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OPEN FOR COMMENT

It’s been an interesting summer here at USGIF. Hosting the GEOINT 2015 Symposium in D.C. this June was yet another departure from our normal “battle rhythm,” though admittedly not as challenging as last year’s GEOINT 2013* gymnastics.

Anecdotal feedback regarding GEOINT 2015 has been almost universally positive. We are tabulating the results of our attendee and exhibitor surveys now, and we appreciate the fantastic return rate we always receive. That so many people make the time to provide this very important insight is a testament to the dedicated engagement of our community and our collective commitment to being part of an agile, learning enterprise.

I took a quick peek at early returns and clearly placed among the all-stars of the event were the three Vapor Wake K9 teams we had on site. They were an important part of our overall security plan, with sloppy dog kisses and photo ops as an added bonus. We will report out the collective survey results when they are complete, and we’ll take action to be responsive to the concerns and suggestions expressed where appropriate, feasible, and affordable.

Based on raw numbers, the GEOINT 2015 stats are exciting. We had a record number of confirmed attendees at 5,498, eclipsing the previous record by just about 1,000. There were about 1,500 government attendees from more than 250 federal, state, and local agencies, organizations, and offices, as well as 28 countries represented. Attendees were able to avail themselves of more than 80 hours of professional development training, a record 294 exhibitors, and about 100 government speakers between the general session, Government Pavilion Stage, and other venues such as GEOINT Foreword, which has grown from a small, precursor event to a sizable and remarkably dynamic program in its own right.

Being in D.C. allowed us to offer Family Day in the exhibit hall, which was very well received. At the end of the week, we hosted a vibrant classified session at NSA Campus East on the cyber-location nexus, with a first-ever dual Q&A session with NSA Director/Commander USCYBERCOM Adm. Mike Rogers. We’re eagerly looking forward to returning to Orlando in May for GEOINT 2016, and we’re also exploring options to bring the Symposium back to D.C. some time in the future.

In the event you missed some or all of the Symposium, be sure to check out PDF versions of the GEOINT Symposium Show Daily at trajectorymagazine.com, brought to you by the trajectory staff, as well as HD video of keynotes, panels, breakout talks, lightning talks, interviews, booth tours, and more via our trajectory On Location (formerly GEOINTv) Vimeo page: vimeo.com/trajectoryonlocation.

I hope you’ll enjoy this edition of trajectory, which includes a great piece exploring the current state of commercial remote sensing from space, touching on space resiliency, SmallSats, and diverse phenomenology. Additionally, there’s a look at the evolving understanding of climate change as a national security issue and how GEOINT uniquely contributes to that important discussion.

As we plan trajectory’s 2016 editorial calendar, there’s another opportunity for your feedback. This is the perfect time to let us know which topics you’d like to see in the magazine, which government, industry, and/or academic leaders you’d like to see interviewed, and other content you’d find valuable. Just like everything we do at USGIF, this magazine is for you, the GEOINT Community, produced by our professional association. I look forward to seeing you at our working group and committee meetings as well as our myriad fall events, including a jam-packed GEOINT Community Week in November.

KEITH J. MASBACK | CEO, USGIF
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NGA'S NEW POWER

During his GEOINT 2015 keynote address, National Geospatial-Intelligence Agency (NGA) Director Robert Cardillo touted the principles of openness and inquisitiveness.

“For decades intelligence was like a regulated currency. We guarded it jealously; we controlled it tightly,” said Cardillo, quoting a December 2014 Harvard Business Review article by Jeremy Heimans and Henry Timms, who referred to this currency as “old power.” “They called [old power] ‘closed, inaccessible, and leader-driven. It downloads and it captures.’ As a currency, hoarding is a good thing. … But in today’s world our enterprise must operate differently—less like a currency and more like a current.”

Instead of old power, Cardillo said, NGA needs new power.

Replacing old power with new—at NGA and across the GEOINT Community—demands not only new ideas, but also new objectives, according to Cardillo, who used his keynote as an opportunity to introduce four new strategic goals for his agency: People, Partners, Profession, and Value.

Behind NGA’s new strategy—which the agency test-drove during the Nepal earthquakes in spring 2015—is a revised mission statement: “We strengthen the nation through our command of geospatial intelligence.”

Cardillo pledged that under his leadership NGA would succeed not by providing all the answers but rather by asking all the questions and by being open and accessible enough to receive answers from others.
SHIFTING CULTURE FOR A COMPLEX WORLD

When Gen. Stanley McChrystal first took the helm of Joint Special Operations Command (JSOC), he approved every operation in Iraq—about four a month. Two years later, “We were doing 300 a month, and I was approving none of them,” McChrystal said during his keynote address at GEOINT 2015.

McChrystal, a retired, four-star general, as well as former commander of JSOC and U.S. and International Security Assistance Forces Afghanistan, said culture changed so much while he was at JSOC that approving operations was no longer his job. Rather, he said his job was to create an environment in which decisions could be made at lower echelons, and “to help put people and things in a mindset and position to create something that operated with the kind of synergy you have to have in today’s world.”

Speaking just after the release of his new book, Team of Teams: New Rules of Engagement for a Complex World, McChrystal challenged the audience to rethink decision-making policies, referencing historical examples of how the traditional hierarchy embraced for centuries doesn’t always work. Within traditional organizations, information starts at the bottom and works its way to the top, where decisions are made, and then it’s communicated back down for execution.

McChrystal shared how his own view of leadership has changed. “I started to think about leaders as gardeners,” he said. “When you think about what a gardener does, a gardener doesn’t grow flowers or vegetables. A gardener creates the opportunity, shapes the ecosystem so plants have the opportunity to do what they do well. You’ve got to prepare the ground, you’ve got to do all the things that make it work, but you’re not growing anything.”

HOW CAN YOU HELP NRO?

In her GEOINT 2015 keynote, National Reconnaissance Office (NRO) Director Betty Sapp challenged those working in the commercial sector to rethink conventional wisdom about NRO and help the agency in its mission to provide innovative overhead intelligence systems for national security.

“For all of you in industry, I want you to tell me how you can help with our intelligence challenges—not why I should buy the system you’ve got ready to sell me,” she said. Sapp addressed some traditional notions of NRO, namely that the organization has lost its innovative spirit, repeatedly builds the same things, and only does one size (big) and one speed (slow).

Rather, she emphasized, the organization builds satellites of various sizes and can keep up with the pace of technology, putting mission payloads on a vehicle at the last minute. She added NRO is also misunderstood because its innovation is not entirely in space. The ability to adapt spacecraft for flying new missions, for instance, happens on the ground.

Sapp reiterated that moving forward depends largely on the performance of industry partners. “We want partners who are as committed to our national security mission as we are,” she said. “We have a direct call line to users in the field. We do a lot to combine our imagery with that available from the commercial providers ... It also lets us distribute things we might not be able to otherwise.”

A record 294 organizations exhibited at GEOINT 2015.
EXCEPTIONAL COMMUNITY CONTRIBUTIONS

The 2015 Lt. Michael P. Murphy Award in Geospatial Intelligence was presented to Geoffrey D. Krassy, an air interdiction agent for the U.S. Department of Homeland Security’s Customs and Border Protection (DHS CBP). David Alexander, director of the DHS Geospatial Management Office, presented the award to Krassy on the GEOINT 2015 Government Pavilion Stage.

The Murphy Award is named for Navy SEAL Lt. Michael P. Murphy, a distinguished Penn State alumnus. Murphy was killed June 28, 2005, by enemy forces during a reconnaissance mission in Afghanistan and posthumously awarded the Medal of Honor. The Murphy Award recognizes achievement by a Penn State graduate who is serving or has served in the U.S. Armed Forces or Intelligence Community.

“Geoff’s experience as a special operations pilot combined with his education achievements in geospatial science resulted in a uniquely insightful and practical study addressing the optimal placement of radar to detect low-altitude, ultralight aircraft crossing the U.S. border,” said Dr. Todd Bacastow, professor of practice for geospatial intelligence at Pennsylvania State University. “Geoff’s work offers invaluable lessons into how automated geospatial analysis might be used by the defensive planner.”

Since 2007, Krassy has served as a CBP air interdiction agent along the U.S. southern border. He also served on the project team that integrates fixed-wing patrol aircraft remote sensing capabilities into a common geospatial picture, maximizing the seamless transfer of data between, and interoperability of, DHS air, marine, and ground forces.

The generosity of USGIF, the DigitalGlobe Foundation, and faculty, staff, and friends of Penn State fund the Murphy Award.
The annual USGIF Awards program recognizes the exceptional work and bright minds from all areas of the GEOINT Community. Award winners are nominated by colleagues and selected by the USGIF Awards Subcommittee. The 2015 USGIF award winners have demonstrated great achievements in advancing GEOINT tradecraft.

“Each year as the nominations come in, we are always amazed by the exceptional work of the individuals and teams from government, military, industry, and academia being submitted for consideration,” said Kevin Jackson, chair of the USGIF Awards Subcommittee. “The opportunity to review the dozens of nominations and to understand the significance of your accomplishments and the impact of your contributions to the community, our country, and the world—which most likely never make the news—is truly humbling. The 2015 USGIF Award winners represent a community that we should be very proud to be a part of.”

**2015 USGIF Award Winners Announced**

The 2015 USGIF Award winners are:

1. **Military Achievement Award:** Air Force/Director for Intelligence, Surveillance, and Reconnaissance Interoperability (AF/A2I); Surveillance Intelligence Reconnaissance Information System (SIRIS) Team
2. **Government Achievement Award:** U.S. Army Geospatial Center
3. **Industry Achievement Award:** George Guy Thomas, Collaboration in Space for International Global Maritime Awareness (C-SIGMA)
4. **Academic Research Award:** George Stanley Bosarge, University of South Alabama
5. **Outstanding Administrative/Support Award:** Donna L. Pelle, National Geospatial-Intelligence Agency

Not Pictured: Academic Achievement Award:
Professor Dorota A. Grejner-Brzezinska & Dr. Charles Toth, Ohio State University
Nearly 30 developers and data scientists turned out for the first USGIF GEOINT Hackathon June 12–14. Participants were tasked to determine why certain areas of West Africa were unaffected by the Ebola outbreak as well as predict where additional outbreaks might occur. However, this was their secondary goal—the primary goal was to expose their team’s thinking and build in hooks so another team working with another geography or outbreak could modify the solution to a new set of conditions.

The first-place team included four student interns and was aptly named “Team Intern.” Their solution focused on travel and revealed an “Ebola superhighway” along the coast of West Africa. They were awarded the $15,000 grand prize as well as complimentary registration to GEOINT 2015. Team Intern members are:

- R. Blair Mason, a member of the U.S. Naval Academy class of 2016 and a double major in computer science and aerospace engineering. Mason is currently interning with the Naval Research Laboratory.
- Briana Neuberger, a senior at Rochester Institute of Technology (RIT) double majoring in imaging science and industrial systems engineering. Neuberger is a SMART scholar and intern with the National Geospatial-Intelligence Agency (NGA).
- Dan Simon, a senior at RIT and intern at OGSystems.
- Paul Warren, a junior at Stanford University majoring in computer science as well as an OGSystems intern.

“We developed an open-source python library to model the spread of disease as it’s carried by contagious people through a network of nodes and edges using network theory,” Warren said.

The second-place team produced what it calls “non-historic” predictive analysis and was awarded complimentary GEOINT 2015 registration. “Team Flo Hacks” members are:

- Boris Polania of Hollywood, Fla., a software engineer with post-graduate studies in economics who moved to the U.S. from Venezuela six years ago. Polania recently helped found small software consulting firm V/F.
- Armando Umerez of Boca Raton, Fla., who recently moved back to the U.S. from Venezuela and is also a partner with V/F. Umerez is an electronic engineer with post-graduate studies in marketing.

The third-place team developed an easy-to-use graphical user interface based on sanitation data such as access to water. They were awarded complimentary registration to GEOINT Foreword, the pre-GEOINT symposium science and technology day. “Team Agile” members are:

- Nathan Currier, a senior at Colorado State University, Fort Collins, majoring in computer science as well as an intern with Stinger Ghaffarian Technologies (SGT).
- Jesse Pai, a sophomore majoring in computer engineering at the University of Maryland, College Park. Pai is also an SGT intern.

The GEOINT Hackathon was sponsored by DigitalGlobe, Esri, and OGSystems, and included judges from USGIF, NGA, DigitalGlobe, Esri, and OGSystems.

USGIF Hosts Cyber-Location Nexus Workshop

USGIF hosted its first Cyber-Location Nexus Workshop June 26 following the GEOINT 2015 Symposium. The classified, daylong session held at the National Geospatial-Intelligence Agency (NGA) in Springfield, Va., focused on critical cyber-location challenges and business opportunities. In this photo, National Security Agency Director Adm. Michael Rogers (left) and NGA Director Robert Cardillo jointly address the audience.
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AS THE DEMAND FOR GEOINT professionals continues to rise, academic institutions are following suit to ensure students achieve the knowledge and skills necessary to succeed upon graduation. One group of academic institutions beginning to make its footprint in the GEOINT Community is historically black colleges and universities (HBCUs).

There are 106 HBCUs in the United States, most of which do not have GEOINT programs. In April, the USGIF-accredited geospatial intelligence certificate program at Fayetteville State University (FSU) hosted a two-day “GEOINT at HBCUs” meeting to provide HBCUs with more insight into the GEOINT Community and geospatial sciences curricula. About 20 individuals representing both HBCUs and non-HBCUs across the Southeastern U.S. attended to discuss the state of their respective GEOINT programs and offerings.

As the first HBCU to gain USGIF accreditation in 2014, Fayetteville shared its experience in building a GEOINT certificate program and encouraged other HBCUs to consider doing the same.

“Hosting this event was important because we started something and we didn’t want to stop at just one HBCU,” said Dr. Rakesh Malhotra, assistant professor and program coordinator of FSU’s geography curriculum. “We wanted other HBCUs to participate. It should not just be one university — this is much bigger than that. Workforce development is important and we want to get the students to a point where they can find employment based on the skills they learn from us.”

USGIF, the National Geospatial-Intelligence Agency (NGA), and the U.S. Geological Survey sent representatives to the event, which also provided an opportunity for the three organizations to learn how to better help HBCUs advance GEOINT programs. NGA shared information on its science, technology, engineering, and mathematics (STEM) initiative as well as the grants the agency offers HBCUs under its Academic Research Program.

USGIF CEO Keith Masback discussed USGIF’s Collegiate Academic Accreditation Program, and he shared how GEOINT plays a significant role in the Intelligence Community as well as how academia can make a difference by collaborating with the Intelligence Community.

“I firmly believe we have an obligation to build an increasingly diverse national security community, which is more reflective of the globally connected

PHOTO COURTESY OF FAYETTEVILLE STATE UNIVERSITY

FAYETTEVILLE STATE UNIVERSITY and NORTH CAROLINA CENTRAL UNIVERSITY students visited the Federal Emergency Management Agency in 2014 as part of an annual student and faculty visit to government agencies in the Washington, D.C., area.

PHOTO COURTESY OF NORTH CAROLINA CENTRAL UNIVERSITY

Fayetteville State University hosted a meeting in April with other historically black college and university (HBCU) representatives to discuss the importance of HBCU GEOINT programs.

PHOTO COURTESY OF FAYETTEVILLE STATE UNIVERSITY
world we inhabit,” Masback said.

Participant Wubishet Tadesse, associate professor in remote sensing and GIS at Alabama A&M University, aims to take to the next level the school’s minors in remote sensing and GIS.

“The best thing that came out of the event was knowing we weren’t the only program seeking help, and there was great collaboration from everyone,” Tadesse said. “NGA and USGIF gave us firsthand experience in what we should do and what direction we need to go. Having the meeting was nice, but it’s the continuation of the conversation and keeping in touch with the other universities that will help get the ball rolling for us.”

Dr. Gordana Vlahovic, associate professor of earth and geospatial sciences at North Carolina Central University, said the event helped her understand the next steps for growing a GEOINT program at her university.

“Sometimes it’s hard to take new programs and initiatives off the ground, due to lack of understanding on the part of administration and even colleagues that do not share the same interests,” Vlahovic said. “Thus, it was encouraging to even be in the same room with faculty from several HBCUs that have similar goals and face similar challenges.”

FSU hopes to make the “GEOINT at HBCUs” gathering an annual event to further the dialogue of HBCU involvement in the GEOINT Community.

FAYETTEVILLE STATE UNIVERSITY and NORTH CAROLINA CENTRAL UNIVERSITY participated as a team (left) in the 2014 North Carolina Geography Bowl at the University of North Carolina at Greensboro.

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HELPING NRO REACH FOR THE CLOUD

USGIF’s NRO Application Service Provider Working Group provides recommendations

By Marc Selinger

THE NATIONAL RECONNAISSANCE OFFICE (NRO) has traditionally acquired new computing infrastructure by hiring a prime systems integrator to build and maintain an entire system. Though this approach met the agency’s needs for many years, it can no longer keep up with rapid advances in information technology and cybersecurity threats.

The NRO is shifting toward cloud-based computing to become more nimble and introduce upgrades more quickly, which the commercial world has done for years. However, NRO perceived resistance from industry partners that feared losing revenue as it replaced a few large, system-level contracts with many small ones providing computer-based services over a network.

“One hundred percent of the industry base believes this is the right thing to do, but a new business model is needed to show industry and government how to acquire and sustain capability in the new environment,” said Nick Buck, president and CEO of Buck Consulting Group and a retired Navy defense acquisition program manager. “The challenge is that defining a new business model requires industry partners to put their heads together and make realistic, executable recommendations.”

With NRO’s support, USGIF launched the NRO Application Service Provider (NASP) Industry Advisory Working Group (IAWG) in September 2014 to help create this new business model, identify potential pitfalls, and suggest ways to address them. Buck serves as one of the co-chairs.

“The group is off to a busy start,” said Keith Barber, associate partner for strategic planning at OGSystems, who co-chairs the NASP IAWG with Buck. About 70 people have joined so far, representing a wide range of small, mid-size, and large companies involved mostly in software and systems integration. The working group prioritized a host of topics and has already completed its first round of reports designed to brief both government and industry on selected issues. It also received positive feedback during peer reviews and in a briefing to senior leaders of NRO’s Ground Enterprise Directorate.

During the presentations to government and industry, “we heard comments like ‘superb,’ ‘outstanding,’ and ‘they told us things we didn’t realize,’” Buck said. “It was a great shot in the arm for the group. There’s a lot of momentum and a lot of increased interest from industry because they see that their voices are being heard.”

One NASP IAWG report delves into pay-per-use software licensing options. It suggests that “not one size fits all” and NRO “must fit the licensing model to the program.” The report describes how pay-for-use may make sense if requirements or workloads are unpredictable but that paying by the hour could be inappropriate if a program is “steady state for five years.”

“THERE’S A LOT OF MOMENTUM AND A LOT OF INCREASED INTEREST FROM INDUSTRY BECAUSE THEY SEE THAT THEIR VOICES ARE BEING HEARD.”

—Nick Buck, president and CEO of Buck Consulting Group
Another report examines how to encourage government and industry to adopt an ASP approach. For example, the report recommends offering incentives to industry to perform “hard” tasks and reuse existing software. It also suggests the government celebrate early wins and hone accountability models to encourage program manager adoption.

In late May, the group was selecting topics for its next batch of reports, which it aims to complete by September. But continuing to have regular meetings with NRO will be just as important, Buck said.

“Objectivity and supplier neutrality is essential,” the group’s charter states. “Discussions must be vendor, supplier, and integrator agnostic, not just by product/company but also by architecture. Working group membership is responsible for ‘self-policing’ on this front.”

Buck said USGIF is ideally suited to be the group’s convening authority because of the Foundation’s focus on promoting the GEOINT Community as a whole.

“It can’t be any one company,” Buck said. “It has to be someone who doesn’t have a dog in the fight.”

The ASP IAWG is expected to continue its work until industry and government achieve a workable business model to realize NRO’s vision.

“The rule of thumb on working groups is that they should last six to 12 months but normally go as long as they are useful,” Barber said. “I believe we’ll keep going at least through the end of this year—and beyond as new topics emerge—but the focus could shift.”

Visit usgif.org/education/accreditation for more information.
Even on the sunniest days, there is darkness beyond the Earth’s blue firmament. And it’s about to get darker, according to National Geospatial-Intelligence Agency (NGA) Director Robert Cardillo, who recently predicted: In just a few short years, mankind will witness a “darkening of the skies” over Earth. This new shade isn’t from a dimming sun—which won’t burn out for another 5 to 7 billion years, astronomers insist—but rather a rapidly expanding host of space-based systems, including commercial satellites collecting imagery for use by governments and, increasingly, private enterprises.
DARK SKIES, BRIGHT FUTURE

BY MATT ALDERTON

IMAGE COURTESY OF AIRBUS
Currently, there are more than 300 active Earth observation satellites orbiting the planet, 42 of which are wholly or partially commercially owned and operated, according to the Union of Concerned Scientists. By 2023, governments and commercial enterprises collectively will launch 353 more Earth observation satellites—many of which will be small and affordable enough to constitute constellations capable of imaging every inch of the Earth every day—predicts global space consultancy Euroconsult.

“I’m energized and enthused about this development … It means our analysis of world events is going to be holistic and persistent,” Cardillo said in June at the GEOINT 2015 Symposium. “The democratization of GEOINT and the darkening of the skies is the opportunity of our time.”

Indeed, the “darkening of the skies” isn’t dark at all. For the GEOINT Community, especially, it’s the opposite—bright—according to Rob Zitz, co-chair of USGIF’s Small Satellite Working Group and senior vice president and chief systems architect for the national security sector at Leidos. “We’re right on the cusp of having geospatial information become a commodity; we’re going to be awash in pixels and geospatial data collection,” he said. “The questions are: How do you combine that data with other data sources? How do you derive meaning from it? And how do you automate processes around it?”

GEOINT is the glue that will hold all these loose ends together for decision-making and action-taking.”

As the Internet fueled the information age, the next generation of commercial remote sensing will drive the ubiquity and utility of GEOINT.

“The ability to image the Earth from space has revolutionized life on this planet,” said SmallSat champion Rep. Jim Bridenstine (R-Okla.), a member of the House Science, Space, and Technology Subcommittee. “We can find better routes to where we’re going. We can see when storms are coming. Our warfighters can know where the enemy is located. The implications of seeing the big picture are enormous and extend to nearly all aspects of the human experience. As the needs for remote sensing have grown over the decades, the responsibilities for providing this service have expanded to the private sector and today we are seeing a boom in this industry.”

Although it’s been decades in the making, the boom in commercial remote sensing is owed, in particular, to events of the last three years, which have increased the pace of change so much, so fast, that the next generation of commercial remote sensing isn’t on the way anymore. It’s here.

RESOLUTION SOLUTION
A major milestone in the recent history of commercial remote sensing was the August 2014 launch of DigitalGlobe’s WorldView-3 satellite, the first commercial imaging satellite to offer 30-centimeter resolution imagery and 16 spectral bands.

“WorldView-3 is the most capable commercial satellite ever launched in terms of its ability to see the earth clearly and in new ways,” said Tony Frazier, senior vice president for U.S. Government Solutions at DigitalGlobe. “From an analytic perspective, a 30-centimeter pixel—especially when you consider that it’s 16 bands of spectral information—allows you to collect an enormous amount of content that can be unleashed to address a problem.”

Until recently, DigitalGlobe could collect high-resolution imagery but couldn’t sell it commercially. That changed in June 2014, when the U.S. Department of Commerce granted DigitalGlobe’s request to sell 0.25-meter resolution imagery to its commercial customers. Because of national security concerns, the company could previously sell only 0.5-meter resolution imagery.

“I can remember a time when there was what we called the ‘10-meter rule’: a company could not commercially launch a satellite that would collect better quality than 10 meters resolution,” Zitz said. “We went from 10 meters down to 50 centimeters, and now we’re down to 25 centimeters, which is about a foot. Think about that. That’s better than seeing home plate on a baseball field. That’s discerning windshields on a car and understanding which direction the car is moving. It’s very, very high quality.”

The emergence of better supply has driven increased demand, according to Frazier, who said looser resolution restrictions allow space-based systems to compete for business in segments served primarily by the aerial market, such as agriculture, disaster relief, and land surveying.

These opportunities represent a major win not only for DigitalGlobe, but also for the U.S. government, which in recent years has become increasingly reliant on commercial imagery for its low cost and unclassified nature.

“Folks looked at [the cons] from a national security perspective,” said John Charles, NGA’s national geospatial intelligence officer for commercial imagery.
“But we also looked at the pros in terms of what the commercial industry can bring to us as a partner, both in our DoD and our intelligence missions. We believe the pros outweigh the cons. … [Lower resolution limits] allowed our strategic partners to position themselves to be more competitive and therefore to go off and take some risks … in order to realize new and better capabilities. We believe this helps strengthen the industry and that we in the intelligence and defense communities can leverage that to our benefit.”

In addition to DigitalGlobe, many commercial imagery providers are nurturing increased demand and innovation, according to Kevin O’Connell, president and CEO of Innovative Analytics & Training and co-author of “U.S. Commercial Remote Sensing Satellite Industry: An Analysis of Risks.” “There has been a proliferation of people who are interested in and now participating at some level in this market,” he said. “In that, we’re seeing new kinds of partnerships and different kinds of demand for the data that’s out there.”

Case in point: Airbus Defense and Space has in the last year formed three significant partnerships—with Esri, Harris Corp. (formerly Exelis), and Hexagon Geospatial—allowing commercial access to Airbus satellite imagery.

“The commercial remote sensing industry has collectively made positive strides over the last decade,” said Bernhard Brenner, head of the Geo-Intelligence Programme Line at Airbus Defense and Space. “The key challenge for now is to make the transition into the mainstream and extend our customer client base.”

**LESS IS MORE**

Lower-resolution limits aren’t the only catalyst for the rise of commercial remote sensing.

“The resolution of a satellite image is an important consideration to the GEOINT Community,” Brenner said. “However, it is worth emphasizing that this is not the only consideration when choosing the optimal solution.”

Consider, for example, Airbus’ twin high-resolution optical data satellites, known as Pléiades. Although they travel in the same orbit, they’re far enough apart that at any given moment each is imaging an opposite side of the planet, giving extensive collection opportunities and a high temporal resolution.

“This constellation, especially when allied to the capabilities of [our] SPOT [wide-area optical imagery] constellation, allows for both greater change detection capabilities and improved map information updating capacity,” Brenner continued.

Customer appetite for change detection and updated maps has helped spark the advent of SmallSats, which reached fever pitch this year following Google’s $500 million acquisition of SmallSat pioneer Skybox Imaging in 2014.

“Based on Google’s acquisition of Skybox, the introduction of venture capital into the market is a really important development,” O’Connell said. “What venture capital seeks, of course, is something that’s going to make a lot of money. It often does that on the basis of taking risks. What that means in the United States, at least, is that we’re going to see proposals for systems that are potentially more innovative, potentially riskier, and for which there is the potential for a larger-scale return.”

Added Adam Keith, managing director of Euroconsult Canada, “In the last four years, we’ve seen in the region of $400–$450 million of venture capital coming into the commercial remote sensing business. Prior to that, there were very few examples of venture capital coming into this world.”

Planet Labs and UrtheCast are two companies that embody the SmallSat value proposition. Established in 2010, Planet Labs so far has launched 84 CubeSats, which it calls “doves.” Totaling just 12 inches long, 4 inches wide, and 4 inches tall, each dove costs less than $1 million to build; by contrast, DigitalGlobe’s WorldView-3 is 23 feet long, 8 feet wide, and 18.7 feet tall, and cost $650 million to build. The latter launched five years after its predecessor, WorldView-2; the former went through 12 iterations in less than two years.

“THE ABILITY TO IMAGE the Earth from space has revolutionized life on this planet.” — Rep. Jim Bridenstine (R-Okla.), a member of the House Science, Space, and Technology Subcommittee

**BY 2019, BLACKSKY GLOBAL** plans to have six satellites on orbit—Pathfinder-1 and Pathfinder-2 as well as Global-1 through Global-4.
IN THE PAST DECADE, the commercial remote sensing landscape hasn’t just changed. It’s also expanded, according to global space consultancy Euroconsult, which reports a four-fold increase in the number of countries with space activities, up from 20 in 2000 to more than 80 today. According to its 2014 report, “Satellite-Based Earth Observation: Market Prospects to 2023,” 33 countries launched Earth observation satellites during the last decade, and 41 countries are expected to do so during the next.

“There has clearly been a proliferation in demand across the globe,” said Bernhard Brenner, head of the Geo-Intelligence Programme Line at Airbus Defense and Space.

Europe, where Airbus is based, has made especially large strides in commercial remote sensing. In a public-private partnership with Airbus, for example, the German Aerospace Centre launched TerraSAR-X and TanDEM-X—twin satellites constituting the world’s first spaceborne radar interferometer, which uses microwave imaging to create high-resolution all-weather terrain maps, otherwise known as digital elevation models (DEMs). Subsequently, in April 2014, Airbus introduced WorldDEM, a global 3D DEM constructed using TerraSAR-X and TanDEM-X data.

“At Planet Labs we have what we call ‘Mission 1,’ which is to make change on the Earth visible, accessible, and actionable,” explained Director of Government Affairs Dr. Richard Leshner, who said Planet Labs expects to have its first fully operational “flock of doves” orbiting Earth in 2016. “Our end goal is to have a satellite constellation in excess of 100 spacecraft that can image the entire surface of the Earth every day… We want decision-makers in all spheres of [society] to be able to make intelligent and informed decisions based on changes they’re seeing in the conditions around them.”

Planet Labs has joined the acquisition game as well. At press time in mid-July, the company announced its intent to purchase Canadian commercial imagery provider BlackBridge, including its five-system RapidEye constellation. The acquisition of RapidEye’s six billion square kilometers of imagery at 5-meter resolution will allow Planet Labs to bring to the web one of the largest commercial satellite imagery data sets.

“It’s not final, but our acquisition of BlackBridge and the RapidEye assets is a strategic business decision to get a historical data set and expand our access to a global network of customers and distributors,” Leshner said. “The more data we have, the stronger we can make our data platform, which increases the speed that we’re able to deliver data to our customers.”

Vancouver-based UrtheCast plans to build, launch, and operate what it claims will be the first fully integrated, multispectral optical and synthetic aperture radar commercial earth observation constellation, scheduled to be deployed over multiple launches in 2019 and 2020. Although UrtheCast’s satellites will be larger than conventional Small-Sats—600 to 1,100 kilograms compared to less than 500 kilograms—they will have similar capabilities.

“Having all these sensors in space will help us realize our vision of democratizing Earth observation data, making these powerful resources more accessible and user-friendly,” said Wade Larson, co-founder, president, and COO of UrtheCast, whose constellation will total 16 satellites deployed in pairs across two orbital planes, with four equally spaced pairs in each plane. “This number of
satellites and this configuration will enable the best revisit in the industry—not the best coverage, to be clear, but the best revisit.”

Although resolution of their satellite imagery—3 to 5 meters—doesn’t match that of a larger system such as WorldView-3, Planet Labs, UrtheCast, and their commercial SmallSat peers dangle a different carrot in the form of persistence and better access to specific tasks.

“Our sweet spot is a different kind of data set that doesn’t exist anywhere else: an everywhere, everyday data set that’s enabled by a platform that’s affordable,” Leshner said.

“The data doesn’t have to be perfect; for some customers, “quick” and “current” are more important than “clear” and “precise.”

“[SmallSats] might not be defense-grade satellite systems, but if you can guarantee daily or weekly revisits regardless of weather, that can have a lot of value in the area of change detection, which has applications across multiple sectors,” Keith said. “With those capabilities, these companies have the potential to open up existing markets and even develop new ones.”

The possibilities are staggering, according to Jason Andrews, president of SmallSat startup BlackSky Global and president and CEO of Spacelift Systems, a space logistics company providing “rideshare” launch services for commercial satellites.

“Ten years ago we didn’t even have Google Maps. We went down to the local map store, and that was our view of the world,” Andrews said. “For the last decade we’ve been able to go on the Internet and look at Google Earth, but it’s a very static environment. The future we’re working toward is ‘Google Earth Live.’ If you want to see how many cars in a Wal-Mart parking lot in Duluth at 4:30 in the afternoon, these new constellations will be able to tell you.”

In 2016, BlackSky Global will launch the first six satellites in what will eventually be a constellation of 60.

“Moore’s Law has advanced the size, weight, and power of modern electronics into something that can be packaged cost effectively in a small form factor,” said Andrews. “You have to live with the fact that it’s only going to last in space for a couple of years, but because it’s cheap enough, that’s OK; you can afford to replace it. On top of that, the availability of launch services like Spaceflight means there’s much more ready access to space. That supports everybody in this industry.”

NURTURING INNOVATION

SmallSat operators face just as many challenges as opportunities, acknowledges Andrews.

“The number of satellites being launched is very exciting. But at the same time, a lot of promises so far have gone unfulfilled,” he said. “As an industry, we have to be really careful about overhyping the potential. Our customers are receptive to these new capabilities, but we have to deliver. That requires management of expectations, realistic timelines, and focusing on the end product.”

It also requires government support, according to Leshner.

“As more companies try to get into commercial remote sensing, it will put added pressure on NOAA (the National Ocean and Atmospheric Administration) to respond efficiently and rapidly to provide licenses for operation, and

"Countries like Vietnam and Egypt are both experimenting with SmallSat systems and constellations, and others—like the United Arab Emirates—are being pioneers by saying, ‘We’re not going to build space systems, but we’re going to buy what’s commercially available from everyone else,’” O’Connell said.

For the United States GEOINT community, the globalization of commercial remote sensing creates both opportunity and challenge.

“It means the GEOINT Community is going to have to do a couple things,” O’Connell said. “One, it’s going to have to innovate on its own in order to stay ahead of the curve. And two, it’s going to have to improve its ability to leverage capabilities from the outside.”

Added Orrin Mills, director of the Source Operations Group at the National Geospatial-Intelligence Agency (NGA), “The genie’s out of the bottle. There’s no going back [to when the United States and Russia were the only players in space], so we have to look at this as an opportunity to embrace new technologies and new capabilities, and to use them to our advantage against our adversaries.”
on the national security community to become comfortable with the explosion of data providers.”

To that effect, Bridenstine in May introduced the Commercial Remote Sensing Act of 2015, proposing regulatory reform to encourage growth in the U.S. commercial remote sensing industry.

“I have been focusing on these issues for the past two years and have seen constant innovation within industry. Every few months, companies come to tell me about new products or capabilities they’ve developed … I think it is crucial that government not stamp out this momentum.”

A second bill Bridenstine co-sponsored that was introduced in March—the Weather Research and Forecasting Innovation Act—would authorize $9 million for a pilot program under which NOAA would be required to purchase space-based weather data from commercial providers and test it against NOAA proprietary data.

“While this is a small amount, it serves as a necessary first step,” Bridenstine said. “The pilot program signals to the private sector and potential investors that Congress and NOAA are interested in buying data, and it allows NOAA to verify that forecasts can be enhanced with commercial providers.”

The weather bill, which passed the House in May and is awaiting action in the Senate, could be a major boon to commercial remote sensing. According to Dan Stillman, senior manager of corporate marketing and communications at PlanetIQ, a SmallSat company aiming to launch the world’s first commercial weather satellite constellation by 2017.

“If it’s passed, it will send a clear signal to investors that that with higher-quality imagery that has been shot in the recent past and tie it to video and other georeferenced data sources,” Zitz explained.

Which is exactly what customers like NOAA covet.

“We cannot allow ourselves to become inundated with all the data that’s out there,” said NGAs director of persistent GEOINT Jennifer Daniel. “We have to be able to create coherence. We have to be able to take data, and we have to be able to connect it and understand it … to maximize the capabilities of all our [data] sources.”

The fusion of the new variety of commercial data sources represents the future of the GEOINT Community, which through automation and integration will be able to turn geospatial information into a commodity that’s searchable, shareable, and actionable.

“[We’re engaging] a revolutionary period that’s going to change the way people can view where they are in context and what they’re doing in context with data sources that are multiple and varied and can be combined to provide a lot of rich information content in a way that wasn’t really feasible just a handful of years ago,” Leshner said.

The skies may be darkening, but the next generation of commercial remote sensing promises to shed more light on Earth than ever before.
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GEOINT HOLDS PROMISE FOR UNDERSTANDING CLIMATE
In a sunny afternoon in May, President Barack Obama stood before a class of U.S. Coast Guard graduates and unequivocally made the case for climate change as a national security issue.

“I’m here today to say that climate change constitutes a serious threat to global security, an immediate risk to our national security, and make no mistake, it will impact how our military defends our country,” he said.

The same day, the White House released a new report, “The National Security Implications of a Changing Climate,” which chronicles the national security implications of climate change and stresses that its impacts increase the “frequency, scale, and complexity of future defense missions.”
For days, the Internet was abuzz with reactions. Some applauded President Obama’s strategy, some questioned whether national security is the best lens through which to frame climate change. In short order, headlines returned to crises that demanded immediate attention: torrential downpours in Texas, record-breaking heat in Alaska, drought in California, a deadly heat wave in India.

In his speech, President Obama said terrorist group Boko Haram exploited the instability partially created by severe drought in Nigeria, and that drought and crop failures helped fuel the early unrest in Syria. Regardless of the causes of climate change, the U.S. now faces increasingly volatile environmental conditions on American soil as well as in politically fragile parts of the world that can’t be ignored. The resounding call is to arm our defense, intelligence, and homeland security communities with environmental intelligence in order to better anticipate climate-related security threats.

The GEOINT Community plays a critical role in leading the effort to better understand climate change and mitigate damage. From imaging and measuring the Earth to mapping environmental and human risks, GEOINT can provide increasingly accurate and timely information about a changing planet to yield better decision-making.

Yet there are many uncertainties: How can the dots be better connected with current data? How can warnings be improved? What is the best way to graphically represent the second and third order national security effects such as changes to growing seasons and water security? How is a changing climate tied to extreme weather events?

“The question that many policymakers have is, when an extreme event happens, can it be scientifically tied to the fact that we’ve changed the climate?” said Rear Adm. (ret.) David Titley professor of practice at Pennsylvania State University’s Department of Meteorology and director of the Center for Solutions to Weather and Climate Risk. “For millennia we’ve had storms and droughts, but the data shows that we’re having more severe heat waves. When it rains, it rains harder.” Connecting these events with climate change, he said, requires adequate monitoring. “Having long-term time series is very important. “If you can do that long enough, the signal comes out of the noise.”

Retired Air Force Maj. Gen. Richard Engel, director of the National Intelligence Council’s (NIC) Environment and Natural Resources Program, said he’s not surprised certain weather phenomena, such as an increase in the number of extreme weather events, are occurring as a result of climate change; however, the rate at which this is happening is disconcerting.

“If these really are fundamental changes we’re seeing, and not just the normal statistical variation in weather,” he said, “we’re in for one whale of a rough ride.”

A 2013 Harvard report, “Climate Extremes: Recent Trends with Implications for National Security” details the security risks of extreme weather and climate change, finding that higher temperatures, stronger tropical cyclones, wider areas of drought, increased precipitation, Arctic warming, and continued sea level rise will affect water and food availability, energy decisions, and the design of critical infrastructure. The report stressed the U.S. government is not prepared for the “new climate normal” and must better observe key indicators, monitor unfolding events, and forewarn of impending security threats.

The biggest environmental threats to national security are threefold: changes in the Arctic, sea level rise, and extreme weather, which includes dangerous heat, drought, and flooding.

**WHEN WEATHER FUELS THE FIRE**

The United Nations Intergovernmental Panel on Climate Change (IPCC) projects sea level could increase up to 23 inches this century. Satellite data collected over a 23-year period beginning with the TOPEX/Poseidon launch in 1992 shows a steady global sea level rise of about three millimeters per year, nearly 50 percent faster than the rate in the previous century.

Although the Arctic is changing faster than anywhere else on Earth thus far, nations have been working together...
to keep the region peaceful. Russia and the U.S., for example, recently agreed to regulate trawling in newly melted waters. However, rising temperatures and melting permafrost means reduced military vehicle access, degraded infrastructure, and uncharted waters for commercial activity. Most significantly, the melting Arctic is a major factor in sea level rise around the globe.

Sea level rise has led to more frequent “nuisance flooding”—whether at the Tidal Basin a mile south of the White House or in the streets of Miami—but the potential for greater flooding has prompted the U.S. Navy to carefully examine its coastal bases in conjunction with geospatial data such as tidal gauges and LiDAR to ensure the service is prepared for long-term operations.

Bordering India’s east coast, Bangladesh—a country the size of Iowa with a population of 157 million—is often cited in sea-level rise scenarios. As heights increase, millions of people will be displaced from the country’s coastal flood plains. A flood may drive the people of Bangladesh to move into areas or across borders where they’re not wanted, causing food and water shortages, or worse—violence.

Christine Parthemore, a senior research and policy fellow at the Center for Climate and Security, who previously worked at the Department of Defense (DoD) and teaches a class on climate change and national security at Johns Hopkins University, said her biggest worry is we’re too focused on the Arctic, where it’s easy to see ice melting. According to her, the most serious geopolitical hotspots lie between 20 degrees north and south of the equator.

“We need to look at North Africa and a lot of places in Southeast Asia that are both important to U.S. security interests and strategy,” she said. “I think climate change is going to wreak havoc in these parts of the world, and we have the knowledge to put these pieces together and mitigate the potential security risks.”

The unknown destabilizing potential of extreme weather is what defense experts are calling a “threat multiplier”—weather events are not causing wars, infectious disease, or terrorism, but they are a contributing factor.

Marc Levy, deputy director of Columbia University’s Center for International Earth Science Information Network and an author of the IPCC report, said he’s never seen anything more serious in security terms than climate change. Levy added it’s easy to imagine how a political hotspot layered with a climate hotspot could result in disaster, citing examples of regions where preexisting grievances coupled with an unprecedented drought or flood has led to unrest.

The Syrian Civil War is the latest candidate for what Levy calls a “climate war,” given the unprecedented, widespread drought, massive relocation, and violence, leading to 3.3 million refugees and a death toll of 220,000.

“I think the easiest thing the Pentagon deals with is the operations stuff—trucking in water because local supplies have run out,” Levy said. “Harder to handle are the effects from a climate shock that trigger a breakdown of order—political events like the Arab Spring, a severe food crisis, or refugee camps in Europe with people crossing the Mediterranean.”

FROM THEORY TO APPLICATION

In addition to the IPCC and White House reports, the climate change-national security connection is the subject of numerous reports from a number of organizations, including the NIC, G7, National Research Council (NRC), and CNA Military Advisory Board. Climate change has also been addressed in the DoD’s Quadrennial Defense Review and the Director of National Intelligence’s Worldwide Threat Assessment.

While the DoD and Intelligence Community have said publically climate is a threat to be taken seriously, the question remains: What are they doing about it?

“It’s one thing to mention in a report, another to take action,” Levy said.

Lt. Gen. (ret.) Mike Flynn, former director of the Defense Intelligence Agency, said thinking about chronic, long-term threats such as climate change is difficult for Americans, versus threats in front of us today, such as extreme weather or ISIS.

For starters, the government needs a clear message and plan, and neither has

The defense and intelligence communities have an increasing need for the timeliest and most accurate information on cloud characterization, soil moisture, snow depth, cyclone intensity, and ocean winds.

Throughout history, weather information has been sourced from balloons, ships, airplanes, and radar. Today, satellites provide the backbone for global coverage and weather models, and the new generation of satellites will help us better understand storms and weather patterns. Their effectiveness depends on each satellite’s orbit, instruments, and technologies, as well as the time lag between data capture and availability.

The National Oceanic and Atmospheric Administration (NOAA) operates two types of satellites: polar operational environmental satellites (POES), which fly 940 miles above Earth’s surface and provide full global coverage and weather predictions for up to a week in the future; and geostationary operational environmental satellites (GOES), which remain stationary above the equator at an altitude of 22,300 miles and provide near-continuous observation of a fixed region. POES help predict the intensity and location of severe weather events several days in advance, such as in the case of the infamous “left hook” track of Hurricane Sandy.

NOAA is working with NASA to develop the next generation of POES, called the Joint Polar Satellite System (JPSS), which is planned for...
launch in 2017. Offering full global coverage twice a day, the system will increase timeliness and accuracy of public warnings. JPSS includes a Cross-track Infrared Sounder to measure atmospheric temperature and water vapor, which will improve both short-term weather “nowcasting,” long-term forecasting, and our understanding of major shifts like El Niño.

The GOES-R Series, also a collaboration between NOAA and NASA, is the next generation of geostationary systems. It is expected to launch in 2016 with Harris’ Advanced Baseline Imager and Lockheed Martin’s lightning mapper, both of which will provide more advanced imaging of environmental phenomena that directly affect public safety.

NASA’s ISS-RapidScat, which launched in 2014 and sits outside the International Space Station, provides data about wind speed and direction over the ocean. The scatterometer plays a critical role in producing weather forecasts that inform ship deployments and rerouting. NASA’s Soil Moisture Active Passive (SMAP) satellite was launched into a polar orbit this year and uses a radiometer and spinning antenna to measure the water in the top two inches of soil, offering high-resolution data for local weather forecasts, drought early warnings, and flood warnings. Further, SMAP provides operational benefits for DoD with its ability to assess terrain and ice characteristics as well as forecast dust and fog.

The U.S. also uses satellite data from other countries. For example, data from Japan’s new Himawari-8 weather satellite may be factored into U.S. weather models.

However, not every country that shares weather information is a U.S. ally, and recent discussions have brought to the forefront the question of how much the U.S. should depend on certain nations for this data. As some satellites retire, specifically, Meteosat-7—a European satellite that provides Indian Ocean and Middle East coverage—the U.S. may find a gap in weather coverage in a critical area of the world.

been communicated well to Americans, Flynn said. Those having a hard time putting bread on the table need a “crystal clear explanation” as to why climate change matters.

“I don’t think the Intelligence Community has done it well, I don’t think the administration has done it well, I don’t think the international community has done it well, and the presidential candidates aren’t talking about it,” Flynn said.

Muddying the White House’s message, the CIA shut down Medea, its decades-old, off-and-on climate study program in May, just days after the administration released its “National Security Implications of a Changing Climate” report. The program had provided civilian scientists with environmental data collected by submarines and satellites to help study the connection between security and climate change.

Meanwhile, the U.S. Geological Survey’s Civil Applications Committee (CAC) allows civilian agencies access to classified satellite imagery for non-military, non-classified purposes such as monitoring climate change. CAC activities include remote sensing applications such as monitoring sea ice, glaciers, and volcanoes; detecting and tracking wildfires; coordinating emergency response to natural disasters; and monitoring ecosystems.

The consensus among experts is a lack of information sharing and no central authority hinders analytic capabilities.

Rear Adm. Jonathan White, director of the Navy’s Task Force on Climate Change, said the U.S. needs to better fuse and synchronize observations of what’s happening at ground level with the ability to predict what is coming in terms of a changing climate.

For example, we can zoom into Google Maps to see a restaurant, but in the future, White said, could we pull up a map and see what a flash flood would do to the same block?

“Then we could start making decisions,” White said. “That granularity is something we should be striving for. We’re not there yet, but it starts with GEOINT.”

The National Geospatial-Intelligence Agency (NGA) has taken a large step in this direction, recently awarding Arizona State University a $20 million, multi-year grant to fund the Foresight Initiative. The initiative examines how to anticipate and visualize global environmental change, specifically as it relates to national security.

Ted Cope, NGA’s director for Basic and Applied Research, described climate change as a “wicked problem with no solution,” but with a set of continual tradeoffs. For example, he described the tradeoff of increasing the amount of water released from a hydroelectric dam during an extended drought to sustain agricultural needs while diminishing the electrical production of the dam, which would cause widespread economic impacts. He said Foresight, when fully realized, will allow multi-discipline government experts, planners, and decision-makers to collectively “see projected outcomes of their decisions and policies” leveraging models, simulations, and supercomputer power to formulate mitigation and adaptation strategies.

Cope said Foresight will also demonstrate how GEOINT can contribute authoritative data to serve as a credible “game board” to establish a foundation for launching anticipatory conjectures.

In June, NGA and the National Center for Atmospheric Research held a first of its kind Climate and Human Security–Geospatial Data and Mapping symposium at the University of Colorado at Boulder. The goal of the symposium was that it serve as a catalyst for a “broad community of purpose across the government,” Cope said, “to explore how we collectively could get better synergy for tackling the complexities of climate change effects on national security-related issues.” A conference paper published late this summer will capture the proceedings and recommended actions.

The European Space Agency (ESA) is taking steps to study climate change as well. Satellite data can be used to capture wavelengths of fluorescent light from vegetation and determine the level of photosynthetic activity in that vegetation. This practice has already been done using data from systems such as Japan’s Greenhouse Gases Observing Satellite and Europe’s Global Ozone Monitoring Experiment. However, ESA’s Fluorescence Explorer (FLEX)
“I don’t think the Intelligence Community has done it well, I don’t think the administration has done it well, I don’t think the international community has done it well, and the presidential candidates aren’t talking about it.” — Lt. Gen. (ret.) Mike Flynn

GAPS REMAIN
For the amount of scientific data we have on the world’s changing climate, we still lack the ability to predict its effects, said Jim Baker, director of Forest and Land-Use Measurement for the Clinton Foundation. The ability to answer the queries of the Intelligence Community (How much will it rain? What will this volcano do?), he said, requires a stronger understanding of the atmosphere, as well as faster computers to crunch the data.

“We know the overall trends, but knowing when a drought or storm will start or end is very tough, and that’s exactly what national security wants,” Baker said. “If you have an area of conflict—Syria or Iraq—and there’s a big change in climate there, do you know what the weather impacts are? Other than broad predictions, I’d say no.”

Security experts say the only thing harder than predicting the climate is predicting human behavior. Climate change is largely a human geography problem, rather than one of physical geography. When a region is hit with a climate shock, one community may come together and become more resilient while the other deteriorates and becomes violent. How will any one population react?

Currently, the Intelligence Community addresses such questions by gathering multidisciplinary subject matter experts on a particular region, Engel said.

“If the climate scientists tell us in 2040 [a particular] country will experience [a predicted] kind of stress, you ask the experts, ‘how will people...

satellite is expected to provide unprecedented capabilities in fluorescence observation and help scientists better understand the global carbon cycle, state of food security, and effects of climate change on crops. FLEX is a candidate for ESAs eighth Earth Explorer mission in competition with CarbonSat, which intends to study levels of carbon dioxide and methane in the atmosphere to understand how they are linked to climate change. ESA and the Earth observation community will select in September which mission will launch under Earth Explorer.
With a $1.9 million grant from the Pentagon that began in September 2014, the center is developing a similar tool for South and Southeast Asia that is expected to be available next year. The center is also starting work on a Middle East mapping project to explore the nexus of water, energy, and human security. Finally, they’re looking at adding the ability to explore different scenarios, i.e., if health care quality or sanitation were improved one percent, how would that change overall vulnerability? Ashley Moran, associate director of the center, said the idea is to create plug-and-play tools that can interface with existing DoD systems and allow decision-makers to explore intervention strategies.

The Air Force’s 14th Weather Squadron is also exploring how to overlay maps with public health data that would be useful in better preparing for situations such as Haiti, where a devastating earthquake was followed by a hurricane and a cholera outbreak. In addition, the squadron is working on creating a global version of the U.S. Drought Monitor so the DoD and Intelligence Community can improve six-month outlooks. This would inform them when a country is 90 days from running out of water, and enable them to visualize reservoir levels and local unrest as a drought becomes imminent.

Levy said connecting the dots in these ways is more important than any one initiative. He noted that an NRC report, which recommended the Intelligence Community establish a system of periodic “stress testing” for countries to better manage potentially disruptive climate events, made an important suggestion, but the government hasn’t yet acted on the recommendations.

The Intelligence Community wants to know how to determine risk, said Roger-Mark DeSouza, the Wilson Center’s director of Population, Environmental Security and Resilience. “How do you assign a value for risk that you can use for decision-making?” he said. “You try to be objective, but it’s a little bit of an art. If there’s a way to do that in terms of technology, it would be very compelling.”

Cope said at NGA, the bigger challenge is not the technology, but rather educating a new generation to think about these multidimensional problems and to reason spatially, temporally, and contextually. He said the next level of capabilities would enable users to see connections and interdependencies as well as consequences of their decisions before they’re made.

“How can we enable people to make these good resource decisions and help them visualize the outcome?” Cope said. “Having a keen grasp of the near present, having insights to connections, and observing that something has changed—that’s what gives us that magic anticipatory power.”

Ted Cope, director for Basic and Applied Research, NGA
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In the late ’90s, telecom giant Southwestern Bell Telephone Company (SBC) acquired many “baby Bells,” which brought with them a mishmash of regional maps ranging from Computer-Aided Design diagrams of Chicagoland infrastructure to 100-year-old hand-drawn maps of lines running through West Texas ranch country. In a quest for order and computerized mapping capabilities for its service trucks, SBC turned to TerraGo’s one-time parent company, Layton Graphics, to standardize its maps.

While working toward uniformity, “Sooner or later, somebody asked the logical question: ‘Can we hook up GPS to this?’” said George Demmy, TerraGo’s chief technology officer, who has been with the company since its Layton Graphics origin.

“That’s partially what got us into the geospatial side of things.”

As the millennium arrived, TerraGo transformed SBC’s static maps into interactive georeferenced PDF map books with supporting software to allow for measurements and display of coordinates. This helped workers in the field find what they needed more quickly or to point out items on the map to headquarters for correction or update. The National Geospatial-Intelligence Agency and Army Geospatial Center got wind of this capability and adopted Layton Graphics’ GeoPDF tools to make maps easier and quicker for warfighters to create and use.

As a result, Layton Graphics in 2005 spun off its mapping software business as TerraGo, which has
for the last decade created tools to facilitate map creation and dissemination.

“Our purpose at TerraGo was then and has always been providing tools for people to better communicate their work, information, data, and insight to the widest possible community,” Demmy said.

The company was at the forefront of the smartphone revolution, helping companies use mobile devices to collect geo-referenced data and receive maps in the field. TerraGo leadership predicts a near future where this process will be as ubiquitous as social media.

“If you think about some of the paradigms of social networking—ease of use, the ability to share what you see and what you understand in a trusted environment of only the people who need to see it—that’s what we’re trying to do [with maps] at TerraGo,” Demmy said.

Communications between headquarters and personnel in the field have only improved as smartphones get smarter. When Apple and Google added location capability to their respective mobile device operating systems in 2007, organizations had options for a growing number of GPS uses in decision-making as well as access to an increasingly smartphone savvy workforce.

TerraGo developed its Edge product to take advantage of emerging location-based smartphone tools, suggesting smartphones—particularly those attached to Bluetooth GPS receivers—were capable of highly accurate geospatial data collection.

“Edge is a distributed, enterprise-managing, group-sourcing application that’s got a server component and uses mobile clients to collect and share information,” Demmy explained.

Data sharing brings TerraGo back to its roots. With Edge, offline mobile devices can gather geo-referenced photos, videos, and notes to be sent to organization headquarters and compiled into maps once connectivity is regained. The maps are returned to the field for use and further updates.

“Talk about democratization of data,” Demmy said. “Where once you had several dozen piles, now you’ve got this OGC (Open Geospatial Consortium) GeoPackage that can actually be consumed through SQLite technology, which is on every smartphone and web browser on the planet. It can be consumed on non-geospatial and geospatial workflows as well. That’s democratization of data in spades.”

Companies now use mobile devices to perform surveys and utility fieldwork, inspect oil and gas pipelines, dispatch emergency services, track transportation and shipping, and much more.

As the smartphones and location-enabled technology continue to proliferate, TerraGo’s products are hardly static. The company’s GeoPDF-oriented software suite is at version 6.7, and Edge recently introduced version 3.6.

“‘We’re not a GIS company in the sense that we don’t build geographic information systems—we extend them and make them more relevant.’”
— George Demmy, chief technology officer, TerraGo
TEAM OF TEAMS: NEW RULES OF ENGAGEMENT FOR A COMPLEX WORLD
By Gen. Stanley McChrystal, U.S. Army (Ret.)

McChrystal set out to discover whether the lessons he learned as commander of Joint Special Operations Command were unique to the military or if they reflected a universal change that could be applied to government and business. The findings make the case for modern organizations to develop a “team of teams,” and eschew traditional hierarchy to instead promote transparency and decision-making throughout their organizations.

THE ACCIDENTAL SUPERPOWER: THE NEXT GENERATION OF AMERICAN PREEMINENCE AND THE COMING GLOBAL DISORDER
By Peter Zeihan

In his book, international strategist Peter Zeihan examines how geography will matter more than ever in a de-globalizing world, and how America’s geography is sublime when considering factors such as free trade, energy independence, and an aging population.

SANCTUARY: EXPLORING THE WORLD’S PROTECTED AREAS FROM SPACE
By The Institute for Global Environmental Strategies

From the Great Barrier Reef in Australia to the Sundarbans in Bangladesh, this collection of stunning satellite images and nature photography highlights how the view from space is an important tool to help protect some of the world’s most threatened locations.

PEER INTEL

The Radiant Group acquired data analytics and software development company HumanGeo. The acquisition will enhance The Radiant Group’s technology offerings by adding HumanGeo technology in the area of mission-focused data analytics. HumanGeo will retain its company name and leadership team.

Former USGIF Chairman of the Board Stu Shea was appointed to the board of trustees at Riverside Research. He was formerly COO of Leidos and has more than 30 years of leadership and business development experience in the government contracting space. Shea is now CEO of Shea Strategies.

Boeing announced several executive appointments effective in June following the creation of a data analytics group within its defense, space, and security business. USGIF Board Member Dewey Houck is now chief data analytics officer for defense, space, and security. Houck was previously the vice president and general manager of electronic and information solutions for Boeing’s network and space systems business.

L-3 Communications appointed Mark Von Schwarz senior vice president and president of the company’s Aerospace Systems business segment. Von Schwarz is a 15-year veteran of L-3, having previously served as president of the ISR and Aircraft Systems section and Mission Integration division of L-3 Aerospace Systems.

Dr. Kirk Borne was hired to serve as principal data scientist with Booz Allen Hamilton’s strategic innovation group. Borne was previously a George Mason University professor of astrophysics and computational science focused on data science education and research.

Northrop Grumman appointed Steve Lunny vice president and program manager for its intelligence, surveillance, and reconnaissance division within its information systems sector.

American Systems added Keith McGhee to its executive team. McGhee serves as vice president and director of the global training and development directorate, overseeing the group’s business development, financial management, and workforce management goals.
Join us for a week of briefings, educational sessions, workshops, technology exhibits and networking opportunities.

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Attendees at the June GEOINT 2015 Symposium in Washington, D.C., had the opportunity to participate in Family Day during the final afternoon of the event. Families learned about the world of GEOINT by exploring the technologies in the exhibit hall offered by 294 exhibitors. About 60 eighth through 12th graders from Anne Arundel County Public Schools’ summer STEM program also toured the exhibit hall. USGIF’s Young Professionals Group hosted a ScavenGeo Dash, an educational scavenger hunt with challenges designed for all ages. From simple imagery analysis to identifying satellite components using Lego models, the challenges helped participants learn basic GEOINT knowledge. Prizes were awarded to teams that completed the dash in the shortest amount of time. Pictured is the Wenks family, whose team IntelliGEOINTsia won the ScavenGeo Dash. From left to right: Tyler, age 9; dad Lt. Col. Kevin Wenks, Joint Staff Directorate of Intelligence; Caroline, age 11; and mom Christina.

To learn more about Family Day and view videos of GEOINT 2015 keynote addresses, breakout discussions, exclusive interviews, and more, visit www.vimeo.com/trajectoryonlocation.
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Analytics

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