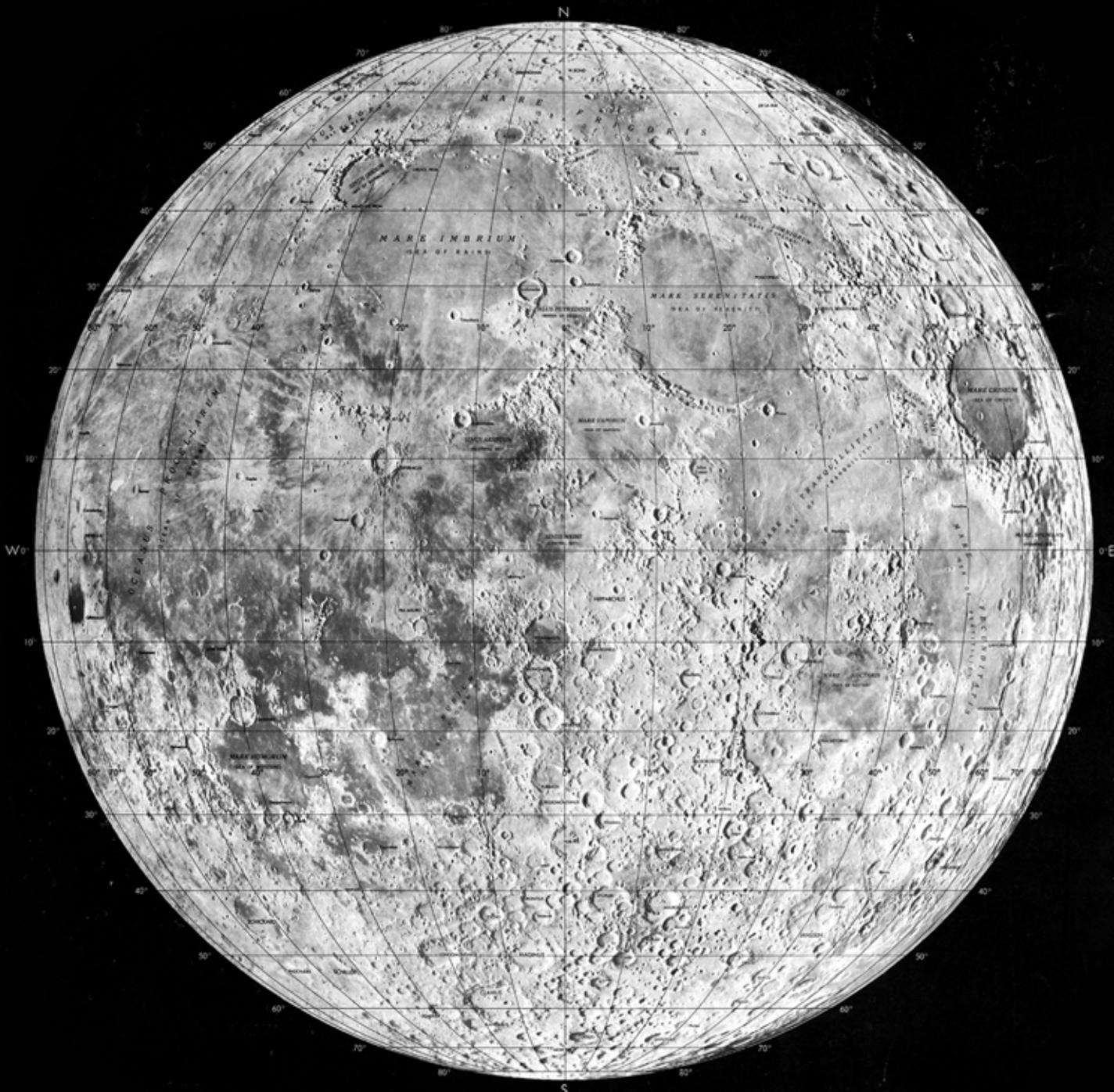


NGA

PATHFINDER

Magazine of the National Geospatial-Intelligence Agency

Vol. 12, No. 3 Summer 2014



INNOVATIVE LEGACY
NGA predecessors pave way for lunar exploration

Innovation at core of NGA's everyday life

AT NGA, INNOVATION IS AN EVERYDAY IDEA.

It is inherent in everything we do. Still, we dedicated the month of June to innovation to encourage employees at every level to deliberately think of ways we could do business better. Nothing was off the table. From technology to morale, we asked, and the workforce responded.

Among the more popular features of Innovation Month was the graffiti wall displayed in the atrium and open for contributions from all employees – civilian, contractor and military. You responded overwhelmingly. Innovation tips ran on NGA Today throughout the month of June. On flat screens in the atrium, we played “Ted Talk” videos and prominent quotations on innovation from academic leaders. Directorates also ran programs and events that paralleled these activities, such as a 3-D fair, and research and development discovery days.

We hosted members from four academic institutions who demonstrated their schools’ programs and innovations in the geospatial sciences. The third week of the month was designated industry week, and private-sector partners joined us at NCE and NCW for exhibits, demonstrations and panel discussions.

In this issue of Pathfinder you will find examples of our Innovation Month activities and interactions, which represent just a smidgen of the innovative and forward-thinking ideas and activities explored during the month and just a glimpse of what you have been doing all along.

We have made gains in the technological capabilities needed to more deeply immerse analysts in data. The wearable devices article in this issue focuses on those gains by looking at Oculus Rift and apps we created that work with Google’s Glass headset. You will also see some of the other ways NGA is already breaking new ground, like being the first intelligence agency with an organizational account on GitHub, where we shared code that can help first responders and others do their



jobs more efficiently and effectively. This issue also takes a look at how we continue to encourage interest in STEM careers internationally and a look back out our mapping legacy that paved the way for lunar exploration in the last decade of the 1960s into today.

Sadly, our agency suffered a loss to its innovative spirit July 20, when our industry innovation advocate, Polly Shaffer, passed away. Her legacy to our agency is one of ingenuity and hope. She looked beyond the current state of our mission, our products and our services and saw what they could be. Polly was the embodiment of innovation, and our agency will not be the same without her. This issue of Pathfinder is dedicated to Polly and her tireless commitment to progress. May we all – family, friends and coworkers – find inspiration in Polly’s work and take comfort knowing that her efforts and her service will have lasting effects on our agency and our nation.

I am proud of the everyday innovation I see within our walls. You are an amazing workforce that regularly challenges the norm and brings to light new and creative ways of delivering world-class GEOINT to our mission partners and customers around the world.

I hope you enjoy this issue of Pathfinder. Keep up the good work.

Letitia A Long
Letitia A. Long
Director

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NGA Leadership
Director: Letitia A. Long
Deputy Director: Michael A. Rodrigue
Chief Operating Officer: Ellen McCarthy

OCC Leadership
Director: William M. Caniano
News & Information Chief: Christine Phillips
Editor: Glenn Holloway
Designer: Valorie Brinson

Contact us
Telephone: 571-557-5400
DSN 547-5400

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Find out more about NGA

NatlGEOINTAgency

@NGA_GEOINT

pathfinder@nga.mil

www.nga.mil



On the cover: The lunar mosaic was created in 1962 by U.S. Air Force Aeronautical Chart and Information Center, with photographs from three different observatories.

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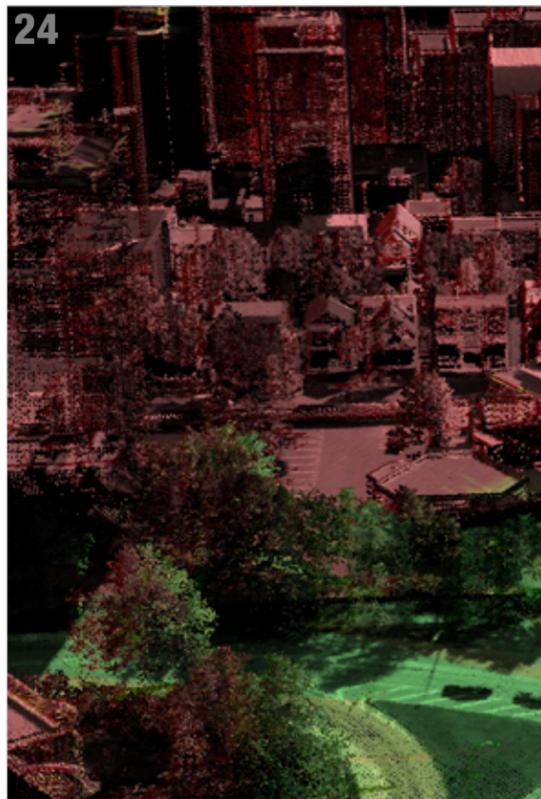
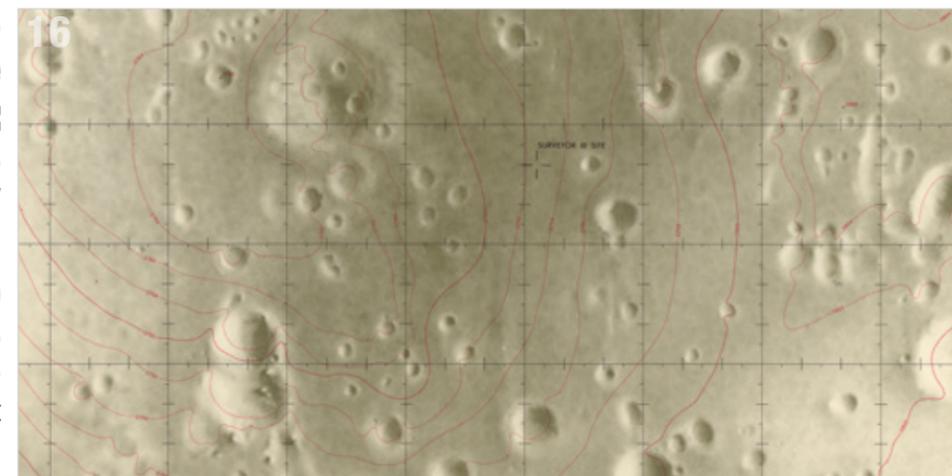
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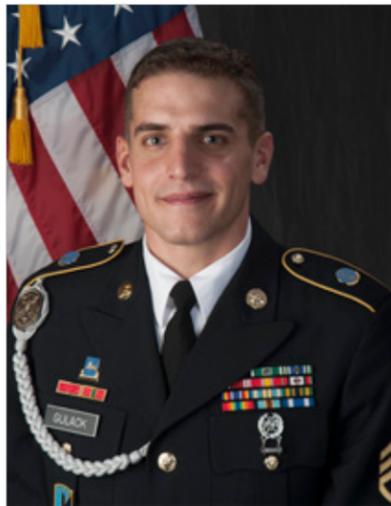


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By Regina Galvin, Office of Corporate Communications
Photo by Tony Boone, Office of Corporate Communications

“His soldier skills, his training and his work as an imagery analyst earn him respect,” said Samuelson. “Gulack won the National Ground Intelligence Center’s Best Warrior Competition 2013,” said Samuelson. “He was nominated as the Geointelligence Midgrade Analyst of the Quarter, and he’s received several Army commendation medals.”

Gulack’s work on a joint intelligence endeavor enabled the discovery of valuable opposition data on electrical infrastructure and power-flow dynamics, according to official Army records. The records characterized his accomplishment as unprecedented for someone of his rank and experience.

When he first entered the Army, Gulack said he was just another soldier pushing a broom. Life changed for him three years ago when he was sent to training to become an imagery analyst.

“I didn’t know what an imagery analyst was three years ago,” said Gulack.

Today he attributes his success to his passion for the job and his coworkers.

“I love what I do and the people I work with” said Gulack. “Our team is out there doing great things.”

Gulack’s team of imagery analysts works with intelligence analysts as part of NGA’s Source Directorate Fusion branch. “In all-source intelligence, we fuse products together, make overall products and send to the customers,” said Gulack.

No longer a 19-year-old who isn’t sure what we wants, at 24, Gulack is focused, driven and excited about the work he’s doing, he said.

“We’re supporting national-level intelligence products all across military and civilian agencies, and the team I work on is the best in the military,” he said.

“You come in to work and you can see the big picture of what you’re doing — it makes you want to work even harder,” said Gulack. “It makes you want to strive harder to make these things happen so that the products you’re sending to the customer have even more of an impact.”

Know a service member worthy of an NGA Salute? Send your suggestion to Pathfinder@nga.mil. ✨

NOT LONG AGO, JACOB GULACK WAS A Fresno, California, teenager trying to figure out his life’s direction. Today, he’s an award-winning Army staff sergeant mapping out a career in geospatial intelligence.

Gulack is a cyber-infrastructure team squad leader serving in the Army GEOINT Battalion at the National Geospatial-Intelligence Agency in Springfield, Virginia, who embodies the “total soldier concept,” said his supervisor, Sgt. 1st Class David Samuelson.

‘Argo’ mastermind speaks at NGA headquarters

By Jason Moll, Office of Corporate Communications

ANTONIO “TONY” MENDEZ, RETIRED CIA officer and mastermind of the operation that brought six American diplomats out of Iran following the 1979 embassy takeover, addressed National Geospatial-Intelligence Agency employees and Commonwealth partners at NGA headquarters in Springfield, Virginia, June 9 as part of the agency’s Distinguished Speaker Series.

The DSS was created to introduce to NGA’s workforce speakers who could discuss relevant topics, including intelligence, leadership, innovation, science and education.

Tony Mendez and the “Argo” operation have a legendary status within the intelligence community, said NGA Director Letitia A. Long in her introduction.

Tony and his wife, Jonna, used film clips to explain the genesis and planning of the ruse that served as the basis for the book Tony Mendez co-wrote, “Argo: How the CIA and Hollywood Pulled off the Most Audacious Rescue in History,” and the 2012 Hollywood hit “Argo.”

While serving as chief of disguise in CIA’s Office of Technical Service, which created the gadgets and

disguises used by officers and agents alike, Tony Mendez conceived and planned the operation to free the diplomats, he said.

The extreme circumstances fueled Tony Mendez’s creativity as he plotted the operation that led the six Americans to safety, he said. He and others created a cover story in which he and the six Americans portrayed themselves as members of a film crew that had flown to Iran to scout filming locations. The ruse allowed them to fly out of Tehran under the watchful eye of the revolutionary guards and their supporters. ✨

Coast Guard team at agency HQ a boon to collaboration, customer service

By Rachael Groseclose, NGA Analysis Directorate

IN APRIL AFTER A YEAR OF PLANNING, THE NATIONAL Geospatial-Intelligence Agency welcomed six embedded U.S. Coast Guard members to its headquarters in Springfield, Virginia.

The Coast Guard assistant commandant for intelligence and criminal investigations, Rear Adm. Christopher J. Tomney, has been a strong advocate for incorporating GEOINT into the service’s mission since stepping into his role in May 2012.

The team at NGA is a direct result of that advocacy, said Lt. Cmdr. Kelly Moyers, head of the new department. The service has no cadre of formally trained GEOINT instructors and relies heavily on NGA for required training.

“While we may be taking a few small steps in terms of GEOINT capabilities, the Coast Guard sees the department’s new environment enabling our members the capacity to get up, walk smoothly, run, and soon sprint in the world of GEOINT,” said Moyers.

The Analysis directorate sponsors the team, which reports back to the Coast Guard’s Intelligence Coordination Center for all service-related requests for information for analysis and production, said Moyers.

Only one team member is a fully trained imagery analyst, so most of the team is taking fundamental imagery and geospatial analysis courses through the NGA College

to build their tradecraft, said Moyers. Since being assigned to the department, one intelligence specialist has completed the “Introduction to GEOINT” course and is attending the “Fundamentals of Geospatial Analysis” course.

“It’s good to be here because now my team has people to lean on and leverage their tradecraft,” said Moyers. “I think that is what’s exciting and what will be most useful is the analyst-to-analyst interaction. The hope is once the team is trained, they can move past responding only to (requests for information) from the field and start producing more advanced analytic products.”

The partnership is mutually beneficial, said Moyers. With a Coast Guard presence at NGA, there is an opportunity to educate NGA about the service’s mission.

This mutual understanding of the needs and capabilities on both sides is vital to integrating GEOINT into the Coast Guard’s vast mission set, said Moyers.

“The Coast Guard’s motto is ‘semper paratus,’ meaning always ready,” said Lt. j.g. Justin Walters. “Positioning the Coast Guard alongside NGA allows both sides to better prepare for ever-changing threats and deliver time-relevant GEOINT products to our customers. Although we must be prepared to respond, we must also be able to anticipate security events requiring a Coast Guard response. Being here at NCE does just that.” ✨

"Positioning the Coast Guard alongside NGA allows both sides to better prepare for ever-changing threats and deliver time-relevant GEOINT products to our customers. Although we must be prepared to respond, we must also be able to anticipate security events requiring a Coast Guard response. Being here at NCE does just that."
— Lt. j.g. Justin Walters



Coast Guard assistant commandant for intelligence and criminal investigations, Rear Adm. Christopher J. Tomney, and NGA Director Letitia A. Long cut a ribbon July 14, officially opening the new USCG detachment at NCE. Photo by Kevin Clark, Office of Corporate Communications

Open source opens door to public innovation at NGA

By Jacquelyn Karpovich, Office of Corporate Communications

THE NATIONAL GEOSPATIAL-INTELLIGENCE

Agency in April established an official organizational account on the popular code repository site Github and began posting software code for open-source development.

NGA Director Letitia Long discussed the move during her April 15 keynote at the GEOINT symposium in Tampa, Florida, noting the opportunity it affords the agency.

"It's another great example of how we can be innovative," said Long. "Most folks might think, 'You are an intelligence agency and you put your software code out there?' Yes. We did."

Long's buy-in on the effort is impressive, said GitHub's Ben Balter, a former presidential innovation fellow, who watched a video of her GEOINT symposium speech in April.

"The director knew what open source and GitHub (are, and she) spoke passionately about the potential at GEOINT," said Balter. "Not many other agencies have that type of top-

down buy-in. That's incredible."

It's also noteworthy that NGA released something that has value to the community, said Balter. It didn't put code out for the sake of putting out code.

"It's well documented, issues are tracked in the open, and contributions are readily accepted from the community," said Balter.

Code for GeoQ, software developed and advanced by NGA and the Federal Emergency Management Agency, was the first to be shared, said Ray Bauer, technology lead for NGA's Integrated Work Group Readiness, Response and Recovery. GeoQ allows NGA and first responders to quickly merge multiple sources of imagery, resulting in faster damage assessments and better resource prioritization in a time-sensitive environment.

NGA released code for GeoEvents software, developed jointly between NGA and MITRE Corporation, in May, said Bauer. GeoEvents gives users a customizable common operational picture for tracking events, such as natural disasters, and has been used by deployers and first responders in over 100 real-world events.

"We are accelerating collaborative development efforts to ensure the Web application capabilities meet essential emergency response needs in preparation for the upcoming storm season," he said.

The goal is for GeoQ to be used as a significant analytic tool for the local, state and federal response communities during this hurricane season and other crisis response events.

"This is another first for NGA," said Bauer. "We are continuing to expand our development partnerships and bonus off a growing pool of shared resources while changing the business model for software development as well as changing the standard for crisis response"

The latest NGA releases on Github are a Request-for-Information Generator and GeoWave, said Bauer. The RFI Generator simplifies the RFI creation and management process for first responders supporting

relief efforts. It was used during hurricanes Isaac and Sandy, flooding in Boulder, Colorado, and mudslides in Snohomish County, Washington. GeoWave is a multidimensional indexing layer for searching big data.

"NGA has at least five more code repositories that we plan to make available on GitHub as they make their way through NGA's release process," said Chris Rasmussen, NGA's lead for the GitHub initiative.

"We appreciate the support of the NGA. Our initiative seeks to demonstrate how we can implement location-based technology and effectively distribute information to first responders and others quickly in the event of local emergencies."

— Tommy Battle, Huntsville Mayor

Releasing open-source code also achieves a number of goals for the agency, both strategic and practical, said Rasmussen. It gives back taxpayer-funded projects and helps reset expectations between the public and the intelligence community. It also provides the benefits of rapid prototyping, and the code can actually end up being more secure due to the transparency of open-source improvements.

Open source provides government the opportunity to create communities around shared challenges, and keeps communities from reinventing the wheel each time, said Balter.

"If NGA creates something great, and GSA uses it, everyone wins," said Balter. ✨

 Awesome- Director Long is now talking about @github and how @NGA_GEOINT is starting to release open source code.

 @NGA_GEOINT first intel agency to post open source code to github. #GEOINT2013 this is huge for the future of our industry. #applause

May 2013 Executive Order, Making Open and Machine Readable the New Default for Government Information — Openness in government strengthens our democracy, promotes the delivery of efficient and effective services to the public, and contributes to economic growth. As one vital benefit of open government, making information resources easy to find, accessible, and usable can fuel entrepreneurship, innovation, and scientific discovery that improves Americans' lives and contributes significantly to job creation.



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Gulf War

shaped NGA operations, influenced tradecraft

By Jason Moll, Office of Corporate Communications

NEARLY A QUARTER CENTURY HAS PASSED since the U.S. and other members of a multinational coalition began assembling forces in Saudi Arabia in response to Iraqi President Sadaam Hussein's invasion of Kuwait.

That defensive operation, known as Desert Shield ultimately, placed three-quarters of a million troops between Hussein and the border of Saudi Arabia and led to Operation Desert Storm, an offensive that began Jan. 17, 1991, and within days drove Hussein's invading forces back into Iraq.

Analysts at organizations that would later become the National Geospatial-Intelligence Agency were among those providing intelligence support to President George H.W. Bush and other U.S. leaders in the buildup, deployment and execution of Operations Desert Shield and Storm.

During Desert Shield, analysts with the National Photographic Interpretation Center, an NGA predecessor, and other agencies kept U.S. leaders apprised of events unfolding in the region. The Defense Mapping Agency — also an NGA

1990

- Aug. 2**
Iraq invades Kuwait.
- Aug. 3**
United Nations Security Council, or UNSC, calls for Iraq to leave Kuwait.
- Aug. 6**
UNSC imposes a worldwide ban on trade with Iraq.
- Aug. 8**
Iraq annexes Kuwait as its 19th province. U.S. Air Force jets arrive in Saudi Arabia.

Nov. 29

UNSC authorizes "all necessary means" to expel Iraq from Kuwait and sets Jan. 15 deadline.

1991

- Jan. 15**
UN ultimatum to Iraq expires.
- Jan. 17**
Coalition forces launch air and missile strikes on targets in Iraq and Kuwait. Operation Desert Storm begins at 3 a.m. The air offensive targets Iraqi air defenses, communication networks, weapons plants, and oil refineries.
- Feb. 24**
(8 p.m. EST Feb. 23) Coalition ground campaign officially begins. Desert Sabre ground offensive begins. Coalition forces invade Iraq and Kuwait from northeastern Saudi Arabia. "The liberation of Kuwait has entered the final phase," President Bush tells nation. At least 200 oil wells on fire in Kuwait.
- Feb. 27**
After 43 days of combat, U.S. President George H.W. Bush suspends offensive military operations and "lays out conditions for permanent cease fire." "Kuwaiti troops raise emirate's flag in Kuwait City." Coalition forces suspend offensive operations exactly 100 hours after the ground campaign began.

"During the campaign, analysts viewed enemy forces on satellite imagery, then processed the imagery with a special measurement technique to identify their precise geographic location."

— Scott Lang

forerunner – created maps and charts that helped the U.S. military and its partners understand the desert terrain, coastal waterways and harbor approaches in the Persian Gulf.

DMA employees worked 10- to 12-hour days six days a week as the agency moved to 24-hour operations to update old products and create new ones, according to documents from NGA's Historical Research Center. DMA also created 19 different kinds of escape and evasion charts to assist service members behind enemy lines and a special "blood chit" that guaranteed a monetary reward for civilians helping downed aviators avoid capture.

Maps were so important that the U.S. Central Command gave them equal billing with medical supplies, weapons and ammunition, according to archival documents.

DMA maps were the foundation on which imagery analysts identified the positions of Iraqi forces, said NGA GEOINT analyst Dennis Stephen Dumain, who was then an Army chief warrant officer. Various imagery exploitation activities merged with NPIC and DMA in 1996 to form the National Imagery and Mapping Agency, NGA's direct predecessor.

During the campaign, analysts viewed enemy forces on satellite imagery, then processed the imagery with a special measurement technique to identify their precise geographic location, said NGA staff officer Scott Lang, also an Army chief warrant officer. Once analysts obtained the coordinates, they placed a map under a transparent overlay, on which they marked the enemy's positions.

"We used acetate overlays to lay down where all of the tanks, artillery, trenches, new roads and logistics were," said Dumain. "It was a very labor-intensive process, especially when we needed to mark the location of individual pieces (of equipment)."

While imagery analysis was tedious, disseminating the intelligence products was even

harder, said Lang. The early 1990s were at the cusp of the digital revolution, and transmitting a digital image took between 30 minutes and three hours. Many products were only delivered by classified couriers, who traveled throughout Washington and the greater Middle East.

"We didn't have a good way of sending graphics like we do now," said Lang. "So, we would often just send (warfighters) a list of coordinates of where things were."

Imagery analysts provided insight into the location of military equipment, said John Crilley, NGA's Iraq Issues branch chief, who served as an Army staff sergeant during the war.

Precision became more important than ever as Iraqis hid their weapons in orchards and beside mosques and other civilian locations and used their destruction as propaganda, said Lang.

Clouds and adverse weather limited the capabilities of satellites and other imagery assets, said Army Brig. Gen. John F. Stewart Jr. in his review of military intelligence in Operation Desert Storm. Assets were likewise constrained in their ability to capture wide-area photos with high resolution. Military intelligence also did not have a robust digital transmission system.

Before offensive operations began, some of the Army's imagery analysts were reassigned to the Army's Digital Imagery Transmission System located at the in Washington Navy Yard. The Army analysts were asked to provide some final imagery intelligence requirements.

"They brought us the big plan for the big push, and they said, 'we need these locations,'" said Lang. "And we spent the entire weekend producing a stack of images, maybe a foot high, giving them anything that was forward — lines of communications, target areas, fuel replenishment locations and landing zones."

The intensity of their work diminished once the campaign began, and they stood by to provide any additional support warfighters requested, said Lang.

Continued on page 10

PRODUCTS OF DESERT SHIELD/ DESERT STORM

- 257,000 copies** of 19 different versions of escape and evasion charts.
- 25,000** Special Desert Storm **bloodchits**.
- 12,000 individual products** printed on 100 million sheets.
- 35 million charts** printed.
- 600 digital products**.
- U.S. Transportation Command moved more than **55 C-5s filled with maps** from the U.S. to the Middle East, enough to fill 130 18-wheel trucks.
- 8,000 tactical target locations** determined during the offensive stage of operations.
- 1900 unique maps and charts** produced and over **56 million paper maps** printed by DMA Aerospace Center.



Pallets and containers of equipment sit in a logistics support area during Operation Desert Shield. U.S. Army photo by Staff Sgt. F. Lee Cockran



U.S. Marines assigned to the 2nd Marine Division's Charlie Company, 1st Battalion, move out on a mission after disembarking from a CH-46E Sea Knight helicopter during Exercise Imminent Thunder, part of Operation Desert Shield. U.S. Air Force photo by Tech. Sgt. H. H. Deffner

Continued from page 8

“ONCE it started, there really wasn’t that much we could do,” said Lang. “It was moving so fast and furious that we simply sat back and watched what was going on. We were doing some analysis and (battlefield) damage assessments, but we couldn’t keep up with them because they were moving so fast.”

Imagery analysts contributed greatly to the destruction of enemy tanks, said Dumain.

“Our (imagery analysts) had a pretty good idea about where every other (enemy) tank was,” said Dumain. “And (U.S. forces) were knocking them out left and right because they could reach much farther than the Iraqis.”

In the following decade, the rusty carcasses of destroyed Iraqi tanks prompted pilots to call in reports, said Crilley.

“Years afterwards we were still plotting those tanks to keep people straight,” said Crilley. “There were so many tanks out there that pilots would

sometimes call and say Iraq was about to invade Kuwait all over again. I ended up doing a big study on that.”

Military commanders praised NGA’s predecessors for helping them visualize the battle space and pinpoint enemy forces.

“No combat commander has ever had as full and complete a view of his adversary as did our field commander (Army Gen. H. Norman Schwarzkopf),” said Army Gen. Colin Powell, chairman of the Joint Chiefs of Staff from 1989 to 1993, in an historical account of the Gulf War.

The analysts now marvel at how far technology and tradecraft have evolved since the first Gulf War.

“Back then, it took a long time to get the warfighter our products, but now you can clip an image and send it forward almost instantaneously,” said Crilley. “We all learned a lot from the criticisms during that war, and I think, in the long run, (they) helped make us better.”

DESSERT STORM/ DESERT SHIELD BY THE NUMBERS

- 12 UNSC resolutions passed against Iraq.
- 34 Countries participating in U.S.-led coalition.
- 300,000 Iraqi troops occupying Kuwait.
- 750,000 Coalition troops participating in Operation Desert Shield by Jan. 1991.
- 540,000 U.S. personnel.
- 63,000 Iraqi POWs.
- 8,000 – 10,000 Iraqi forces killed in action.
- 300 Coalition killed action.



INSPIRING INNOVATION: Multi-INT, collaboration add value to IC investments

By Regina Galvin, Office of Corporate Communications
Photo by Tony Boone, Office of Corporate Communications

INNOVATION IS THE PROCESS OF INTRODUCING NEW IDEAS AND METHODS INTO the status quo. An intelligence community initiative, the Art of Multi-INT, and its progeny, the Multi-INT Tradecraft Community of Practice, is trying to do just that, said Phil Hwang, technical executive for the National Geospatial-Intelligence Agency support team to the National Reconnaissance Office.

In interviews with the Pathfinder, Hwang and Melissa Pacak, branch chief for the tradecraft operations branch in the Office of Analytic Plans and Programs, address the origins of AOMI, the evolution of MINT-T-CoP and how they hope tradecraft collaboration can bring additional value to the IC investments in technology, infrastructure and data sharing.

TO ADVANCE OUR MISSION CAPABILITIES FOR (THE DIRECTOR OF NATIONAL Intelligence’s) intelligence-integration vision. AOMI is about the practice and sharing of multi-INT tradecraft. Innovative analytical tradecrafts are being invented every day by analysts and collection officers to solve some of the most wicked intelligence problems, but their creation is only known within their small group. We will shortchange our mission if their findings are not captured, documented and scaled in a way to be discoverable and shareable. This would allow these innovations to solve other problems and drive continuous collaborative creation of new tradecrafts.

AOMI IS A GRASSROOTS EFFORT TO IMPROVE INTELLIGENCE THROUGH leveraging multi-INT tradecraft. Its objectives are to discover and share the community’s best tradecraft of Multi-INT analysis; to foster collaboration across functional disciplines; to identify multi-INT challenges and solution approaches; and to generate ideas and actions for multi-INT opportunities to advance our intelligence mission.

The 2013 AOMI was a huge success and was driven top-down by an Integrated Product Team with the senior representation for 11 IC organizations including ODNI and USD. They saw the value of focusing on sharing multi-INT tradecraft in the IC. They selected eight AOMI deep-dive round table topics they deemed most critical to bring practitioners of multi-INT analysis from across the community to share the results of their analysis (and) their knowledge (and) intellectual know-how with each other. Seven topics were mission based, with only one cross-cutting roundtable on Tradecraft Capture and Documentation, which I co-moderated with Eric Vessey from the National Security Agency.

AOMI roundtable moderators spent more than eight hours with the IPT on recommendations from the nearly 300 AOMI contributors. The IPT organized and ranked all recommendations into 27 actions. They voted that the No. 1 priority was the establishment of a grass-root, multi-INT tradecraft community of practice. ODNI took the action and asked Eric and I to lead this effort and the MINT-T-CoP was born.

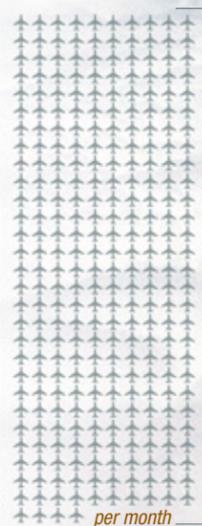
PHIL, WHY IS THE ART OF MULTI-INT IMPORTANT TO THE INTELLIGENCE COMMUNITY?

MELISSA, YOU WERE ONE OF THE FIVE LEADERS OF THE SECOND ART OF MULTI-INT COMMUNITY INNOVATION EXCHANGE IN MAY. PLEASE EXPLAIN THE RELATIONSHIP BETWEEN THE AOMI AND MINT-T-COP?



U.S. Air Force U-2 Dragon Lady, photo by Master Sgt. Rose Reynolds

U-2 BY THE NUMBERS

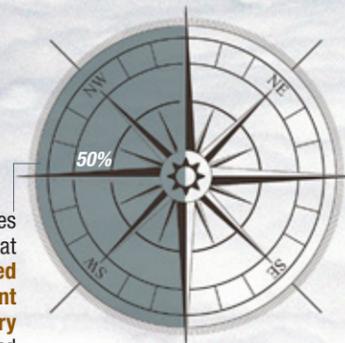


During the five months of **Desert Shield**, the U-2 flew **284 sorties** and 2726.2 hours, averaging nearly 57 sorties and over 545 hours per month.



During the six weeks of **Desert Storm**, the U-2 flew 260 sorties and 2022.5 hours, averaging over **43 sorties** and 337 hours per week.

Authorities estimated that the U-2 provided about **50 percent** of all imagery intelligence and 30 percent of total intelligence for the war.



WHAT IS THE DIFFERENCE BETWEEN INTEGRATED WORKING GROUPS AND THE MINT-T-COP?

HWANG: MINT-T-COP IS ABOUT SOLVING PROBLEMS THROUGH THE EXCHANGE of knowledge and crafts. It seeks to share and document tradecraft, going beyond learning to collaboratively creating new tradecrafts and best practices in real time. In the IC, the multi-INT community members share two important characteristics: 1) they work on very hard intelligence problems that do not yield to (single) INT approaches, and 2) they proactively reached outside of their silos to other INT experts to solve these problems. Multi-INT practitioners are a coalition of the passionate and one of intelligence integration and all-source's best friends.

The MINT-T-CoP extends the concept of an integrated working group into open, self-organizing working groups at the grassroots level. The idea is a community that's porous where people can come in, learn, share, collaborate and even leave. Mentoring is one of the best ways to share, learn and invent tradecraft. Traditionally, mentoring is practiced on a one-to-one basis where I learn more from Melissa than she does from me.

MINT-T-Cop is a group of the willing — IC-wide analysts coming together (with a) common cause and need to improve tradecraft practices to solve mission problems. While the focus is on sharing and capturing multi-INT tradecraft, single INT tradecrafts are always welcome.

IT SOUNDS LIKE CROWDSOURCING.

HWANG: IT IS FOCUSED CROWDSOURCING ON KNOW-HOW (AND) TRADECRAFT. People within the different INTs will start recognizing that they have similar problems with similar fundamental characteristics. You're trying to solve a timeline problem. I'm also trying to solve a timeline problem. We have totally different objectives, but the timeline is the underlying commonality. Once we recognize that, we can start building taxonomy between them. Many cognitive tradecrafts transcend the domain for which they were invented. By documenting and sharing tradecraft, we envision applying tradecraft invented for one issue to solve other problems — and even classes of problems.

HOW DOES THE MINT-T-COP ACCELERATE THE GOAL OF BROADENING AND DEEPENING TRADECRAFT?

HWANG: BY EXPOSING INNOVATIONS TO OTHERS IN THE MINT-T COP, tradecrafts will be critiqued . . . by peers. But they don't just critique. They also suggest ways to refine the ideas with wider application, resulting in new tradecraft. This is tradecraft co-creation. The director means broadening and deepening by continuously advancing tradecraft.

WHAT'S DIFFERENT ABOUT AOMI AND MINT-T-COP, AND WHY SHOULD PEOPLE CARE?

PACAK: THE SPARK OF CREATIVITY IS OFTEN BORN IN TIMES OF CRISIS — WHEN circumstances force individuals, organizations, and (communities) to do great things. Yet, when the smoke clears and the sweat dries, we walk away usually without capturing the critical “ah-ha” analytic breakthrough moments the crisis illuminated — those instances of lightning in a jar.

If we don't capture and share tradecraft knowledge, those “ah-ha” cinders turn to ash without our notice. As part of tradecraft, we need to introduce urgency into the routine, to discover the lightning in the day-to-day business analysts, scientists and collection managers routinely conduct without notice.

The MINT-T-CoP shares analysts' “ah-ha” moments by illuminating solutions that work for individuals and others with similar problems in processes and methods that capture best practices through collaboration by making tradecraft wisdom discoverable and sharable. These sparks become available to analysts in other mission areas and across the IC and Department of Defense.

WHAT ARE THE CURRENT OBSTACLES TO CO-CREATING AND SHARING EFFORTS?

PACAK: PROFESSIONALLY, WE LACK VENUES TO EXCHANGE AND DISCOVER innovative ideas new analytic methodologies across mission and/or organizational boundaries. Technically, we do not have an easy, non-evasive way to capture our tradecraft knowledge, so we rely mostly on direct mentoring. The MINT-T-CoP is attacking these issues at the grassroots level and working bottom-up to help with the DNI's Intelligence Integration objective. Intelligence integration is the sum of all-source, multi-INT and integrated tasking and collection.

HOW CAN MANAGEMENT HELP?

HWANG: BY UNDERSTANDING, ALLOWING, ENCOURAGING AND EVEN REWARDING the sharing and capturing of tradecraft. For AOMI, analysts and collection officers are enthusiastic. They say, “This is great. We'd love to share. We have things that we have done that could help others and we'd love other people to know about it.” But almost in the same breath, they ask, “Would you mind smoothing it with my management? Otherwise, I'm not going to be allowed to participate.” I spend a lot of time talking to people's management (so) people (are) allowed to share. It's a new way of thinking. Once they understand the value, they generally are very supportive. This is why the community of practice is truly something that we need to help nurture and help establish.

ANY SUCCESS STORIES SO FAR?

PACAK: EVEN THOUGH THE COP IS IN ITS FORMATIVE INFANCY WITHOUT FORMAL documentation and metrics, we do have anecdotal successes. One analyst said they heard the solution for a problem they had been struggling with for years at a discussion for a totally different intelligence issue. It was the similarity in intelligence reasoning process that gave them the breakthrough. Another example from 2013 was the common complaint in several roundtables that analysts were “wasting” time foraging, organizing and conditioning data and workflow. When the same tool was offered by their peers as workable solutions for their own problems, the (use of) that tool quadrupled in a few months.

WHAT'S NEXT?

PACAK: (FROM THE MAY EVENT) WE'RE LOOKING AT WHAT ACTIONABLE ITEMS we, as the MINT-T-CoP, can take action on. In August, we're looking at holding some leadership/organizational meetings. We have a skeleton structure now — we're looking at solidifying our structure in the August timeframe. We're also looking at a MINT-T-CoP kickoff and another AOMI forum in November.

ALTHOUGH MINT-T-COP IS AN IC-WIDE ENDEAVOR, PHIL HAS SAID GEOINT SHOULD BE THE CATALYST TO ADVANCE MULTI-INT. WHY?

HWANG: MULTI-INT IS STEEPED IN GEOINT. THE MULTI-INT COMMUNITY IS STILL small, but every one of these groups has a need for GEOINT expertise — because you've got to know where, you've got to know when, and you want to anticipate intent early enough to allow our clients to take actions. Otherwise, it's not actionable intelligence. GEOINT is foundational to multi-INT. GEOINT should help advance it. ✨

AOMI is sponsored by the MINT-T-CoP to encourage analysts and collection managers to share and exchange tradecraft knowledge in a roundtable Socratic discussion. At the inner circle of the roundtable are practitioners from across the community, selected based on mission or topic. The outer circle includes observers charged with listening and receiving. The observers represent supporting or enabling communities, such as R&D, technology, training and education. The forum allows communities represented by the observers to gain insights from the grassroots level of their customer or constituent base.

Common products lead to analytic innovation

By Dale Lehner, Office of Corporate Communications

THE NATIONAL GEOSPATIAL-INTELLIGENCE

Agency's Advanced Visualization Branch, known as ASCSV, is taking imagery to new heights of usefulness for the warfighter and customer, and they are doing it with commonly used off-the-shelf software.

The branch uses advanced geospatial and 3-D modeling tools to perform precise measurements, feature extraction and high-resolution terrain generation using available geospatial data and imagery, said Dave Bonner, ASCSV chief. The branch created a geo-referenced 3-D PDF, known as Geo3D PDF, to give customers highly detailed, geospatially accurate 3-D visualizations based on imagery.

"For our interactive visualization products to be useful, they must meet three criteria," said Bonner. "They need to be easy to use, deliverable via email and require no specialized, extra software on our customer's computer. More importantly, the products needed to be geo-referenced — after all, that's the 'G' in NGA."

Adding geo-referenced information to the 3-D PDFs image models virtually places the model in the same position on earth as the real object, allowing accurate coordinates to be reported, said Bonner. This gives the user the feeling of being "on-scene" at the actual location and allows them to derive defensive and offensive locations for the area. The branch has had the ability to produce rudimentary 3-D PDFs that met the first three criteria for some time, but were not able to geo-reference their products.

"My branch has always taken painstaking steps to ensure the geospatial accuracy of our interactive products," said Robin Kang, a software developer and 3-D visualization specialist with ASCSV. "However when our products were packaged into 3-D PDFs, all the geo-referencing information was lost."

Kang found a promising software solution that was compatible, but the licensing cost was a show-stopper, he said. The software also needed a plug-in — a plug-in customers may not have. The next step for Kang



A screen shot of a 3-D PDF of an area of Sochi, Russia, created in support of the 2014 Winter Olympics. NGA Image

was to look for software that allows implementation of new functionality within 3-D PDFs without the need for plug-ins.

"I was able to leverage (the software) to develop the new geo-referenced 3-D PDF capability," said Kang. "The Geo3D PDF features mouse-over, geo-coordinate readout, dynamic compass and azimuth reporting, and basic point-to-point distance measurements."

Kang then tackled the problem of presenting Web-based, large scale, real-time 3-D scene visualizations to a broad customer base, he said.

Though the technology is primarily geared toward the manufacturing industry for archiving parts and other assets in 3-D, there are many distribution advantages to using 3-D PDFs for NGA customers, said Kang.

Looking for the next level of product that gives NGA's customer the advantage is always at the forefront of the branch's mission, said Bonner.

There are a lot of gaming engines that could make NGA's products more effective for customers, said Kang. Unfortunately, customers can't always run the executable programs or install the special software these products need.

After extensive research, Kang found that a common platform on computer systems would work without specialized software, he said. He used the accelerated graphic capabilities of the program with Away3D, an open-source, script-

based, real time 3-D engine for Adobe Flash. He leveraged Away3D to bring the capability to NGA's systems without installing software.

Kang added many innovative advantages to Away3D for the end user, including a new workflow for optimizing and loading 3-D geometry and texture assets into the framework, he said. The enhancements also include intuitive 3-D navigation controls, dynamic compass display and a mouse-over geo-coordinate readout, an interface to facilitate scene navigation, interactive map legends, annotations within the 3-D scene, and a Web-based 3-D visualization product to accompany an official NGA intelligence report.

The immediate prime beneficiaries of the Web-based, 3-D visualization product are NGA analysts, said Bonner. It can be highly customized with layers of intelligence, icons, links, etc., and some customers are already feeling the benefits.

The accomplishments are just the beginning, said Kang, who has more ideas for future Away3D products. "The Away3D product will enable higher fidelity visualization of larger footprints, better interactive performance and unlimited customization which will be highly beneficial for all customers," said Bonner. "Browser-based 3-D visualization, requiring no specialized browser plug-in, is the product of the future — Robin is making this a reality." *

Exercise helps beat blahs, stimulate noggin

By Regina Galvin, Office of Corporate Communications

WANT TO BE INNOVATIVE? TRY HITTING the gym.

Dowell Davis, a personal trainer for the fitness center at the National Geospatial-Intelligence Agency's Springfield, Virginia, campus, touts the benefits of a physical workout as a good way to bring innovation to your work endeavors.

"Fitness isn't about aesthetics," said Davis. "If you feel good, you're going to perform well in your personal and professional life."

Davis's colleague and fellow personal fitness trainer, Collette Mason, agrees. A workout in your work day offers a much needed mental break, she said.

"I definitely think the gym can be an outlet for innovation," said Mason. "A workout can take your mind off of the problem or project. It helps free up your mind. Afterward, you feel refreshed and ready to go back and tackle the situation."

Stress is an innovation obstacle, said Ronnie Hinton, a strength conditioning coach at the center.

"Stress can inhibit performance," said Hinton. "Studies have shown that exercise relieves stress. If you work out you'll feel better about yourself — you recharge your batteries and your brain."

While the benefits of exercise and stress reduction are well known,

cognitive psychology research in the last decade has found links between exercise and increased creativity, according to a study by Professor Lorenza Colzato of Leiden University in The Netherlands. The findings of her study were published in 2013 in the scholarly publication "Frontiers in Human Neuroscience." Colzato found that those who exercised at least four times a week thought more creatively than their more sedentary counterparts.

NGA police Sgt. Shawn Beachley agrees with the idea that if you need some creative inspiration, you need to get moving.

"Absolutely nothing beats oxidized blood to the brain to perform at a more optimal level," said Beachley. "When (I'm) stressed out, it's hard to focus on the task at hand. After a workout, (I) get an endorphin boost, which can lead to a burst of inspiration."

A change in routine via a trip to the gym helps Steve Craig, a technical data integration analyst, be more innovative, he said.

"Sometimes you can get caught up in going to meetings and reading the email streams," said Craig. "I find that even the walk from the workplace to the gym is beneficial." The change in environment and the physical exercise has multiple benefits, said Craig.

"When I'm here working out, and I'm thinking about an objective I'm trying to reach, I think differently," said Craig. "And the workout allows me to stay in shape."

As a personal fitness trainer, Davis is aware that getting people to walk away from their desks and into the gym requires motivation, he said.

"Everyone has a different way to get motivated," said Davis. "Everyone has a different story. I am in the business of selling optimism. One way I do that is through quotes."

Davis created a motivation wall at the fitness center and populated it with random quotes, encouraging the reader to "Savor Every Victory," "Expect Success" and "Embrace and Conquer Failure."

An Elvis Presley quote on the wall, "Ambition is a dream with a V-8 engine," is his favorite, said Davis.

Employees who want to try to drive their own innovative ideas into high gear through exercise, can hit the fitness centers at the NGA's Springfield and St. Louis locations, which are open to all NGA employees 24 hours a day, seven days a week.

The centers offer a variety of classes, including cardiovascular, strength and flexibility, and weight management and lifestyle change. *

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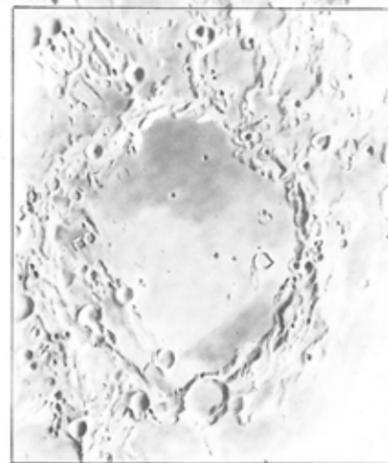


INNOVATIVE LEGACY

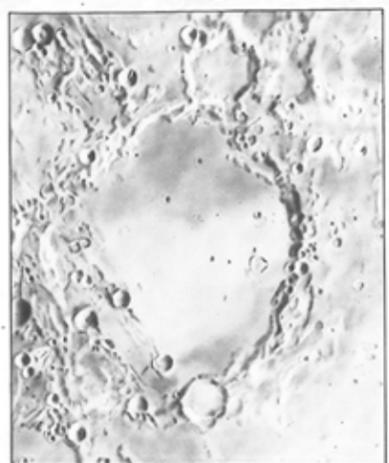
NGA predecessors map moon, pave way for lunar exploration



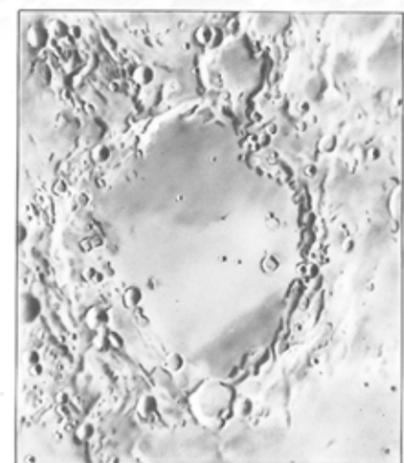
NGA Archive images



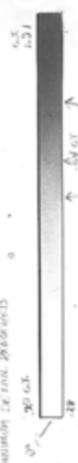
1960s



1960s



Unfinished Sample for Repress to 500,000 Resolution



By Jessica Daues, Office of Corporate Communications

A LITTLE MORE THAN 45 YEARS AGO, astronauts Neil Armstrong and Buzz Aldrin stepped out of the Apollo 11 spacecraft and onto the moon's surface. When they and fellow astronaut Michael Collins returned to Earth four days later, they fulfilled President John F. Kennedy's promise of eight years earlier to put a man on the moon and return him home safely by the end of the decade.

A relatively new government agency known as the National

Aeronautical and Space Administration played a major role in the mission, but NASA didn't do it alone. Cartographers from predecessor agencies of the National Geospatial-Intelligence Agency created detailed maps and charts of the lunar surface, which provided NASA scientists and technicians precise coordinates and optional landing sites.

Formed in 1958, NASA faced some constraints on its capabilities, including a lack of

personnel and expertise to map the surface of the moon, said Raymond Helmering, Ph.D., former lunar mapping technical project manager for the U.S. Air Force Aeronautical Chart and Information Center, or ACIC. The administration also was prohibited from duplicating the capabilities of other federal agencies.

So, in 1959, NASA funded a joint effort by ACIC of St. Louis and the U.S. Army Map Service, or AMS, of

Washington, D.C., both NGA predecessor agencies, to collect data to map the surface of the moon. Both ACIC and AMS had anticipated the need for lunar maps to support moon exploration and were already working hard at the task.

The tools available to cartographers then were much better than the telescope used by English mapmaker Thomas Harriot, who in 1609 created the first known maps of the moon. Astronauts on Apollo missions 8 and 10 had collected detailed stereo photography of the moon from about 100 miles above the surface, according to NASA.gov.

The Apollo moon orbits also allowed cartographers to photograph and map the dark side of the moon, the side that always faces away from Earth, for the first time.

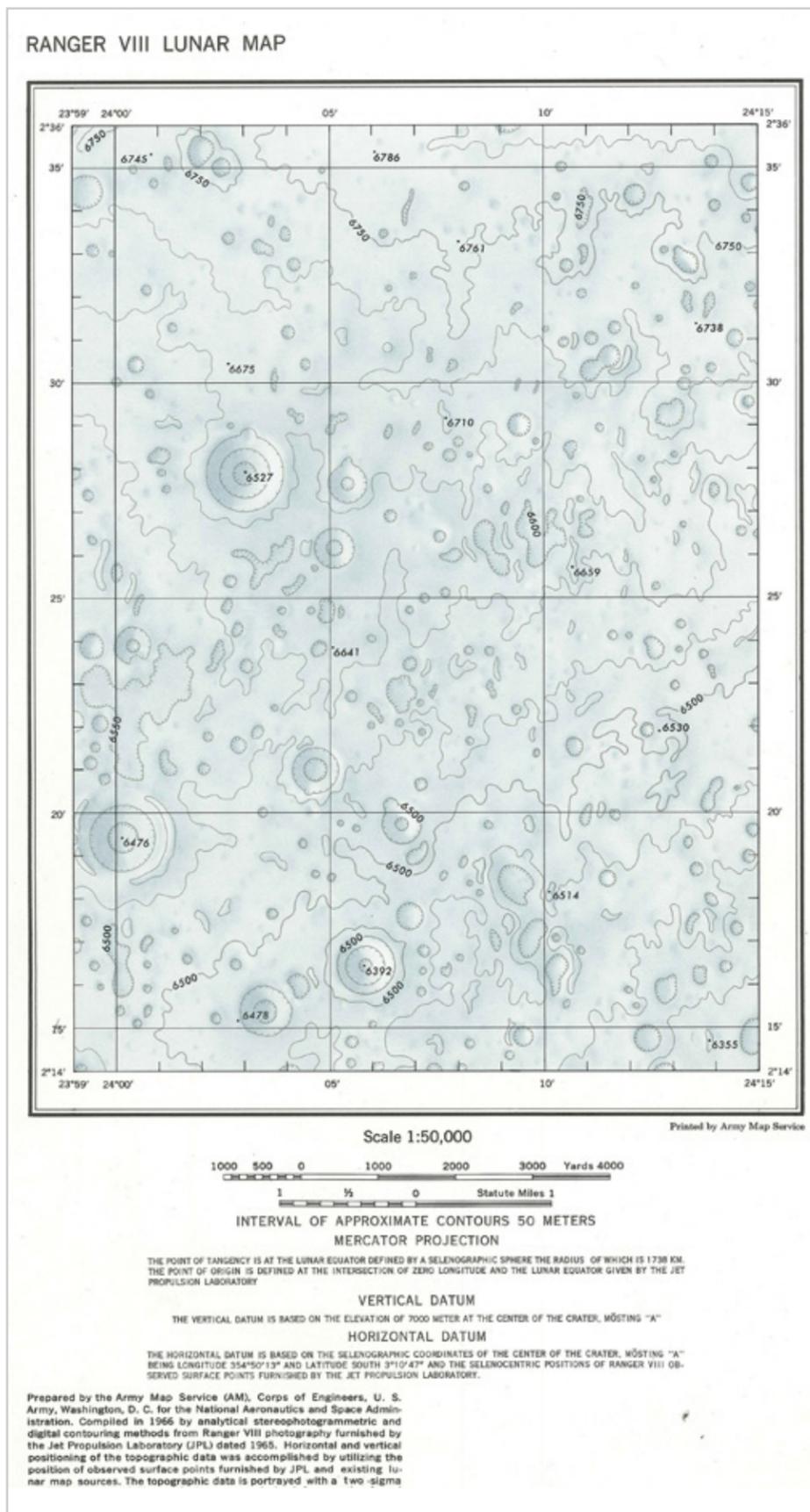
But even the most detailed photographs couldn't convey the moon's surface features as accurately or usefully as cartographers could on their maps, Helmering said. Cartographers first identified and compensated for distortion in the moon photographs. By comparing many different photographs of a particular feature, such as a crater, they determined the feature's true qualities, including height, diameter and depth.

That precision was vital for NASA to land a spacecraft on the moon, said John Unruh, Ph.D., former cartographer and scientist with ACIC.

The first of two main steps to create a lunar map is assembling the disparate "snapshots" of moon territory, said Helmering. It is similar to piecing together a jigsaw puzzle – only more exacting.

"You have to make sure whatever territory appears in one photograph appears again in an adjacent photograph," he said. "The process to relate all the photographs is not trivial. It's a mathematical process done with the help of computers."

Cartographers then used photo-viewing equipment



The U.S. moon mission was a shared national priority. The Army Map Service created the chart above in support of that mission. NGA Archive image

and computers to make measurements of the details of the photographs, ultimately creating a map, said Helmering.

"There was a cursor we could move, using levers, across the photos," Helmering said. "The computer would record points and determine distances and shapes. It was computer-assisted, but everything was captured by a cartographer."

ACIC and AMS produced hundreds of maps for NASA throughout the 1960s and '70s. During the 1969 fiscal year, ACIC created more than 300 different cartographic products in support of five Apollo flights, and in FY'70 about 200.

As many as 200 people at ACIC worked lunar mapping during its peak in the early 1970s, including cartographers, geodesists and personnel from the photo lab, negative engraving and printing, said Unruh.

Included in the hundreds of products made by ACIC and AMS were 3-D plastic topographic maps of potential moon landing sites.

"We would make several for each mission," Helmering said.

"Astronauts would study them and evaluate which would be the best one for landing, and the best for doing whatever experiments they wanted to do. Maps we made were used to evaluate those sites and make those final selections."

Unlike many analysts today at NGA, lunar cartographers at ACIC and AMS in the 1960s and '70s were able to talk about their work with their family and friends, said Helmering. At the time, many Americans were captivated by the idea of space exploration.

The Apollo program was well publicized," Helmering said. "The idea of putting a man on the moon was something everyone was talking about."

With his part of the mission complete, Helmering was at a training course with fellow ACIC team members at Ohio State University in July 1969 when Armstrong took his historic first steps on the moon, he said. Helmering remembers watching the event from a TV with about 10 other ACIC trainees in the front room of a small house in

Cartographers first identified and compensated for distortion in the moon photographs. By comparing many different photographs of a particular feature, such as a crater, they determined the feature's true qualities, including height, diameter and depth.

Columbus that he and his wife were renting.

"I had been involved in lunar work for a long time," Helmering said. "But I wasn't thinking about that. I was thinking about those guys up there and what that must have been like. It's hard to figure out how someone has the courage to do that, to walk on the moon, something that had never been done before."

"We were just amazed that we were able to do that — that we were there," said Helmering. "It was such a great achievement for the country."*

Family donates historic personal collection to NGA

By Jessica Daues, Office of Corporate Communications

THE FAMILY OF THE LATE THOMAS C. Finnie, former technical director of the Aeronautical Chart and Information Center and Defense Mapping Agency, recently donated about 30 items from Finnie's personal collection to NGA.

The items included a collection of 23 moon photographs presented to Finnie by the NASA for the assistance provided by ACIC and DMA to the moon landing efforts.

"We are incredibly proud of our dad and what he did for our country," said William Finnie, Thomas' son. "The history here is just incredible. I knew more people would be able to see these items at NGA."

The collection, which also includes awards,

acknowledgements, photographs, lithographs and certificates, was stored at the Finnie home, said William Finnie. It will now be catalogued and become part of historical exhibits at NCW and NCE.

Thomas Finnie was one of the initial eight DOD planners who helped organize DMA in 1972. He retired from the federal government in 1974 and was inducted into the National Imagery and Mapping Agency Hall of Fame in 2001. He passed away in 2003.

The U.S. Geospatial Intelligence Foundation recently renamed its lifetime achievement award, the Arthur C. Lundahl-Thomas C. Finnie Lifetime Achievement Award, to honor Finnie.





Canadian Coast Guard Ship Louis S. St-Laurent approaches U.S. Coast Guard Cutter Healy in the Arctic Ocean during a 2009 survey of the region. Photo by Petty Officer 3rd Class Patrick Kelley

Agency helps U.S., DOD execute Arctic strategy at

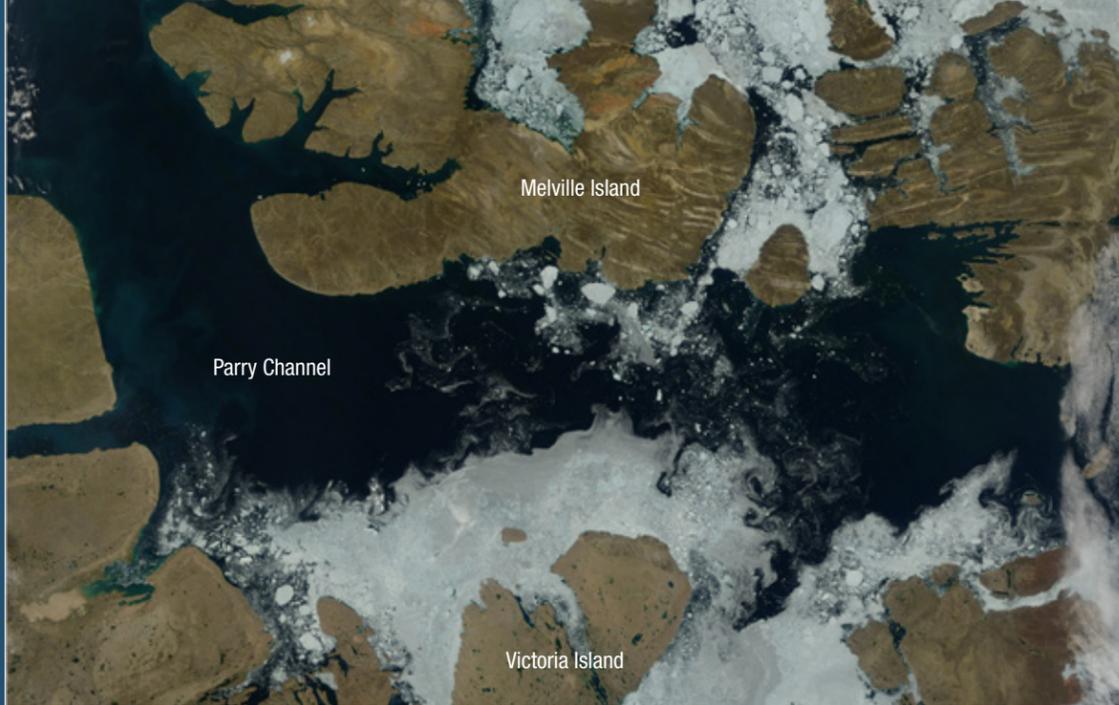
At the top of the world

By Jason Moll, Office of Corporate Communications

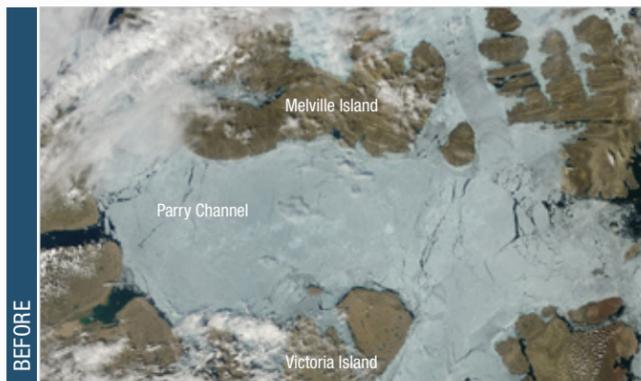
WHILE THE U.S. HAS HAD AN INTEREST IN THE ARCTIC SINCE IT purchased Alaska from Russia in 1867, climate change has caused national leaders to develop new policies and strategies for the region. The National Geospatial-Intelligence Agency has a key role in fulfilling the nation's Arctic strategies because of its

mission and ability to understand the land, sea and human activity, said Alan Goldberg, a scientist in the agency's Source Directorate. Warmer temperatures are causing the region's ice to melt, which is exposing areas of land and water that have been covered for eons, said Goldberg.

AFTER



Images acquired July 17 (right) and Aug. 3, 2012 (above), show changes in the ice coverage of the Parry Channel in the Northwest Passage. Though the images, captured by the Moderate Resolution Imaging Spectroradiometer on NASA's Terra satellite, show reduced ice cover, the ice may still be too thick for ships to navigate the channel, according to NASA Earth Observatory. Images by NASA Earth Observatory



BEFORE

NGA's Arctic activities include mapmaking, electro-optical and radar imagery to monitor natural and human activity, and products and services that enable safe navigation.

"It's not melting at a steady rate, but actually is accelerating," said Goldberg. "Less ice means less light and heat is being reflected back into space. The ocean ends up absorbing all of that energy, which causes more ice to melt."

The melting of the polar ice has created newly navigable waterways and provided access to virtually untouched fisheries and large deposits of minerals, including petroleum, said Michael Parke, a senior technical analyst with the Frontier Studies and Analysis Group in NGA's Office of Geospatial Intelligence Management.

New access to the region's resources has sparked a mad dash among Arctic countries and others hoping to profit, said Parke. Along with the U.S., the eight Arctic countries are Canada, Iceland, Norway, Sweden, Finland, Russia and Denmark, through its association with Greenland.

Calling the Arctic one of the planet's last great frontiers, President Barack Obama commissioned a policy paper in May 2013 that defined the nation's interests and objectives in the polar region. The national strategy was followed by Department of Defense and Navy strategies in November 2013 and February 2014. Together, the strategies outline U.S. government plans to protect its interests and achieve its objectives in the region.

NGA's Arctic activities include mapmaking, electro-optical and radar imagery to monitor natural and human activity, and products and services that enable safe



Canadian Coast Guard Ship Louis S. St-Laurent and U.S. Coast Guard Cutter Healy work together in the Arctic Ocean Aug. 15, 2009. The two ships took part in a scientific effort to locate the outer edge of the North American extended continental shelf. Photo by USCG Petty Officer 3rd Class Patrick Kelley

navigation, said Goldberg. Commercial synthetic aperture radar, or SAR, is particularly helpful since it can peer through clouds and capture imagery during the region's long nights. Commercial SAR coverage is also relatively robust, with each satellite making 14 passes per day over the high Arctic.

"Space-based remote sensing and communication systems are ideal for the region, given its remote location, sparse population and limited infrastructure," said Goldberg. "These systems allow us to maintain an understanding of the Arctic's land and water without having to physically be there."

NGA's expertise in safety of navigation will be needed as the region becomes what Secretary of Defense Chuck Hagel called "an evolving navigable ocean" when he introduced the DOD Arctic Strategy.

Traffic in the Northern Sea Route, which links Russia's Far East with Europe, has increased dramatically since mariners completed the first commercial crossing in 2009. Seventy-one vessels transited the route in 2013, compared to 46 vessels in 2012, according to information from the Northern Sea Route Information Office, a private organization based in Norway.

NGA works with the National Ice Center, or NIC, a joint activity of the National Oceanographic and Atmospheric Administration, Navy and Coast Guard, to advise mariners about where it is safe to travel in the Arctic, said Goldberg. NGA supplies NIC with SAR imagery that identifies regions of sea ice. NIC passes the information to mariners through bulletins and posts on its website.

NGA also responds to requests for information during special circumstances, like when the Coast Guard dispatched an ice-breaking vessel to Nome, Alaska, after the city's port and approaches froze in the winter of 2011-12, said Goldberg.

"NGA's provision of SAR and (electro-optical) imagery was critical to helping the Coast Guard reach Nome and allow much-needed fuel and supplies to get in," said

Goldberg. "Ice breakers don't travel in a straight line, but zigzag through whatever route is easiest—and fastest—to break. Time is of the essence during emergencies like this."

NGA also uses underwater depth data, called bathymetry, to help produce charts the Navy and other mariners use to navigate, said Whitney Anderson, a bathymetrist in NGA's Maritime Safety Office. NGA obtains raw bathymetric data from ships operating single and multi-beam sonars that ping the ocean floor to determine the depth and produces comprehensive maps with the information it obtains.

"We have seen a marked increase in requests for information in the Arctic," said Anderson. "And as the waterways expand, we'll need even more bathymetric data to make sure our charts are as accurate as possible."

The value of safety of navigation goes beyond helping ships travel from one place to another, said Anderson.

"Safety of navigation is a fundamental component of what we call 'safety of life at sea,'" said Anderson. "The safety of navigation mission supports the preservation of life and commerce and supports the nation's defense and the Navy's dominance of the high seas."

Policymakers also will increasingly rely on NGA's mapping expertise to help define boundaries and settle disputes, said Anderson.

"As the ice recedes and more areas of the Arctic become navigable, you're seeing more debate among international parties and others about who has the rights to the area's navigable sea lanes and minerals above and below the ocean floor," said Anderson.

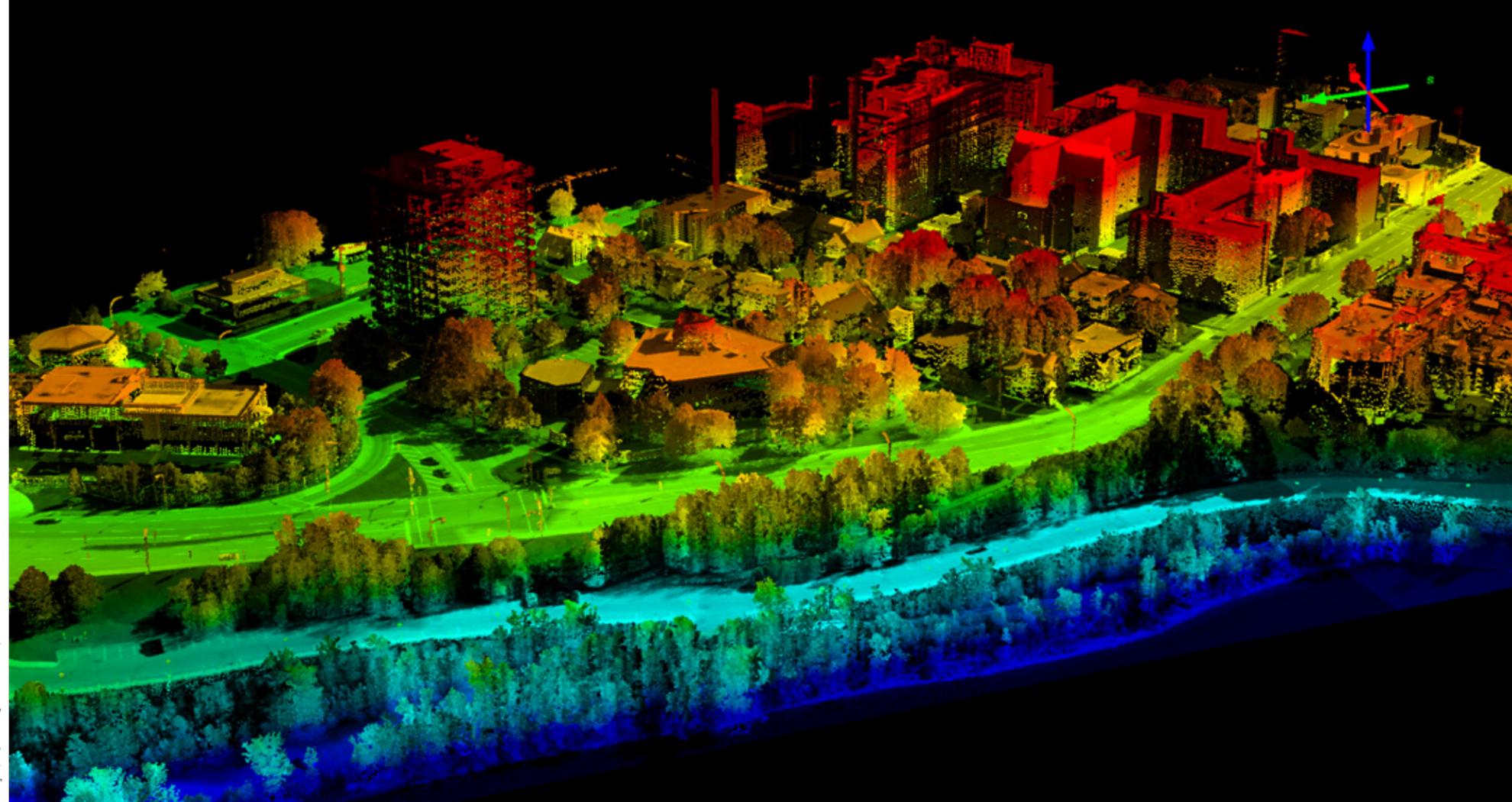
The United Nations Convention on the Law of the Sea captures customary law as it relates to the world's oceans, said Parke. The law states that a country has sovereignty rights extending 12 miles from its shoreline. A country also has exclusive economic rights up to 200 nautical miles from its shoreline. A country has rights to resources on or below the bottom on parts of the continental shelf beyond its exclusive economic zone. Since this includes oil, gas and minerals, this latter right has become contentious in many places including the Arctic.

The international community has yet to universally recognize all of the territorial agreements nations have made with each other, said Parke. The U.S. and its citizens have a direct interest in how these disagreements are resolved.

NGA's work will be essential in helping the U.S. stay informed about what other nations and non-state actors are doing, said Parke.

"It's necessary for the U.S. to maintain a leadership position in the region," said Parke. "At the same time, NGA and its partners are well-positioned to play a key role in informing (the nation's) leadership about the changing nature of the Arctic."*

"The United States is an Arctic Nation with broad and fundamental interests in the Arctic Region, where we seek to meet our national security needs, protect the environment, responsibly manage resources, account for indigenous communities, support scientific research, and strengthen international cooperation on a wide range of issues." — National Strategy for the Arctic Region, May 2013 (Originally published in National Security Strategy, May 2010)



Oblique view of the Ottawa, Canada LiDAR point cloud with points colored by elevation and intensity (screenshot from within QT Modeler)

"The prototype applications created for Google Glass and Oculus Rift could serve as gateways to the immersive intelligence experience being advanced by NGA leadership."
— Matthew McNerney

send and receive information to another NGA application that creates a common operational picture, or COP, over the Web. Working together, the applications help others understand what the operator is observing in the field.

Wearing Google Glass also limits many of the common distractions users experience when holding smartphones or other handheld devices, said Ben Tuttle, Ph.D., who created the COP application as the mobile apps team lead for NGA's Geospatial Intelligence Advancement Testbed in Denver.

Originally conceived for gamers, Oculus Rift allows users to visualize and navigate virtual environments in three dimensions, or 3-D.

An NGA prototype application created by Tim Hattenberger, a visualization subject matter expert in InnoVision, lets users navigate 3-D "point clouds" created by light detection and ranging, or LiDAR, scans. Fundamentally similar to radar, each LiDAR point in a point cloud was obtained by scanning an area with pulses of laser light that identify an object's range, or position in space. When coupled with a LiDAR city scan, Oculus Rift lets users virtually fly over a city or walk along its streets. The 3-D point cloud creates a city scene replete with trees, power lines, light poles and buildings.

Analysts primarily view LiDAR point cloud products on their computer screens, which gives them a top-down, or two-dimensional view, said Eric Aasted, an InnoVision project scientist. Oculus Rift could change that by providing users with a 3-D perspective, while also facilitating collaboration in a way similar to multiplayer online games.

"By immersing themselves in the same data, Oculus Rift could let two analysts see (their avatars), walk across the landscape, annotate what they see and communicate what they're seeing—all in real time—and even if they are in different (physical) locations," said Aasted.

While wearable electronic devices like Google Glass and Oculus Rift could serve as gateways to the immersive intelligence experience, that experience is only likely to occur when devices work in concert with each other, said McNerney.

"When you have two devices communicating with each other, the sum becomes greater than each part working alone," said McNerney. "That's the idea of convergence, where two or more devices can provide capabilities that weren't possible before." ✨

Wearable electronic devices augur change for NGA operations, show 'immersive' potential

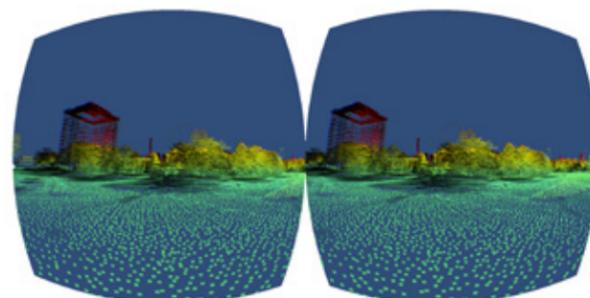
By Jason Moll, Office of Corporate Communications

DEVELOPERS AT THE NATIONAL GEOSPATIAL-

Intelligence Agency are creating applications for wearable electronic devices that place analysts and customers in virtual and augmented-reality environments to help them do their jobs better.

The prototype applications created for Google Glass and Oculus Rift could serve as gateways to the immersive intelligence experience being advanced by NGA leadership, said Matthew McNerney, a visualization engineering subject matter expert in InnoVision, the agency's research and development arm.

Google Glass allows users to see their surroundings while interacting with the device, creating an augmented reality. The device projects digital information on translucent spectacles and obtains Internet connectivity from a nearby smartphone. Oculus Rift is a pair of opaque goggles that allows users to visualize virtual environments while connected to a computer or gaming device. Google Glass received its mass market release in May, while Oculus Rift is only available as a development kit.



Screenshot of what is rendered to the Oculus Rift from the perspective of the marker in the middle of the intersection. The Oculus Rift allows the viewer to be immersed in the data, and get a first-hand perspective of what is visible from any given location.

"Immersion is touted as the next major phase of intelligence, while wearable (electronic) devices are seen as the next big thing in mobile computing," said McNerney. "Putting them together seems like a natural fit."

Wearable electronic devices are projected to eventually displace smartphones as the preferred mobile technology used by consumers, according to a January 2014 article in Wired magazine.

Besides eyewear, mobile electronic devices include rings that facilitate mobile payments, bracelets that serve as fitness activity trackers, and Internet-enabled watches with integrated cameras.

InnoVision is charged with executing the immersive intelligence vision outlined by NGA Director Letitia A. Long at the GEOINT symposium in April. Long characterized immersive intelligence as a world where practitioners will live, interact and experiment with data in a multimedia and multi-sensory experience. The immersive experience will help break down barriers between collectors, analysts, customers and decision makers, she said.

Immersing analysts and operators in data and information will help them generate new insights as they view and interact with source material from different perspectives, said McNerney.

"By giving analysts a different kind of perspective, we're hoping they will be able to more rapidly derive information from it and obtain meaningful intelligence from the imagery and other products they're analyzing," said McNerney.

NGA's Google Glass application is designed to enhance the situational awareness of field operators working special security events or sensitive law enforcement investigations, said Zachary Swain, who wrote the application while working in InnoVision. It allows the user to

NGA Google Glass app shows potential for field operations

By Jason Moll, Office of Corporate Communications

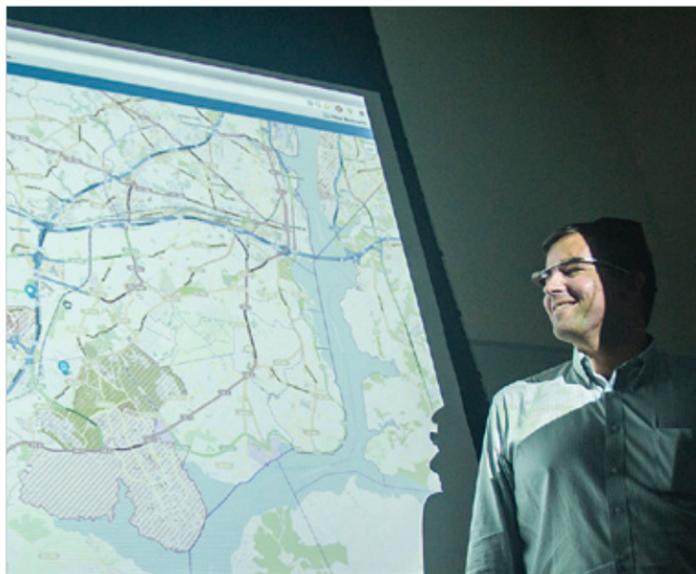
Photo by Kevin Clark, Office of Corporate Communications

APPLICATION DEVELOPERS AT THE NATIONAL Geospatial-Intelligence Agency have created a unique application for Google Glass that enhances situational awareness for operators in the field.

Developers believe the application could be used during special security events and sensitive law enforcement investigations where having a common operational picture is critical to success, said Zachary Swain, who wrote the Glass application while working in NGA's InnoVision directorate.

Glass is a wearable computer developed by Google and features an optical head-mounted display that operates similar to a smartphone. NGA's proof-of-concept application uses Glass to display relevant digital information in the user's field of view while allowing interaction with another NGA application, said Swain.

"The (Glass) user sees an augmented reality view," said Swain. "The lenses are translucent, so they are able to see what they're doing, while also being able to view



Eric Finnen, a developer with NGA's Xperience directorate, explains how the agency's Google Glass application works using Glass and NGA's Mobile Analytic GEOINT Environment.

instructions or field observations sent their way."

The application uses the device's multiple sensors when interacting with the Web-based common operational picture application known as the Mobile Analytic GEOINT Environment, said Ben Tuttle, who developed MAGE as the mobile apps team lead for NGA's Geospatial Intelligence Advancement Testbed in Denver.

"MAGE provides rapid awareness about what people are doing in the field, where they are and what they're observing," said Tuttle.

The Glass application is able to use the device's camera to take photos and video, record audio via the embedded microphone, and harness the compass to obtain directional bearings or tag images with geospatial coordinates, said Tuttle.

"That information can be transmitted back to a central server, where it is posted to MAGE and shared with the operations center and the rest of your team in the field — (who) may also be using Google Glass," said Tuttle.

Glass has the potential to streamline the MAGE user's workflow and limit common distractions, said Tuttle.

"The real benefit of Glass is that it gets things out of your hands," said Tuttle. "It's annoying having to take out your cell phone every time you get a notification. When something pops up with Glass, you can either ignore it or respond with a voice command or a quick swipe of your hand."

NGA wrote the Glass application to explore the capabilities of wearable electronic devices, said Eric Finnen, a developer with NGA's Xperience directorate, who acquired the device from Google's Explorer Program in June 2013. Google is using the program to distribute the device to select users before launching it to the general public.

"Wearables are the future (of mobile technology), so it's good to get something in-house and start developing against it and start thinking about how they can be used," said Finnen.

NGA's decision to use Glass as a proof of concept for wearables was based on the device's design, the ease with which it can be customized and Google's commitment to users and application developers, said Finnen.

Multiple federal agencies have already expressed interest in NGA's Glass application even though it is still being developed and tested, said Tuttle. NGA developers are working with their customers to discover their needs and understand how they might use the device.

"That's the exciting part about developing this," said Tuttle. "Rather than making it up and hoping we got it right, we can ask whether what we're designing is useful or not."

NGA developers are considering designing several applications for Glass, including one that allows users to visualize the location of teammates scattered around a building, said Finnen. Another application could allow users to "see" infrastructure below ground or behind walls.

"When you're out in the field, it's often difficult to know what you're looking at with any given certainty," said Finnen. "Let's say I see a pipe or some sort of electrical line. It would be nice to know whether I can cut into it or whether I'll cause an explosion, or end up shutting down the neighborhood's power supply."

It is still too early to tell whether NGA and its customers in the field will select Glass or another wearable device as their technology of choice, said Tuttle.

"Google Glass is somewhat delicate and may even be too conspicuous for our customer set," said Tuttle. "I think we'll see more robust and ruggedized form factors as time goes on. When the right device does come along, it will be good to know that we've already figured out how to use (wearable devices) and integrate them." ✦

"The application uses the device's multiple sensors when interacting with the Web-based common operational picture application known as the Mobile Analytic GEOINT Environment."

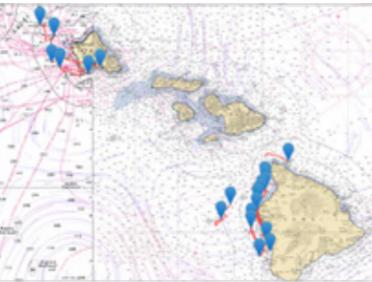
— Ben Tuttle

GEOINTERESTING



ACRE, BRAZIL
The best way to safely track uncontacted indigenous societies? Scientists observing a tribe in Brazil are recommending remote surveillance and satellite imagery to track population movement and health without disrupting the fragile tribal ecosystem. Using the information gathered via satellites, government policies and boundary zones can be developed to mitigate extinction threats, such as deforestation, mining and colonization.
Image: Government of Brazil

WWW.SCI-NEWS.COM



HAWAII
Kowabunga! This is whale watching for couch potatoes. From the comfort of your home computer, a new online map allows you to interactively track whales around Hawaii, while also giving you a view of ocean and wind currents. The engineers who built the map hope to draw attention to the more than 20 different whale species that migrate to the area every October through May and raise consciousness for dangers such as net entanglements and sonar pollution.
Image: Smartmine

WWW.WIRED.COM



GULF OF GUINEA
Sadly, this isn't a story about the long-awaited return of TV's SeaQuest DSV. Until recently, the lack of a common radar picture left Gulf of Guinea nations with few resources for sharing information on suspicious vessels. Enter SeaVision, a U.S. Navy Web-based vessel tracking system using ships' transponders to draw a real-time picture of marine traffic on a common, unclassified interface. This tool will help the military keep an eye on issues like drug trafficking and illegal fishing and enable the sharing of that information with Gulf partners. Coupled with satellite imagery, a better picture of ships operating illegally and "under the radar" emerges.
Image: U.S. Navy

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LOCH NESS LAKE, SCOTLAND
What's next, Sasquatch with an iPad or the Abominable Snowman sporting Google Glass? Amateur "Nessie" hunters recently spotted a curiously-shaped wake in satellite imagery used by Apple for its smartphone maps and claimed it was the famous lake monster. Detractors note the photos could also be showing underwater currents or a boat wake, but members of the Official Loch Ness Monster Fan Club will not be dissuaded.

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ENGLISH CHANNEL
Good to know before you go below. Large concentrations of jellyfish may be on the rise due to recent warm weather and effects of global warming. To globally track the bloom locations, researchers created the open-access Jellyfish Database Initiative, or JeDI, for experts and the public to map jellyfish sightings. Scientists hope to use the database to learn more about jellyfish ecosystems and identify future population spread.

TELL RIFAAT, SYRIA
Everything old is new again and retro satellite imagery is all the rage. Or, in this case, pics of previously unknown archaeological sites in the Middle East. Researchers examining the CORONA Atlas of the Middle East, a database of Cold War imagery from a spy satellite in operation during the 1960s and 1970s, have uncovered the remnants of ancient cities and settlements now lost to expanding modern development. Researchers hope to take a closer, in-person look at some of these sites and identify distribution patterns for settlements.



WWW.NBCNEWS.COM



QUEENSLAND, AUSTRALIA
What? Emoticons aren't good enough? A new tool, We Feel, uses English language-processing algorithms to analyze 27 million tweets per day for 600 specific words, which are then mapped to emotions including love, joy, surprise, anger, sadness and fear. The tool can be searched in real-time, by geographic location and gender. The tool was developed for researchers treating mood disorders to figure out if tweets could indicate poor mental health and observe emotional shifts based on time of day, breaking news or weather.

WWW.GIZMAG.COM



Map is for illustrative purposes only.

International ambassador NGA employee takes STEM education to Kosovo students

By Kristen Mackey, Office of Corporate Communications

WHEN A NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY employee heard from a friend in 2013 that children in Kosovo needed education more than utilities, he took leave from his NGA job at the National Air and Space Intelligence Center, left his five children with their grandparents and used his vacation time to help others.

Christopher Sultan, chief of the technical analysis division for the NGA support team at NASIC, which is located at Wright-Patterson Air Force Base near Dayton, Ohio, flew to the heart of war-torn Kosovo to inspire fourth through ninth graders there through education in science, technology, engineering and math.

“I heard about a woman who has worked with widows and orphans in the still-devastated Albanian section of Kosovo since 2000, and I was called to action,” said Sultan, who volunteered to lead students from Cedarville (Ohio) University to Mitrovica, Kosovo, to teach STEM-based education. “She recognized the lack of foundational

training for students who must be able to create their own jobs, invent something or make themselves invaluable in a country where rare jobs go to the politically connected, the corrupt or the grown children of wealthy families.”

Sultan, his wife Holly, Cedarville University staff and six university students began collaborating in October 2013 to develop hands-on projects and lesson plans for students in Mitrovica, in the northern most part of the country.

With no teaching background, Sultan used management experience gained at NGA to provide direction to the college students, he said. This helped with lesson planning, deadline management and logistics.

Preparations for the two-week trip became a full-time effort outside of work, said Sultan. He

“The primary goal was not just to teach, but to get the students and community to think about ways to use their education to create jobs and stimulate the economy.”

— Christopher Sultan



Sultan and university students work with Kosovar children during a STEM class in Mitrovica. Photo courtesy of Christopher Sultan

attributes his ability to accomplish the mission to an alternate work schedule and a supportive boss.

In Kosovo, the team introduced parents, native teachers and the local community to STEM, taught three different classes of children every day for two weeks and hosted a community STEM fair with interactive exhibits, said Sultan.

His managerial experience again became critical in his role as representative to Kosovo government education officials, said Sultan. The officials embraced the concept and plan to implement accredited STEM training.

The primary goal was not just to teach, but to get the students and community to think about ways to use their education to create jobs and stimulate the economy, said Sultan.

“This is a country where the schools that were not blown up entirely are still in shambles, they can only hold school for hours at a time in shifts, and utilities like electricity and water come and go,” said Sultan. “We wanted to provide hope through actionable education, not just come in to teach and leave these children behind.”

NGA AT THE BALLPARK



NGA employees unfurl the American flag while the NGA honor guard presents the colors during the singing of the national anthem at the St. Louis Cardinals game May 22 for NGA Night at the Ballpark at Busch Stadium. Photo by Dave Schaefer, Office of Corporate Communications



NGA's Tim Christenson sings the national anthem May 31 during NGA Day at the Ballpark at Nationals Park in Washington, D.C. Christenson, from the Human Development directorate, was selected from 27 auditions through NGA's East Civilian Welfare Council. NGA's Color Guard presented the flag before the national anthem. Photo by Paul Frommelt, Office of Corporate Communications



Photo by Kevin Clark, Office of Corporate Communications

NGA team chief pays it forward mile after mile

By Kristen Mackey, Office of Corporate Communications

KEN FOLEY IS A CARTOGRAPHER, A TEAM CHIEF ASSIGNED TO the National Geospatial-Intelligence Agency's support team at U.S. Strategic Command, and a volunteer who drives a red, white and blue 2014 Ford Mustang Shelby as part of the Wounded Warrior Family Support program's "High Five Tour."

The High Five Tour is a four-month road trip across America that covers more than 26,000 miles and visits 60 cities in 48 states to raise money, awareness and support for WWFS, according to its website, highfivetour.com.

WWFS Program provides support to the families of service members wounded, injured or killed during combat operations, according to its website, woundedwarriorfamilysupport.org.

"The High Five Tour is unique way for Wounded Warriors Family Support to raise awareness of issues that face our wounded veterans and their families and to raise funds to address those issues," said Foley.

Foley has been with NGA and its predecessor, the Defense Mapping Agency, since 1991. He volunteered in 2013 for a one-week drive across parts of the Midwest and arranged the July 7 visit to NGA's headquarters in Springfield, Virginia, to engage the workforce and promote the tour's commitment to help "treat the wounds that medicine cannot."

"By putting the Shelby on a 14-week, 48-state tour, Americans (can) give back to those who have given so much," said Foley.

The car stops for fundraisers along the drive, and in a year's time, has helped the WWFS raise enough money to build two custom smart homes for wounded veterans and fund respite and retreat programs.

"I got involved because it is a tangible way to repay our military men and women for what they do, especially those who have been wounded," said Foley. "Participating in the High Five Tour is a rewarding feeling." ✨



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