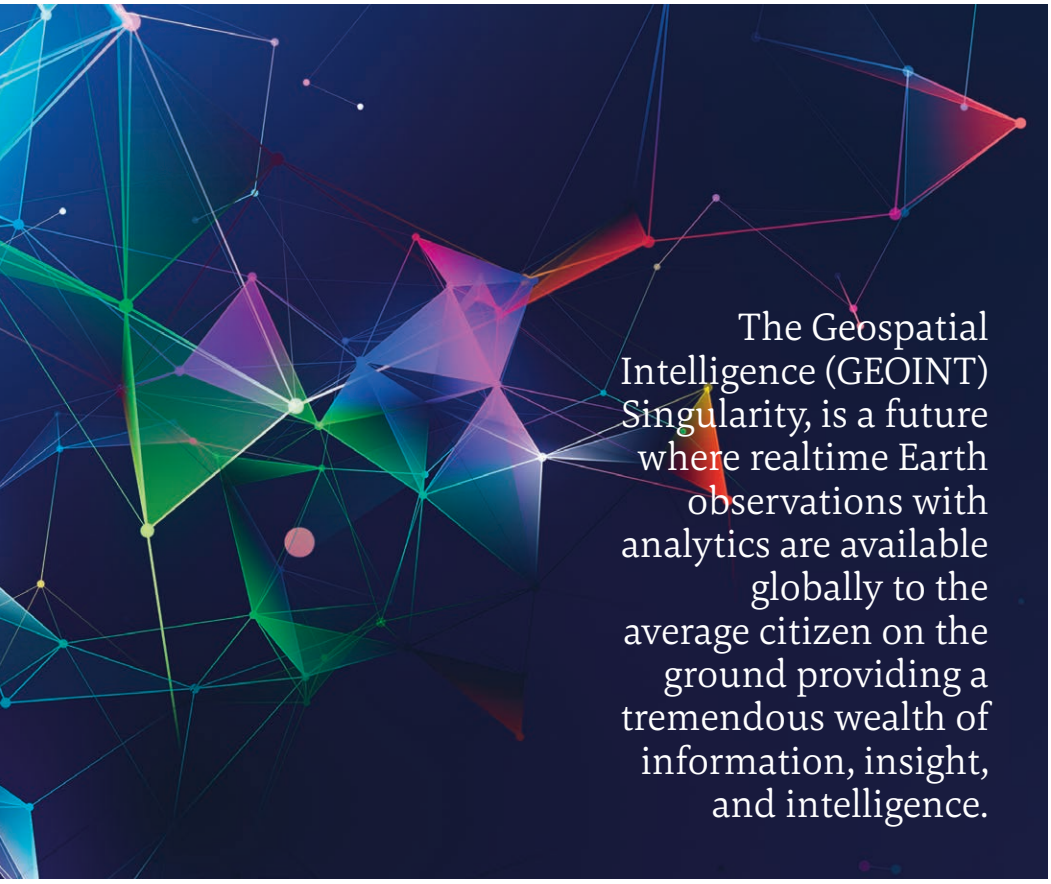


IMAGE: ISTOCK.COM/IN-FUTURE

Third, geospatial services are getting more personalized, Gauthier said. "It used to be that only a big government could create and provide a geospatial capability. But now, with so many smaller-scale services available and easy to access, we've seen commercial apps and other things that let an average consumer enjoy the power of GEOINT."

All three of these themes have a common thread: commercial.

"The government is trying very hard right now to be innovative in many ways," Gauthier said. "But there is certainly, in a competitive market, an inherent drive to innovate to survive." With more operators in commercial remote sensing than ever before, there have been unexpected and unanticipated innovations, Gauthier said. "That's fantastic. We benefit from their cycle speed at bringing those things into operation. We really do partner closely with the commercial market for those reasons."

Frank Avila, NGA director of the Discovery and Assessment Office, agreed. "The explosion of innovation and the speed of the innovation that is happening, it's really exciting," he said. "We're extracting so much intelligence from the data that we're collecting today, information that we didn't think was possible just a few years ago."

ESSENTIAL PARTNERSHIPS

NRO and NGA partnerships with commercial imagery and service providers will continue to grow and strengthen in the years ahead, for a number of reasons.

"What's going on in the commercial remote sensing world and commercial in general is critically important to us," Meink said.

Muend explained, "There are many advantages to leveraging the capital efficiencies the commercial market brings. For one, we don't have to bear the total cost of development and operation of those systems."

It is more cost-effective to purchase from commercial providers because the costs are spread across a wider customer base. "We get more for the same amount of dollars," Meink said. "We can support more of our users for the same cost, which is obviously important from a taxpayer perspective."

The other big advantage of partnering with industry is tapping into its innovations.

"They're able to move very fast and roll in new technologies," Meink said. "With the rapid rate of change to keep up with the missions we're being asked to do, commercial companies have a tendency to be pretty good at that. And we want to take advantage of that innovation."

"We want these companies to be successful and commercially viable," Muend said. "Their success enables us to be more successful." To that end, later this year NRO plans to award a number of operational commercial imagery acquisition contracts.

"They're able to move very fast and roll in new technologies. With the rapid rate of change to keep up with the missions we're being asked to do, commercial companies have a tendency to be pretty good at that. And we want to take advantage of that innovation."

—DR. TROY MEINK, NRO DIRECTOR OF GEOSPATIAL INTELLIGENCE SYSTEMS ACQUISITION

NRO STUDY CONTRACTS

As of press time, the National Reconnaissance Office (NRO) awarded study contracts to six companies. These contracts represent an important milestone in the agency's strategy of embracing both existing and emerging commercial geospatial providers to create an integrated overhead architecture consisting of both national and commercial capabilities. Study contracts allow the NRO to evaluate the companies' capabilities to meet NRO requirements. This helps the NRO effectively use the full breadth of commercial imagery providers' capabilities across multiple phenomenologies.

BlackSky Global
Contract: commercial imagery
About: BlackSky is a global monitoring company. Using high-revisit satellite imagery integrated with data gathered from sensor networks, it provides change and activity insights.

Maxar Technologies
Contract: commercial imagery
About: Maxar has been contracting with NRO for a decade to offer commercial imagery (initially when the company was DigitalGlobe). Using a combination of its own satellite imagery and publicly available data, it provides change detection and other mapping solutions.

Planet
Contract: commercial imagery
About: Planet uses satellites to generate images of the Earth every day and promises near-real-time insights on the changes revealed in that imagery.

HySpecIQ
Contract: commercial imagery
About: HySpecIQ is the first hyperspectral imaging company to win a commercial imagery contract from the NRO. Hyperspectral images are made up of light from hundreds of colors across the electromagnetic spectrum, and each object has a unique color signature, allowing users to obtain information about each pixel in an image.

Capella Space
Contract: commercial synthetic aperture radar
About: Capella delivers synthetic aperture radar (SAR) on a high-revisit basis. SAR provides the unique benefit of being able to detect changes through clouds, smoke, fog and darkness. NRO sees applications of SAR for intelligence analysis, battlefield reconnaissance, land and ocean monitoring, and natural resource and agricultural monitoring and assessment.

Hawkeye 360
Contract: commercial radio frequency remote sensing
About: Hawkeye 360 specializes in mapping radio frequency emissions, allowing for the identification and geolocation of radio frequency-emitting sources. NRO is interested in identifying a broad set of radio frequency signals, including shipborne automatic identification systems.

IMAGE: ISTOCK.COM/IN-FUTURE

Leading up to this milestone, NRO has awarded several study contracts with companies to assess their current and future capabilities to meet rigorous national security and defense.

Regarding the current and future needs of NGA, Gauthier sees raw commercial imagery as a resource, and compared it to GPS. "There are so many different apps now that rely on the GPS signal to do something value-added to improve our lives every day. We're consuming the apps, not the underlying GPS signal. And we see commercial imagery heading the same way."

There is a fundamental need for imagery and raw data to be available on the market, he said. "We expect any company who wants to provide analytic services to go get access to the raw data and come up with an innovative recipe to deliver something that's mission-relevant to us."

MACHINE-ASSISTED DATA TRIAGE

Addressing the whirlwind of innovation and the deluge of new data, Avila said, "One of our biggest challenges is how do we handle the volume of data, not only imagery but other information that's now available to us?"

As a growing challenge, NGA identified the need to address this a few years ago, according to Gauthier. "We put together a strategy for automation, augmentation, and artificial intelligence—what we call triple A."

NGA will rely increasingly upon automated capabilities in the years ahead in order to triage the scale of data coming in, Gauthier said. Machine learning automation has been successful in specific areas. "We are seeing the proliferation of many specific use cases of machine learning helping us across the board as machine assistants in GEOINT production."

Avila offered a glimpse of the potential future, "That's the environment we want to get to, where we have automated tools triaging the imagery at night before the analysts come in. When we know what we're looking for, the analysts can focus their attention on specific things that they should be looking at."

Training the machines, the algorithms, to know what to look for is the real task to fully enable automation. Meink succinctly stated, "There's simply no way to do all of this stuff manually anymore. It requires automation. It's going to have a massive impact."

Bernard Brower, L3Harris Technologies director of Artificial Intelligence, Space and Airborne Systems, expressed a similar view. "We need to leverage AI to do some of the things that humans are doing today. Otherwise, the advantage of having all of these sensors will not be realized if we can't extract all of the relevant information from the data they're collecting."

Thinking beyond data processing automation, Brower predicts a future of intelligent sensor autonomy where drones or small sats equipped with onboard processors will detect something of interest and then tip-and-cue other sensors to take a closer look—all on their own.

"Getting the AI algorithms closer to the sensor is going to be a game-changer," Brower said. "The systems themselves are going to be able to change their tasking based on the information available."

THE ART OF THE POSSIBLE

Another big change anticipated for the GEOINT Community over the next decade is the evolution of the workplace environment toward greater openness and faster collaboration between industry, government, and academia.

"We see a lot of demand for us to be operating at an unclassified level," Gauthier said. "If that's where many of the data sources are growing and many of our users are living, that's where we should be as well."

> "There are so many different apps now that rely on the GPS signal to do something value-added to improve our lives every day. We're consuming the apps, not the underlying GPS signal. And we see commercial imagery heading the same way."
>
> —DAVID GAUTHIER, NGA DIRECTOR OF COMMERCIAL BUSINESS OPERATIONS

IMAGE: ISTOCK.COM/TARRAS79

An aerial view of the proposed design for the new western headquarters of the National Geospatial-Intelligence Agency in north St. Louis.

IMAGE BY MCCARTHY-HITT

> "I'm hopeful we'll see an explosion in the use of geospatial data through collaboration with industry and academia. Innovation is going to increase by being able to operate more openly in that kind of an environment. We have pilot-tested the art of the possible—soon, we will be able to do it at a greater scale."
>
> — FRANK AVILA, NGA DIRECTOR OF THE DISCOVERY AND ASSESSMENT OFFICE

Avila pointed to commercial analytic services as an example. All of that data is distributed in an unclassified environment, he said. When this data has value toward operational use, a decision will have to be made. "Does it make sense to do the heavy lift and move all of that data up to a classified level? Or can we use it at the unclassified level to consume it at the speed we need to? Because every time we have to move something up, it takes time to do that, which can take away from the value of some of this data."

In late 2019, NGA broke ground on a new facility in north St. Louis, with plans for it to be that evolved, collaborative environment of the future by the time the 97-acre campus opens in 2025.

"That we'll be creating a campus for GEOINT at this scale speaks volumes to the staying power of geospatial intelligence and the demand for our goods and services." Gauthier said.

"I'm hopeful we'll see an explosion in the use of geospatial data through collaboration with industry and academia," Avila said. "Innovation is going to increase by being able to operate more openly in that kind of an environment. We have pilot-tested the art of the possible—soon, we will be able to do it at a greater scale."

Muend added that because of the global nature of geospatial intelligence, both NRO and NGA also anticipate greater collaboration with foreign government mission partners. "Intelligence is a team sport; now more so than ever," he said.

THE FLEXIBILITY OBJECTIVE

"Change is hard," Meink said. "The entire community has realized we're going to have to evolve more quickly than we have in the past. The good news is that, from the executive branch to Congress, we're getting a lot of support and flexibility in meeting these challenges."

"There is an awakening to understanding place and time in context as a new standard for complex decision-making," Gauthier said. "And people are finding geography more relevant in the way that they consume and use data."

"We understand all of these commercial companies have different goals," Meink said. "They're in different places within their own evolution, have different cultures, different technologies, and there is not a one-size-fits-all approach to our interactions. We are really trying to be flexible so that we can do what's best for them and for the government."

SPONSORED CONTENT

Digital Transformation Augments GIS for Government

By Lacey Wean, Geospatial Manager, Carahsoft

While geospatial is still used in traditional ways, digital transformation is augmenting how geospatial is executed and used by governments. Agencies are increasingly adopting emerging technology, shifting to subscription models, and moving to the cloud to make cutting edge solutions and processes more accessible than ever.

GIS has always been a key component to analyze data from physical, connected devices, such as phones, vehicles, cameras, sensors, and drones and then fuse these multiple sources of data together to present an operating picture. With advances in technology, organizations are now able to capture additional data and perform advanced analytics, enabling faster, more informed decisions.

Multi-cloud environments are the new norm for agencies

Agencies are already collecting large amounts of data and can enhance that data with public and open-source data sets. With the maturation of cloud computing, agencies are able to process, store, access, share and manage massive amounts of data mined from various sources. Most organizations already use multiple cloud platforms or have a strategy to use multiple platforms within the next 2-5 years.

The benefit of using multiple clouds is that it puts the user in control. The user can outsource the complexities to industry and focus on the assimilation of multiple cloud technologies to best meet specific requirements around compliance and functionality. Users are able to spin up an application in the cloud of their choosing from anywhere in the world. This type of flexibility provides the user with the ultimate control.

Automation amplifies existing investments

Modern analytic tools apply refined algorithms to parse through large amounts of data to predict trends, inconsistencies and conduct advanced analysis on potential sets of problems or solutions autonomously. In the coming years, we'll continue to see automation expand as agencies are mandated to invest in technology such as artificial intelligence (AI), machine learning (ML) and robotic process automation. Integrating AI and ML technology with modern decision making and visualization tools enables agencies to present complex findings in dashboards, extract actionable intelligence from big data and provide decision makers with clear recommendations. Additional investments in back-haul systems, like 5G, will further accelerate automation, making it faster to collect, process and analyze data to provide real-time situational awareness.

It's not about a transaction – it's about a partnership

Embracing a new model and automating everything isn't about a single or series of investments. It's about a new way of thinking. It's about understanding and evaluating every aspect of the job and thinking about how technology enhances every mission, project and process from in-field hardware and systems, to the data being collected, to the enterprise software, and to the people who are behind it all. It relies on the trust between government and industry and a deep look into the future of where technology will take us in the coming years. Building and evolving partnerships opens a world of new possibilities.

For more information, contact Lacey Wean at 703-230-7579 or visit www.carahsoft.com/geospatial.

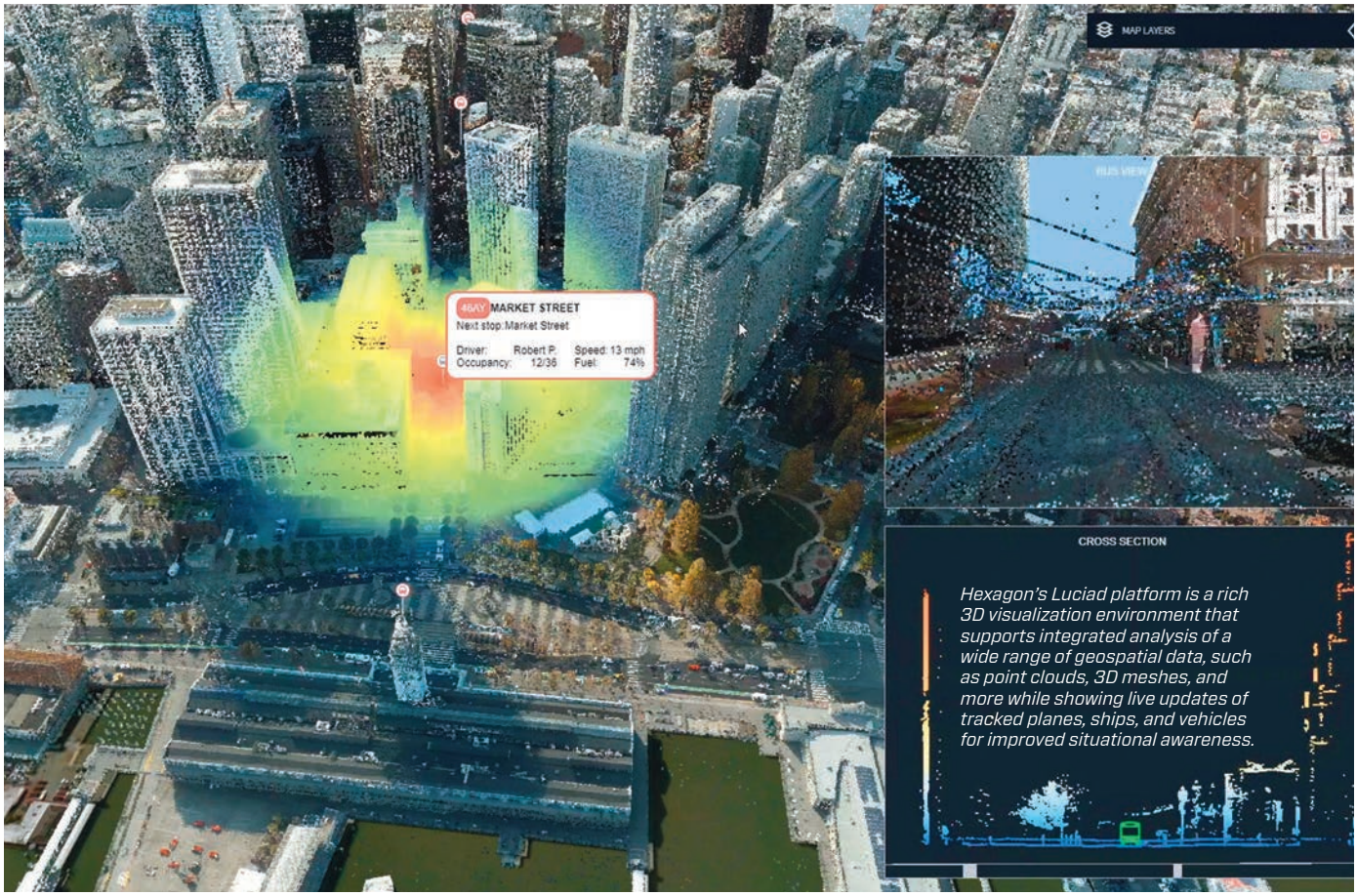


IMAGE BY HEXAGON

Delivering Mission-Specific Solutions

Q&A with Elliot Ferguson, Vice President for Geospatial Programs at Hexagon US Federal

Q How would you describe Hexagon's role in the GEOINT Community?

We are a trusted partner that delivers a wide range of virtual geospatial technologies and services for critical programs across the Department of Defense (DoD) and the intelligence community (IC). We bring a mix of our brands to the GEOINT Community, such as Luciad, Intergraph, Thermopylae, ERDAS, Leica, and Sigma Space. We take commercial off-the-shelf technologies and platforms and customize them to build mission-specific solutions that will better meet the requirements of our customers.

Elliot Ferguson

Q Who are the main customers and industries Hexagon serves?

Hexagon US Federal is an independent subsidiary of Hexagon AB's US federal business. We explicitly bring a range of technical support services for our mission-specific customers in the U.S. federal government. Some of our key customers in the federal space include the National Geospatial-Intelligence Agency (NGA), DoD, the United States Department of Agriculture, several organizations under the Department of Interior, and NASA.

Q What solutions and services do you provide for your customers?

We provide high-quality solutions, services, and products to help our customers in their missions. Our ERDAS tool suite allows for image processing and remote sensing. We have a capability called Cartographic Web Services, which creates off-the-shelf products in an automated fashion widely utilized for mission-specific needs. We offer advanced visualization for C4 and C5 ISR platforms, data production services, foundation GEOINT production services (specifically under NGA), and we provide cleared resources for off-site DoD and IC programs.

Q What makes you stand out within the GEOINT Community?

Hexagon US Federal has an incredibly diverse portfolio coupled with 35+ years of supporting NGA, and its predecessor organizations. We are set apart in that capacity just because we have a long-term relationship with the DoD and the IC specifically. In addition to traditional GEOINT capabilities, our company focuses on developing autonomous, connected ecosystems that harness IoT and the flow of information across entire ecosystems, all in support of driving more productive assets in complex environments.

Q How has Hexagon leveraged USGIF resources?

Hexagon has been a strategic member of USGIF since the organization formed in 2004; we were Intergraph at the time. It was a natural choice for us because the partnership offered a unique opportunity to build within the emerging GEOINT Community at the time. It provided a great way to establish vital connections with government and industry customers and gain a deeper understanding of critical requirements and trends in the community. The relationship has also helped us to understand our customers emerging needs, influencing our innovation, which results in much better end-to-end solutions. The annual GEOINT Symposium and other USGIF events provide excellent venues for us to hear firsthand from industry leaders and colleagues on changes occurring. It has provided Hexagon US Federal the opportunity to show the GEOINT Community that we acknowledge and can meet their needs.

Q What does the future hold for Hexagon?

The trend in the GEOINT Community is to increase the adoption of commercial technologies as we move into the future. Hexagon US Federal will continue to play a vital role in that, developing those end-to-end solutions to solve complex problems for our government clients. Hexagon aggressively and continuously innovates through acquisition and organic research and development. We are excited to take the resulting new technologies to our customers and assist them with their hard problems.

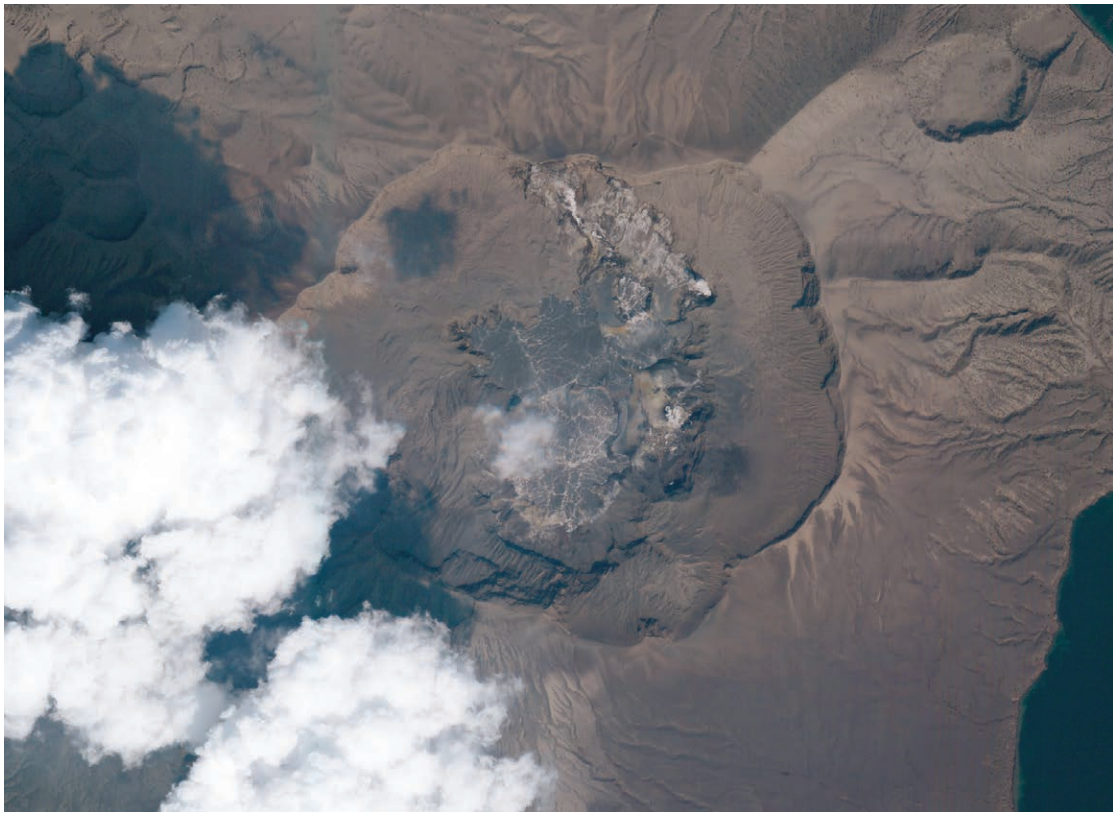


IMAGE BY PLANET

Eruption of Taal Volcano, Batangas, Philippines, Jan. 12, 2020.

Daily Imagery

Q&A with Planet's Jennifer Marcus, VP of Government Strategic Partnerships; and Rich Leshner, VP of Government and Regulatory Affairs

Q How has Planet advanced the geospatial tradecraft?

Jennifer: Planet's dataset encourages advancements in the tradecraft. Our datasets allow not just the markets we serve, but also the broader Intelligence and GEOINT Communities to make improvements in how analytics are done and how human-based intelligence analysis is gathered.

Q Who are the main customers and industries Planet serves?

Rich: We serve several markets. We've seen growth within energy and infrastructure, consumer mapping, defense and intelligence, and civil government sectors. But our biggest customer is the agriculture market. We work with people directly involved in growing and harvesting crops, as well as industries that manage the agriculture ecosystem.

Q What solutions and services does Planet provide its customers?

Jennifer: Planet offers a unique set of imagery collected throughout the day from everywhere on earth, which allows our customers to observe changes occurring in roads and buildings, movements of ships carrying imports, movements of planes at airfields, etc. We have a taskable constellation of satellites that collects these sets of images. We also have a set of products emerging around analytic feeds. We also provide a few professional services such as training, architectural workshops, and general guidance, so our customers get the most out of our platform and products.

Q How distinctive is Planet from other GEOINT organizations?

Jennifer: First, we collect imagery through small sats. We are leading the industry with this. We have the largest constellation of small sats in orbit. We are involved in the design, build, launch, and mission control of all these satellites. We also do all the image processing. Second, in terms of traditional GEOINT, we work with customers to

Jennifer Marcus

IMAGE: ISTOCK.COM/METAMORWORKS

customize our products to support their missions.

Rich: As a person who came from the civil side of space to Planet, I initially wondered, are we doing something that will provide a new, unique data set to this community, particularly on the science side? We are adding a revolutionary capacity to understand the earth, in terms of our available daily global imagery. This is not only offered to the science sector, civil application sector, weather sector, etc., we provide highly valued data that contributes to broader missions, things that can tangibly touch a lot of people's everyday lives over time.

Q How has Planet leveraged USGIF resources?

Rich: We were growing as a company, and we realized that we needed to engage the broader community and not just government members, but other companies and universities. It was the smartest place to go to engage with our community.

Rich Leshner

Jennifer: The GEOINT Symposium, which we look forward to every year, is one of our most significant resources. It is such a fantastic community event where we can see all of our customers, friends, partners, and other GEOINT Community members. It provides us with opportunities to connect. Other USGIF events, such as GEOINTeraction Tuesdays, also allow us to communicate with people and make sure we're engaged in all the right places that support the community that USGIF has built and the business that we are building with our customers.

Q What excites you about the future of GEOINT?

Jennifer: With the data set Planet collects, and all of the buzz on machine learning, artificial intelligence, and analytics, we can see daily change that all of us in this industry worked for, and I'm excited to see this data set merge with all of the data already available.

Rich: We're talking about a community that's able to leverage the data set or make it more vibrant and informative. When you combine that with our capacity to understand growth in our industry, I'm excited about how that new data could appear.

Exploring the Margins

Q&A with Daniel Whalen, Vice President of Business Development at Altamira Technologies

Daniel Whalen is the Vice President of Business Development at Altamira Technologies, an open-source technology company that delivers innovative solutions to the defense, intelligence, and homeland security communities. In his role, Whalen leads Altamira's engagements with the marketplace, aligning its solutions with market needs to secure new business and transitioning proposals to business units for on-contract execution.

Q How did your career in GEOINT begin?

GEOINT, for me, has been a thread that started in my earliest days in the Army at the National Training Center at Ft. Irwin. While there, as an OPFOR intelligence officer, I was charged with understanding the terrain and the posture and potential actions of our adversaries precisely and accurately.

"The ubiquity of GEOINT in our lives—over and above how it applies to national security—is exciting."

— DANIEL WHALEN, ALTAMIRA TECHNOLOGIES

Location and the anticipated and actual speed of movement across diverse terrain were central to our success.

Q What challenges did you face in your career?

One challenge is establishing trust with the decision-maker. In the legacy GEOINT Community, the standard issue was a tendency for everyone to be a photo interpreter. We might find ourselves spending considerable time addressing challenges to the method of data collection, and more to its interpretation. I learned that trust between the final intelligence professional and the decision-maker is critical. The decision-maker already has enough soft variables to contend with. To address that issue, I structure reports so that uncertainty is acknowledged and conclusions presented in a highly transparent and understandable manner.

Q What advice would you give young professionals starting their careers today?

Explore the margins and adjacencies of all domains. Consider analogous situations to what is before you when considering the way ahead.

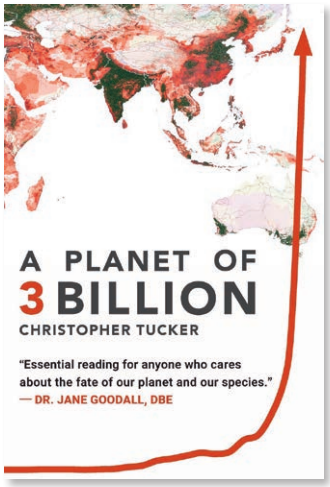
Q How have you leveraged USGIF resources?

I have been an active USGIF participant for over a decade and joined as a member when the opportunity presented itself several years ago. I joined to grow with a community of GEOINT professionals. The annual GEOINT Symposium has been a wonderfully central aspect of my career. Through engagements I have on the floor, in the speaker sessions, and throughout the event, I have grown overlapping personal friendships and professional networks. These engagements extend to the workshops, GEOINTeraction Tuesdays, and the Annual GEOGala—which have produced ongoing engagement with the community.

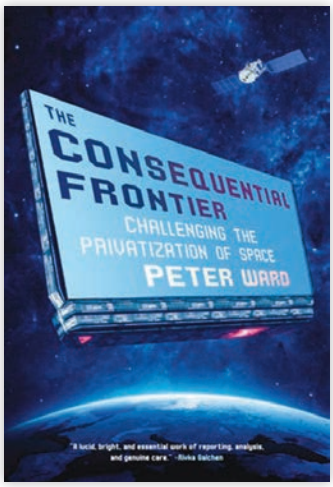
Q What motivates you about the future of GEOINT?

The ubiquity of GEOINT in our lives—over and above how it applies to national security—is exciting. It is inherently understandable and tangible, offering a firm connection to our everyday [lives]. As we move forward, we will look to GEOINT as our lives, politics, and cultures increasingly become interrelated into tightly coupled systems. GEOINT will help us keep the advantage of the security of humankind.

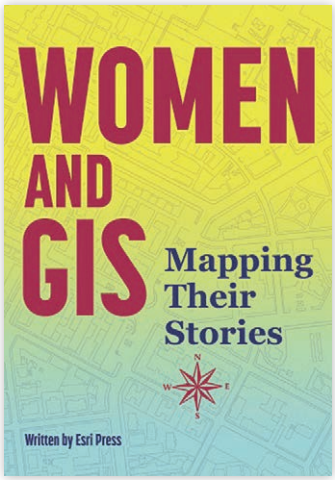
READING LIST



A Planet of 3 Billion
By Dr. Christopher Tucker
How many people can the Earth support? This is the question USGIF Board Member and Chairman of the American Geographical Society Dr. Christopher Tucker poses in his new book. Tucker estimates the Earth's carrying capacity is 3 billion people, and humanity's ecological debt must be paid down promptly. Tucker encourages readers to marshal their own data and calculations to engage in this debate. The book contemplates the fate of humanity by exploring history, science, economics, demography, conservational thinking, ethics, and foreign affairs through a geographic lens.



The Consequential Frontier: Challenging the Privatization of Space
By Peter Ward
Business and technology journalist Peter Ward posed the question: If humans and their private wealth have made such a mess of Earth, who can say we won't do the same in space? In his new book, Ward interviews tech CEOs, investors, scientists, lobbyists, politicians, and future civilian astronauts to shed light on a whole industry and introduce a new generation of activists. Ward explores the amount of cooperation needed to protect necessary universal resources and how beneficial it could ultimately be for humanity.



Women and GIS: Mapping Their Stories
By Esri Press
Esri collected 23 stories of extraordinary women making significant contributions to our world. From oceanographers to activists, archeologists to entrepreneurs, the women in this book tell their stories of how they applied themselves and overcame challenges using map analysis, and geographic information systems (GIS).

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GEOINT Community Week
Virtual

MAY 2–5, 2021
GEOINT Symposium
Orlando, Florida

FEARLESS PURSUIT OF INNOVATION

Q&A with Dr. Chris Scolese, Director, National Reconnaissance Office

Q The cover story of this issue of *trajectory* explores some of the themes and challenges ahead for the GEOINT tradecraft in the new decade. As the NRO Director during a time of rapid technological change, how do you foster the flexibility needed to keep up with evolving mission requirements?

There are three key attributes that contribute to NRO's success. We're small, flat, and streamlined, which enables us to make decisions quickly and adapt to change. And, our end-to-end mission enables us to make improvements at every stage of an acquisition—from research and development through system acquisition, launch, and operations. Third, we are constantly developing and evaluating new capabilities, technologies, and partnerships.

I would also say that our culture of innovation and risk tolerance play an important role, enabling us to achieve innovative breakthroughs within relevant timelines that are needed to maintain our competitive edge.

The foundation of NRO's success continues to be its people. Therefore, we provide the resources and opportunities necessary to enable our team at NRO to thrive. Throughout NRO's history, our vibrant and exceptional workforce has achieved an amazing record of mission success.

Moving forward, we're focused on three strategic areas that guide our approach. First, we must pursue innovative approaches to rapidly infuse advanced technologies into our space and ground systems, which will enable us to stay ahead of our adversaries. Second, we must continue to deliver advanced systems and capabilities. And third, we must continue to evolve existing and emerging partnerships to strengthen our national security space posture. Because let's face it, space superiority is not an entitlement. It's something we must aggressively earn every day. There's no room for complacency. We must fearlessly pursue innovative new ideas with courageous impatience. By acting on these three strategic focus areas, I have absolute confidence that we'll preserve our security interests in space to ensure America and our Allies remain secure and strong.

Q NRO has awarded multiple study contracts to companies in the lead up to acquisition contracts expected later this year. How important is commercial imagery to the overall NRO mission?

Commercial imagery is an integral part of the current GEOINT architecture and an important critical component of our future architecture. Our customers' requirements are changing—they need both high resolution and rapid revisit, they need greater persistence, they need

> "We must fearlessly pursue innovative new ideas with courageous impatience."
>
> — DR. CHRIS SCOLESE, DIRECTOR, NRO

"As we prepare for the next generation of commercial imagery contracts, the NRO has been diligent about seeking to better understand the scope of both existing and emerging commercial imagery providers and their ability to satisfy U.S. government requirements today and into the future."

— DR. CHRIS SCOLESE, DIRECTOR, NRO

spectral diversity, etc. Commercial imagery can help satisfy these diverse needs. Moreover, the integration of commercial imagery capabilities and sources into the national overhead enterprise creates opportunities for acquisition efficiencies and operational synergies. Ultimately, this means delivery of better, faster geospatial intelligence to our customers via a more capable, integrated, resilient, and affordable architecture.

For these reasons, the NRO's approach to commercial imagery—and commercial products and services in general—is best characterized as "buy what we can; build only what we must." It's based on fair and open competition, meaning we recognize that, by its nature, commercial imagery is unclassified, and many providers, especially emerging ones, do not have clearances. This is a changing paradigm for the NRO, but we have truly embraced the value of commercial imagery. As we prepare for the next generation of commercial imagery contracts, the NRO has been diligent about seeking to better understand the scope of both existing and emerging commercial imagery providers and their ability to satisfy U.S. government requirements today and into the future. The GEOINT Functional Manager's requirements, our market studies, and the recent study contracts will all help inform our plans for commercial imagery procurements by late 2020.

Q What are some developments NRO is working on currently that most excite you?

It's definitely an exciting time to be at the NRO, and our future has never been brighter! One area I am especially excited about is the rapid infusion of advanced technologies into our space and ground systems. This is critical for two reasons. First, our competitors are becoming increasingly capable and are spending a lot of time and resources to make space a contested environment, so we must continue the evolution of our future space systems and capabilities to outpace today's threats while meeting or exceeding the performance needs and dynamic execution requirements of our customers. Second, the rapid pace of technology refresh and innovation means we need to constantly look for ways to leverage the best technological advancements coming out of academia, industry, and our own research and development efforts.

Let me give you a few examples of what I'm talking about. We're now leveraging an innovative NRO demonstration satellite program that went from concept to launch in less than two-and-a-half years. This is significant because it illustrates how quickly we can go from identifying a user need to delivering the capability required to meet that need. This program demonstrates a variety of new capabilities designed to accelerate the delivery of data to our user community by featuring an array of sophisticated data processing technologies designed to achieve the rapid collection and processing of information in space and the direct delivery of unclassified data to warfighters in theater. The NRO is also pioneering research to enable our evolving collection capabilities to drive down sensor-to-shooter timelines—closing the gap between data collection and operational decision-making. And, it's also enabling us to meet DoD's dynamic execution requirements against unpredictable, small, fleeting, and quiet targets. All of these advancements will ensure our warfighters stay ahead of the growing scope of multi-domain threats facing the nation.

Another area where we're achieving progress in terms of rapid tech infusion is innovative and cost-effective investments in small satellite technology demonstrations. This is really exciting because it provides a rapid, risk-tolerant, and cost-effective means to develop and evaluate new capabilities in space and get them into operations quickly. One recent example of this was the launch of two IMPACT CubeSats in November 2019 that carried 14 technology demonstrations, four of which were part of our new Greenlighting program. This program demonstrates the on-orbit performance and space survivability of new technologies developed by nontraditional commercial partners that might not be originally developed for space applications but show promise for use in that environment. For example, one of the first Greenlighting experiments delivered was a quarter-sized processor used in the oil and gas industry. Even though the environments in the space industry and the oil and gas industry are different, both are very harsh on micro-electronic components. With Greenlighting, we were able to quickly take a component developed for an entirely different industry and evaluate it for use in space. These types of technology demonstrations are vital to helping us achieve the rapid tech infusion we're looking for to preserve our strategic advantage in space.

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SEE HOW PEOPLE AND NATURE CAN THRIVE, TOGETHER.
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