SPECIAL 20TH ANNIVERSARY ISSUE

NGA PATHFINDER

KNOW THE EARTH ... SHOW THE WAY ... UNDERSTAND THE WORLD.

Magazine of the National Geospatial-Intelligence Agency

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20 YEARS

SECURITY • HUMANITARIAN • TRADECRAFT

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GEOINT On the Rise

1996 NGA 2016

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EDITOR'S MESSAGE

Convergence may well be the best word to describe the creation of the National Imagery and Mapping Agency, which was renamed National Geospatial-Intelligence Agency after a handful of years. The agency's standup on October 1, 1996, represented both the joining of complementary tradecrafts and the mixing of existing and emerging technologies to establish a sophisticated new level of intelligence in support of national security.

Imagery analysis, cartography and intelligence techniques, combined with the rapidly expanding capabilities of computers, satellites and digital communication technologies, enabled the birth of what eventually became known as geospatial intelligence in 2001.

This issue of NGA Pathfinder celebrates 20 years of GEOINT rising. It does not attempt to tell the history of the agency or the rich heritage of the tradecrafts – cartography, imagery analysis and intelligence – that predate the formation of NIMA. Doing that would require a book, and that's exactly why our NGA historians are currently writing a comprehensive history that will be released next year.

Instead, this issue celebrates the outcomes, or what Director Robert Cardillo calls the consequence, made possible by the formation of NIMA two decades ago. Highlighted are security mission, humanitarian aid and disaster response, and tradecraft evolution. Also included are special first-person insights from several NGA retirees and statements from all directors about what they consider their proudest moments while leading the agency.

Our lead feature presents key examples of how NIMA/NGA has bolstered diplomacy and national decision-making. From uncovering war crimes in Kosovo to helping America and its coalition partners fight terrorism in the Middle East, the agency's unique GEOINT products and services have significantly and permanently changed the national security decision process, including during times of military conflict.

A second feature highlights how NIMA/NGA has contributed to the improvement of humanitarian aid and disaster relief. By helping its federal agency partners respond to crises around the world, the agency has made humanitarian aid faster, safer, more effective and less costly. Most importantly, by providing precise geopositioning capabilities and imagery analysis directly to first responders in stricken areas, NGA has helped save countless lives and facilitated the delivery of assistance to exactly where it's needed most.

The third feature in this issue focuses on how NIMA/NGA has worked to lead, most often in a collaborative fashion, the evolution of the GEOINT tradecraft. While the topic could no doubt fill several volumes of NGA Pathfinder, this issue shines a light on 'firsts.' Of significance are the development of activity-based intelligence and the creation of NIMA production cells, where the agency created unprecedented new intelligence by assigning experts from different disciplines to work together on hard national security problems.

It is not the specific topics covered in this issue that are most important to remember, however; what we hope you take away from your reading is that throughout the 20-year history of NIMA/NGA, real people have done real things to make a real difference to our country and its security.

We are proud of our past. Even more, we look forward with hope and confidence to serving our nation and its people for the next 20 years and more of GEOINT rising.

Jeanne Chircop

V/r,
Jeanne Chircop
Editor

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CORPORATE MEMORY:
LEARNING FROM THE PAST

By Carling Uhler, Ctr., Office of Corporate Communications

The word 'history' often means that something stays in the past, sometimes even forgotten.

Not at National Geospatial-Intelligence Agency. For NGA's history team, it's all about helping people understand that what happened previously affects both the present and possibly the future. For them history is not a sideline study; it's all about the mission.

The NGA history program, like many things in government, began with an email. In 2000, when NGA was still known as the National Imagery and Mapping Agency, the agency's director, Army Lt. Gen. James C. King, tasked James Mohan with developing 'a historian function' for the agency.

"When I was given the task to establish a history program, I felt there was an extremely practical aspect to having an agency historian," said Mohan, who was head of NIMA's public affairs office in St. Louis at the time.

Mohan jumped on the task, believing it was critical to document 'corporate memory' of how the agency responded to important events. Fresh in his mind was the Chinese Embassy bombing in Belgrade, which had happened only shortly before.

"For me history is not a 'nice to have' or even a 'statutory' responsibility," he said. "There is truly a mission imperative to know all that has gone on before – and not only to document, but to learn and grow from every agency experience."

Mohan reached out to colleagues and experts, including the senior historian at the National Security Agency, and helped facilitate the hiring of Martin Gordon, Ph.D., as NIMA's first chief historian the following year.

Gordon had received his doctorate from George Washington University and had begun his career in the history office of the U.S. Marine Corps. He then moved to the History Office of the U.S. Army Corps of Engineers, where he spent more than 15 years. He was a natural choice to serve as NIMA's historian.

Gordon, who passed away in 2014, spent five years in the role. During his tenure he filled out the department with archivist Lisa Wagner from the historical program at the U.S. Army Corps of Engineers and curator Marylou Gjernes from the U.S. Army Center of Military History, both as contracted professionals.

Historian Jim Mohan summarizes the history of GEOINT for a group of high school students visiting the NCW museum as part of the agency's ongoing student outreach program.

The agency's history program is now led by Chief Historian Gary Weir, Ph.D. Rounding out the team are Wagner, Gjernes and Mohan, who retired and rejoined the agency in 2014 as a consultant for the NGA museum in St. Louis. Combined, the foursome boasts more than 130 years of experience.

Like Mohan and Gordon before him, Weir firmly believes in the 'lessons learned' impact of NGA's history program.

"Making people aware of where they came from instills pride and provides an opportunity to learn," said Weir. "To discover where we've been is a starting point to understanding where we're going. We never stay the same; we always change and evolve over time."

Lessons learned from history can also advance what people do within the agency, said Weir. Both former and current leaders have looked to the past to evaluate where the agency is going or needs to go.

"The people who are in charge need to know where we've been and how we got to our present circumstance, so they can wisely invest in the future," he said.

In fact, Weir believes everything about an agency's history program should advance the mission. Included in 'everything' is collecting and holding onto archival papers, photographs, maps and equipment.

The history team does more than hold onto artifacts, however; they also share them through displays and in actual museum settings. NGA Campus West in St. Louis has housed a robust artifact and museum collection since 2005. A new museum at NGA Campus East in Springfield, Virginia, opens in fall 2016. Both museums will offer historical perspectives on NGA tradecraft and culture, which although relatively young compared with some of its military and intelligence community counterparts, has grown up a lot, according to Gjernes.

An example of this growth can be found in one of Gjernes and Wagner's favorite items in the collection, an antique field desk that belonged to U.S. Army Col. John James Abert, currently displayed at NGA's Springfield facility. Abert served as chief of the U.S. Army Corps of Topographical Engineers during the 1800s. His field desk was used during exploration for documenting the U.S. western territories and for military, border and railroad surveying.

To Wagner and Gjernes, the field desk represents more than just an interesting NGA historical artifact. It is a representation of where the agency and tradecraft has been and how much or little that tradecraft has changed.

"The exciting part – and the hard part – is getting our arms around everything we [NGA] do," said Weir. "It's extremely difficult, but it's also a blast."

Jacquelyn Karpovich, Ctr., Office of Corporate Communications, contributed to this article.

NGA SALUTE:
Intelligence Specialist Christie Ayers

By Nancy M. Rapavi,
Office of Corporate Communications

Six countries competed this year in the international women's armed forces basketball championship — the Conseil International du Sport Militaire — and Navy Petty Ofc. 2nd Class Christie Ayers was there representing the United States and the Navy.

Ayers, an intelligence specialist who works in the National Geospatial-Intelligence Agency Analysis directorate, brought home the silver medal with her team after a competition with teams from Brazil, Canada, China, France and Germany. The tournament was held in Camp Pendleton, California.

"It was truly a blessing to wear USA on my chest and represent the military while playing a sport that I love," said Ayers. "The group of ladies that we had on the team was easily the most talented group I've ever had the privilege of playing with."

Ayers' road to the tournament can be traced back to her days playing basketball in Hawaii, where she grew up with a love of sports. She attended Shelton State Community College in Alabama on a basketball scholarship before receiving a scholarship to play for St. Francis University in Pennsylvania.

Hailing from a family of veterans, including her parents who retired from the Air Force, Ayers said her decision to join the Navy just made sense.

"I wanted to join the Navy to serve my country and travel, and be a part of something great," she said. "I come from a family that has actively served, so it was an easy decision."

Her path to joining the Navy in 2014 was also furthered by a job Ayers had after college at the Transportation Safety Administration where she checked boarding passes and bags, and screened air passengers.

"I knew it wasn't what I wanted to be doing as a career," she said. "I wanted a drastic change and to just take a risk and step out of my comfort zone."

NGA is Ayers first duty station. Her love of sports and basketball followed her to Springfield, where she played on the Ft. Belvoir base basketball team and competed in various military tournaments.

She made the All Navy Women's Basketball team and then was selected to compete in the All Armed Forces Tournament this year, where she was one of 12 women selected from across the armed forces. 'Friendship through basketball' was the tournament's theme.

"I couldn't have asked for a better experience. Meeting new people and making lifelong friends is priceless," she said. "With all of the tension and negativity that is going on in the world, it was nice to have a friendly competition with good sportsmanship with military teams from other countries."

Ayers said she was humbled by the opportunity.

"Being able to represent the Navy, my family and NGA on the All Armed Forces team was truly a blessing and an experience I will never forget," she said. "I hope to be able to participate again next year."

After finishing up the tournament in July, Ayers returned to Virginia and back to her off-the-court team at NGA, where she will be stationed for the next year and a half. She is currently working on her package for Officer Candidate School, with a goal of becoming an intelligence officer.

"I love working at NGA," she said. "I have met a lot of wonderful and very helpful people. The team I work on is great and very supportive of everything. I am learning so much here — whether it's by taking classes, or taking in the knowledge that all of my coworkers provide me. This is a great opportunity to gain a lot of knowledge that I can take with me when I get out in the fleet."

> "It was truly a blessing to wear USA on my chest and represent the military while playing a sport that I love"

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

I AM NGA:
JOHNETTA WILLIAMS

By Muridith Winder,
Office of Corporate Communications

There was no fanfare – no confetti raining down, no lightshow or banners – for Johnetta Williams when she began work 20 years ago, but maybe there should have been. Williams was the first person hired by the National Imagery and Mapping Agency, later renamed National Geospatial-Intelligence Agency.

"When I came on board, I was excited about working as a contracting officer in a new agency," said Williams. "Being identified as the first hired is kind of a novelty, but exciting, especially considering I had no idea I was the first until recently."

When the disparate group of organizations combined to form NIMA, they blended their teams of experts to form the workforce of the newest member of the intelligence community. Williams was the first actually hired as a NIMA employee to begin work under the fledgling agency.

Two decades later Williams still works with the Office of Contract Services. She is currently in a rotational assignment as the career services manager for the office.

"I'm responsible for recruiting, hiring and professional development of the contracting careerists," said Williams.

Williams' odyssey at NGA started with a simple meeting at Fort Leonard Wood, Missouri, with Dell Bowman. Bowman had come to Fort Leonard Wood from the Defense Mapping Agency, one of NIMA/NGA's predecessors, to serve as the director of contracting. She thought Williams would be a good fit with her home agency if she ever moved to the Washington D.C. area.

"Six months later I found I would be moving to this area, so I called her," said Williams. She was interviewed and hired, but had to wait to start work because DMA was transitioning into NIMA at the time.

Change has been a part of her routine since the beginning.

"The type of work has changed," she said. "I remember what we were doing when I first got here. We were doing manual mapping; everything was manual. There was not a lot of automation. The infrastructure was very different, and we had fewer resources."

Now NGA has gone mostly digital, with paper products nearly an afterthought.

Williams also notes that NGA has a position, a footprint, in the intelligence community, which NIMA lacked at its inception.

"The evolution over the last 20 years, in my mind, has been extreme, but it's been good," she said. "We're respected within the IC and recognized for our agency's contributions."

A St. Louis native, she earned a bachelor's degree in early childhood education and taught kindergarten for a period. She started her career as a purchasing agent in Heidelberg, Germany. Three years later she became a contracting officer at Fort Sheridan, Illinois, while earning masters' degrees in procurement and acquisition and management.

Williams believes it's unusual in her profession to stay in one place for this long.

"People tend to move around every three to four years, to different communities in the contracting career field," she said. "They move around for different opportunities, but NGA has provided me an abundance of challenges and opportunities for professional growth. I have had an amazing and diverse career within the agency."

> "The evolution over the last 20 years, in my mind, has been extreme, but it's been good," she said. "We're respected within the IC and recognized for our agency's contributions"

She has no regrets about relocating to the Washington metropolitan area those many years ago.

"Coming here was an adjustment, but I wouldn't want to live anywhere else," she said.

Part of her attachment to the area includes her after-work activities. A lifetime member of Delta Sigma Theta, a public service sorority, Williams supports community activities such as luncheons for senior citizens, dress-for-success workshops and the mentorship of young women.

As far as what the future might hold for NGA, Williams believes the agency has progressed well. She believes one of the agency's more positive moves has been the creation of the common desktop environment.

"Just being integrated and collaborating with other agencies is a big step forward," she said. "It's one of the major things that I see we've been able to accomplish."

On a personal note, Williams believes NGA evolved from its early days into "a pretty good place to work." She said, "That's why I've homesteaded here for 20 years."

GEOPOLITICS, THEN AND NOW

By Christopher J. Fettweis, Tulane University

Editor's note: *The views expressed in this article are those of the author and do not reflect the official policy or position of the National Geospatial-Intelligence Agency, the intelligence community, the Department of Defense or the United States Government.*

The ideas in two very old books have been getting re-examinations lately in international strategic circles, with worrisome implications. "The Influence of Sea Power upon History," written by American naval strategist Alfred Thayer Mahan in 1890, is apparently all the rage in China. Meanwhile, the ideas contained in Sir Halford Mackinder's "Democratic Ideals and Reality," first published in 1919, have apparently found new life in Moscow.

Western strategists would not find the ideas in these books particularly interesting or useful, but they ought to be a bit concerned about what their potential rivals have chosen to spend their time reading and thinking about.

Mahan and Mackinder were early theorists of 'geopolitics,' or the study of the interaction between geography and strategy. They and their contemporaries looked at the globe as if it were a big, spherical game board and applied their geographical knowledge to attempt to determine the most advantageous parts to control. In the game of Monopoly, as most everyone knows, possession of Boardwalk and Park Place usually means victory; in Risk, the player who dominates Australia has the best chance to win. Does Earth contain a similar strategic heartland, one that could serve as a launching pad for world domination?

For Mahan, the answer was obvious: The seas were Earth's most important parts. Control of the oceans would bring not just secure navigation and commerce but the ability to transport troops to any far-flung theater. His ideas made Mahan every navy's favorite thinker, in large part because his theories contained no room for size or spending limits in maritime affairs.

A flurry of recent reports indicates that Mahan has become popular in China, suggesting that Beijing may be beginning to believe that a blue-water navy is a key to its future plans. Without one, the country would continue to cede global dominance to the United States.

Mackinder disagreed with Mahan's notion of the world. While he viewed the seas as important, Mackinder argued that the decisive moments of wars occurred on land. He searched his globe for its figurative Boardwalk/Park Place and believed that it had to be in Eurasia – which he called the "world island" – which contained the majority of Earth's people and resources. The country that controlled Eurasia, he reasoned, had the potential to extend its dominance worldwide.

The most geographically significant, defensible portion of Eurasia – what Mackinder called the "heartland" – was roughly in its center. Extending over most of Russia, this heartland was a natural fortress, surrounded by the Arctic,

mountains and deserts. He first drew this famous map, which referred to the 'pivot area' instead of the heartland, in 1904:

The only way into Mackinder's defined heartland was from the west, through Eastern Europe. This led Mackinder to devise his famous dictum, which is reprinted in every work that discusses him:

Who rules East Europe rules the Heartland;

Who rules the Heartland commands the World-Island;

Who rules the World-Island commands the World.

Mackinder's warnings were clearly on the mind of some of the early U.S. architects of containment, since the Soviets dominated the heartland. Today, according to a few recent reports, geopolitics is a central part of the training of Russian strategists. According to Charles Clover in Foreign Policy magazine, in Russia Mackinder has been "suddenly plucked from obscurity to fame and given the status of prophet."

The appeal of geopolitics crosses over from elite to popular circles, too: Some Russian bookstores have sections devoted to the topic, and the Duma has a geopolitics committee. As anyone who has written on Mackinder can attest, the subject generates a great deal of interest in Moscow. Russia's inherent geographical advantages are crucial to the empire rebuilding project of its right wing.

Most in the West have long forgotten Mahan and Mackinder, and with good reason. Their advice contains one anachronistic idea after another, all of which have been overcome by technology, economics and evolving norms against imperialism and conquest. Trade at sea no longer needs a gigantic navy to defend it, since it has no enemies, for example; it is in every country's interest to keep goods flowing. And the notion that there is a heartland that provides a jumping-off platform for world domination is undermined by the tragic facts of Russian history. If there is a geographical heartland, an area that affords its owner with

immense advantages over all potential rivals, it is coterminous with the United States.

It is always difficult to say just how much any country is influenced by a particular idea. Did Cold War U.S. strategists refer to Mackinder because they really worried about the geopolitical advantages of the heartland power or because they wanted to justify a policy of containment they had already decided upon? And are we to believe that naval strategists would not want more ships if they had never read Mahan's theories?

Still, it is instructive to know what kinds of ideas are being discussed by Chinese and Russian thought leaders, even if the concepts are more rationalizations than inspirations for policy. Most importantly, if potential rivals of the United States are thinking geopolitically, it means they are also thinking *competitively*. Central to geopolitical theory is the belief that countries in the international system are locked in a perpetual competition for dominance.

Geopolitics was born as an aid to imperial statecraft, as guidance about how to defeat rivals in the pre-world-war era. If strategists in China and Russia are consulting geopolitical thinkers of the past, it is a sign that they anticipate that neo-imperial rivalry with the United States will be the central feature of their policies for the new century. If the Chinese are reading Mahan, it implies that they consider future maritime operations will be essentially competitive rather than cooperative. If right-wingers in Moscow are discussing Mackinder, it is because they are thinking of the best way to dominate Eurasia, rather than integrate into it.

Mahan and Mackinder were hoping to help their countries defeat rivals in the battle for global domination, the underlying goal of all geopolitical writing. It is sometimes the case that old books are better left unread.

Christopher J. Fettweis *is associate professor of political science at Tulane University. Before moving to New Orleans, he taught strategy at the Naval War College, where Mahan is regarded as somewhere between genius and demigod. Fettweis can be reached for comment at fettweis@tulane.edu.*

Rear Admiral Joseph J. Dantone Jr., U.S. Navy
Director, NIMA, Oct. 1996—Mar. 1998
Director, DMA, May 1996—Sept. 1996

"My proudest moment as the NIMA director really was the same thing over and over again, and it was those times when the leadership and I recognized that the next week was going to be a hard week and that we were unlikely to get through it well. Somehow or other, the workforce would sense our concern, and when the week was over, it was great . . . [T]he things that the people in the organization did are what I remember with pride."

GEOINT On the Rise 20 1996 NGA 2016

COMBATING VIOLENT ISLAMIST GROUPS:
THE ABSOLUTE NEED FOR OUR MUSLIM PARTNERS

By Cmdr. Youssef Aboul-Enein, U.S. Navy

Editor's note: *The views expressed in this article are those of the author and do not reflect the official policy or position of the National Geospatial-Intelligence Agency, the intelligence community, the Department of Defense or the United States Government.*

Combating violent Islamist groups in the post-Arab Spring Middle East requires a level of skill and nuance in analysis and collection that necessitates the integration of our Muslim partners. The realities of triumphs such as the elimination of Osama bin Laden and the foiling of the 2010 toner-cartridge bomb plot, planned by al-Qaida in the Arabian Peninsula, could not have occurred without the cooperation and sacrifices of Muslims.

The collection phase of the bin Laden raid provides a good example. Dr. Shakil Afridi, the doctor who attempted to collect DNA samples unsuccessfully, was part of the clandestine team trying to confirm who was in the Abbottabad compound. This hero continues to languish in a Pakistani prison.

It was also intelligence sharing with our Muslim partners that foiled Operation Hemorrhage, also known as the 2010 toner-cartridge bomb plot. In this plot, AQAP's master bomb-maker, Ibrahim al-Asiri, had manufactured three toner-cartridge bombs for an alleged $4,200. He had successfully inserted them into the UPS and FedEx air cargo system. If everything had gone according to plan, the plot would have crippled our air cargo industry, necessitating the expenditure of hundreds of millions of dollars to secure the industry again. According to the plan details that were uncovered, AQAP would then have moved to target another industry, with the United States responding with millions to secure that industry, and so on. At that rate the American economy would hemorrhage, which is the basis for the AQAP's name for this operation.

POST-ISLAMIC STATE

We are now living in a post-ISIL world in which the organization's targets have expanded. The Islamic State in Iraq and the Levant now targets not only all Muslims that do not share its vision and methods, but also all Salafis that disagree with them. ISIL leaders have even gone so far as to call for the death of some of the most senior Saudi Wahhabi clergy, including the Grand Mufti of Saudi Arabia.

WHO ARE THE WAHHABI?

Wahhabism is a fundamentalist form of Sunni Salafi Islam that advocates strict interpretation of the Quran and the purification of Islam. It was founded by Mohammed ibn Abdul-Wahhab in 1743 and born in the austere and harsh environment of the Najd, or Central Arabia. The European Parliament has identified Wahhabism as the main source of global terrorism.

We have relied on our Muslim partners ever since Sept.11. One of the most satisfying moments during my four-year tenure as director for North Africa and Egypt in the Office of the Secretary of Defense for Policy, was helping to engineer bilateral talks with Algeria. Part of the agreement included information-sharing, which led directly to the undermining of the Salafist Group for Propagation and Combat, known by the French acronym GSPC, which then morphed to al-Qaida in the Land of the Islamic Maghreb, or AQIM.

UNDERSTANDING DIFFERENCES

So how does one resist the hyperbole of the media and focus one's attention on the realities of combating terrorism?

First, it is important to understand the complexities and diversity inherent in 1.6 billion Muslims. Organizations like al-Qaida and ISIL will not tolerate the diversity of Muslims, much less non-Muslims. That is why we have had Muslims in the fight against terrorism since Sept. 11.

ISIL has since taken it to the next level by demonizing all Salafis not in agreement with their worldview. Of note is Abu Muhammad al-Maqdisi, who was Abu Musab al-Zarqawi's spiritual advisor when he was in Jordan's Suweiqah prison. Maqdisi spoke out against ISIL on television after a Jordanian pilot was burned to death in a cage. From a U.S. and anti-ISIL perspective, Maqdisi's criticism was a major coup, as many consider Zarqawi to be the father of ISIL. The event barely made the news cycle outside the Middle East, however, and even then only for a short time.

Second, it is important to delineate among violent Islamists such as AQ and ISIL and Islamist political groups such as the Turkish AKP and the Tunisian Ennahda Party. One group wants to bring about an Islamic social order in their image, and impose that order on Muslims and non-Muslims alike through conspiracy to commit violence; the other wishes to accomplish the same thing, except through the electoral process and by legislating their form of Islam on Muslims and non-Muslims alike. Both camps require different forms of national security engagement from our side, ranging from diplomatic to kinetic, with an emphasis on America's strong values of individual liberty. The freedom to practice Islam without harassment or persecution is a fundamental American constitutional value.

What is common in the debate among Muslims themselves is imposing a single interpretation of Islam at the

expense of all other Islamic expressions. If you understand that, you are better equipped to understand contentious debates from Sunni-Afghans who resent being told how to practice Islam in the image of an Arab foreign fighter, as well as differing views as to why the Egyptian Muslim Brotherhood President Mohammed Morsi failed. The burning question involved in imposing an Islamic social order will always be: whose Islam?

SPLINTER GROUPS

A third consideration in combating terrorism is that there are hundreds of offshoots that have splintered off the main to create their own movements. Looking at Salafis only, even Arab commentators have to contend with hundreds of Salafi groups, of which Wahhabism is only one – and Wahhabism itself has offshoots.

Salafism is derived from the Arabic term connoting a return to the Salaf-al-Saliheen, or in English, The Pious Founders. There is no agreement on which pious founders to follow, however; and even if one chooses a dozen companions of the Prophet Muhammad, there is no agreement on how to emulate those dozen in the hundreds of Salafi offshoots existing in the 21st century.

That is why a few Arabic counterterrorism books, as well as those that discuss Islamist politics, speak in terms of Salafi-Ilmi (proselytizers), Salafi-Ikhwani (political activists) and Salafi-Jihadi (direct violent-action types). Generally, the proselytizers argue that the jihadi ruin their ability to proselytize, and the political activists argue that the jihadi ruin the political space. Understanding these nuances can help to cultivate cooperation from two groups to turn in Salafi-Jihadi cells in their neighborhoods and communities.

Further, do not confuse Salafi-Ikhwani with the Ikhwan al-Muslimeen, which is the Muslim Brotherhood. Do that, and you miss the Salafi political parties that were rivals to the Muslim Brotherhood when Morsi was president. Finally, alienate Salafis specifically, and Muslims generally, and it becomes a harder counterterrorism environment in terms of cultivating sources and methods.

INTERNAL COMBUSTION

I am of the opinion that only a cacophony of various Islamic-based counter-narratives can begin to undermine ISIL's narrow narratives. This means never missing an opportunity to highlight how ISIL wishes to impose its manhaj – Islamic interpretation – and literally wipe out any other Islamic expressions; not only Shiites in its various forms, but Sunnis and now even Salafis in their various forms.

That is why ISIL in its propaganda makes passing references to manhaj and speaks of its interpretation as aqeedah, or Islamic creed.

In reality aqeedah are the basic things one must believe to even begin to call themselves Muslim, such as there is only one God and Muhammad is the messenger of God; after that, the human condition creeps in, and there are arguments of how to practice the faith in daily life.

Christians also have aqeedah, which is believing that Jesus is Lord and savior and that he died for your sins. After that, the arguments begin and develop into myriad interpretations, resulting in different Christian denominations.

Islam is no different in that regard. Anyone who believes all Muslims share the same interpretation of Islam will be analytically blind. In 2016 it is not enough to say 'Sunni'; we must specify what kind of Sunni – to say 'Salaf,' without specifying what kind of Salafis; or to say 'Shiite' without specifying what kind of Shiite. This matters in the human landscape of Arabia, Yemen, Iraq and Syria, to name a few. This is the kind of intellectual rigor needed by our intelligence analysts in the post-Arab Spring Middle East and in the future.

DIVERSITY OF THINKING

Finally, analysts must understand that technology and many other disciplines demand diversity in thinking and intelligence analysis – not just language and cultural diversity, but men and women versed in the technologies of social media and economics, and in assessing massive amounts of data in algorithms and equations. ISIL is an organization raised with technology. As such, ISIL is comfortable and innovative with social media and the internet, more so than al-Qaida.

I have had the privilege of interacting with men and women within the intelligence community who understand all of these things and more. I have also benefited from the diversity within the IC that breeds alternative analytic thinking. This diversity has at times caused me to revise my own views and expose biases in my critical thinking.

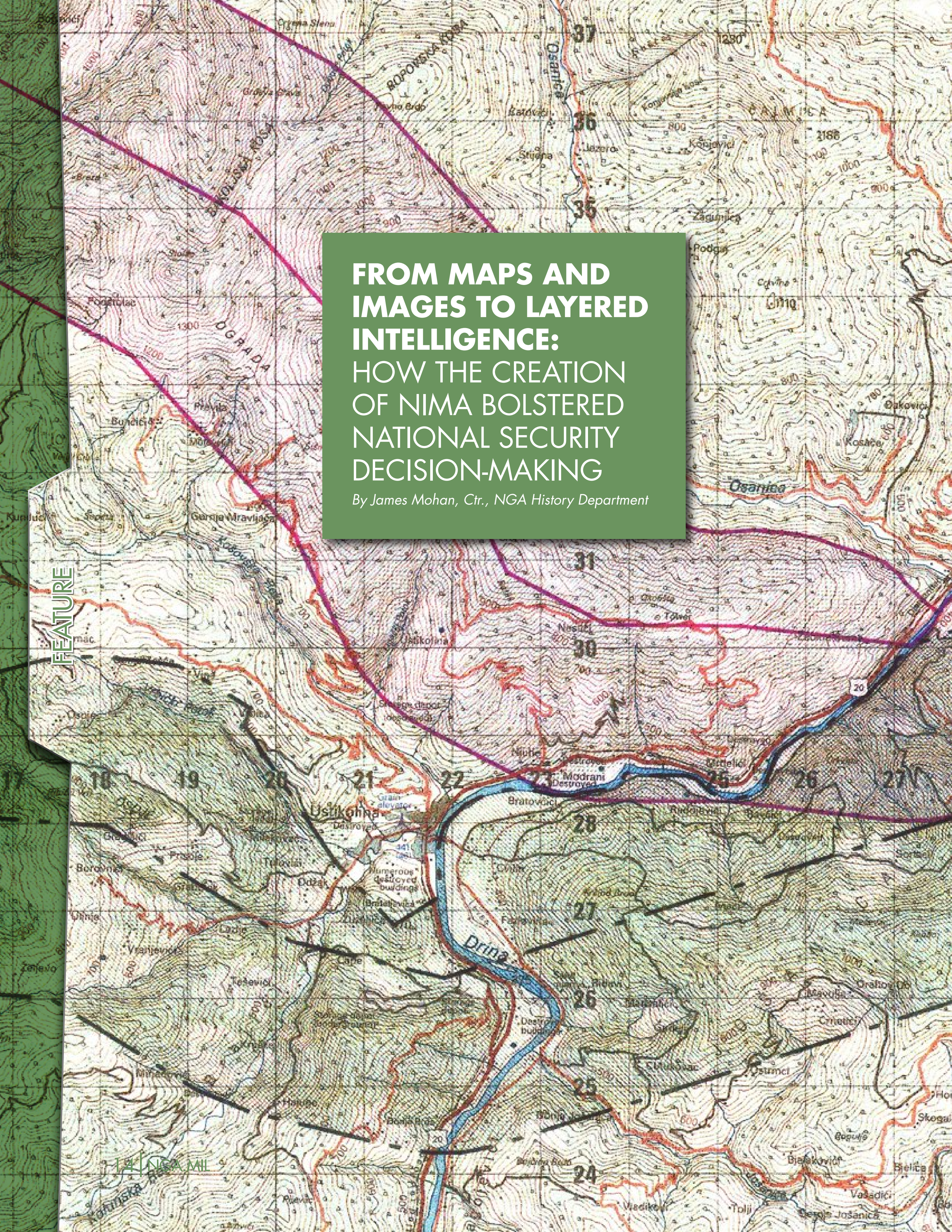
I have often said that ISIL and AQ are threats to non-Muslims and Muslims alike. As Americans we can use our individual liberties, which tolerate the views of all faith groups, to attract more diversity into the IC and benefit from the fruits of increased knowledge diversity. Ultimately, we have the advantage over terrorism by being inclusive and attracting the diverse talent and partners needed to counter these threats.

Navy Cmdr. Youssef Aboul-Enein is on the faculty of the National Intelligence University and is a senior advisor on Violent Islamist Groups at DIA's Defense Combating Terrorism Center. He is the author of several books, most notably, "Militant Islamist Ideology." (Naval Institute Paperback, 2013).

Have an idea for a GEOINT or national security Viewpoint contribution? Send your query to Pathfinder@nga.mil.

FROM MAPS AND IMAGES TO LAYERED INTELLIGENCE: HOW THE CREATION OF NIMA BOLSTERED NATIONAL SECURITY DECISION-MAKING

By James Mohan, Ctr., NGA History Department



Behind the scenes and out of the spotlight, as President Bill Clinton helped to broker an end to the hostilities in Bosnia in November 1995, a team of more than 50 cartographers and terrain visualization specialists worked to assist the diplomats in their deliberations.

The technical team, comprising staff of the Defense Mapping Agency and the U.S. Army Topographic Engineering Center, digitally mapped the disputed Balkans areas in near-real time and created three-dimensional visual imagery to 'walk' negotiators through the disputed terrain as they discussed terms. Known as the Dayton Peace Accords, the diplomatic event ended with Yugoslav President Slobodan Milosevic compromising on a key area under dispute – a milestone that signaled the end, at least temporarily, of bloodshed that had cost the lives of more than 300,000 Serbs, Croats and Muslims in just four years.

The Dayton event predated the creation of the National Imagery and Mapping Agency, later renamed the National Geospatial-Intelligence Agency, but it nevertheless demonstrated the tremendous power of mixing mapping and imagery analysis to support diplomacy and decision-making at a time when the agency's formation was being contemplated. Less than three weeks later, Secretary of Defense William Perry, Director of Central Intelligence John Deutch and Chairman of the Joint Chiefs of Staff Army Gen. John Shalikashvili wrote a joint letter to Congress stating their commitment to creating a new agency within the Department of Defense – NIMA – to "improve the overall effectiveness and efficiency of imagery and mapping support to both national and military customers." In December, a month after the success at Dayton, President Clinton added his official endorsement.

While the Dayton negotiations demonstrated what could be accomplished diplomatically with the combined support of mapping and imagery, it was not the start of the story by any means. More than a year of intense study and debate, often heated, had preceded the decision to create NIMA – and proponents had first floated the idea the better part of a decade earlier. But the advent of the nation's newest intelligence organization on October 1, 1996 was more than simply rearranging intelligence assets under one roof; it was a true breakthrough, allowing the intelligence community to realize a significant step forward in the evolution of tradecraft and analysis. It led to the emergence of geospatial intelligence, or GEOINT, as a powerful new analytic discipline critical to our nation's security and leaders in the years ahead.

The new agency came about in an era of rising complex global strategic challenges. This forced the nascent organization to immediately begin transitioning from the traditional missions of its predecessor organizations – producing maps and static images – to creating layered GEOINT to meet both the intelligence and operational needs of our nation's decision-makers and military leaders. This transition allowed GEOINT to become a critical tool for envisioning, exposing and combating threats around the globe.

CRIMES AGAINST HUMANITY

Despite the success of the Dayton Peace Accords, the situation in the Balkans did not resolve. On November 25, 1998, the North Atlantic Treaty Organization ordered Milosevic to stop the persecution of Albanians in Kosovo or face NATO airstrikes. His lack of response led to a nearly three-month bombing campaign aimed at stopping the conflict that threatened the stability of the south Balkans.

In support of NATO, NIMA produced virtual fly-throughs of the affected territory to prepare pilots for the local terrain and conditions they would face while waging the campaign against Serbian forces. The agency provided near-real time imagery and

maps at multiple scales, plus near-real time imagery and geospatial information on laptop computers, which could be easily accessed with the click of a mouse or downloaded directly into aircraft. Dubbed 'NIMA-in-a-Box,' the device provided extensive data displays and also was equipped with a printer to generate hard-copy products. Almost immediately its use helped save the life of a downed U.S. Air Force F-16 pilot by allowing mission planners to plot a safe course for rescue helicopters.

NIMA's work also revealed evidence of ethnic cleansing in the region. This hard evidence assisted the United Nations in indicting Milosevic and four of his associates for crimes against humanity.

I was there…

WEATHER AND DAMAGE ASSESSMENTS SHORTENED AIR CAMPAIGN

The director of operations, U.S. European Command headquarters, confided to me after successful execution of the Kosovo War that an R&D space-based capability provided near-real time weather and battle damage assessment support that significantly shortened the air campaign by as much as 20 percent, potentially saving civilian and U.S. military lives and aircraft.

— *John L. Morris, former director, Central MASINT Organization; appointed senior technical advisor to NGA Director James R. Clapper in 2002*

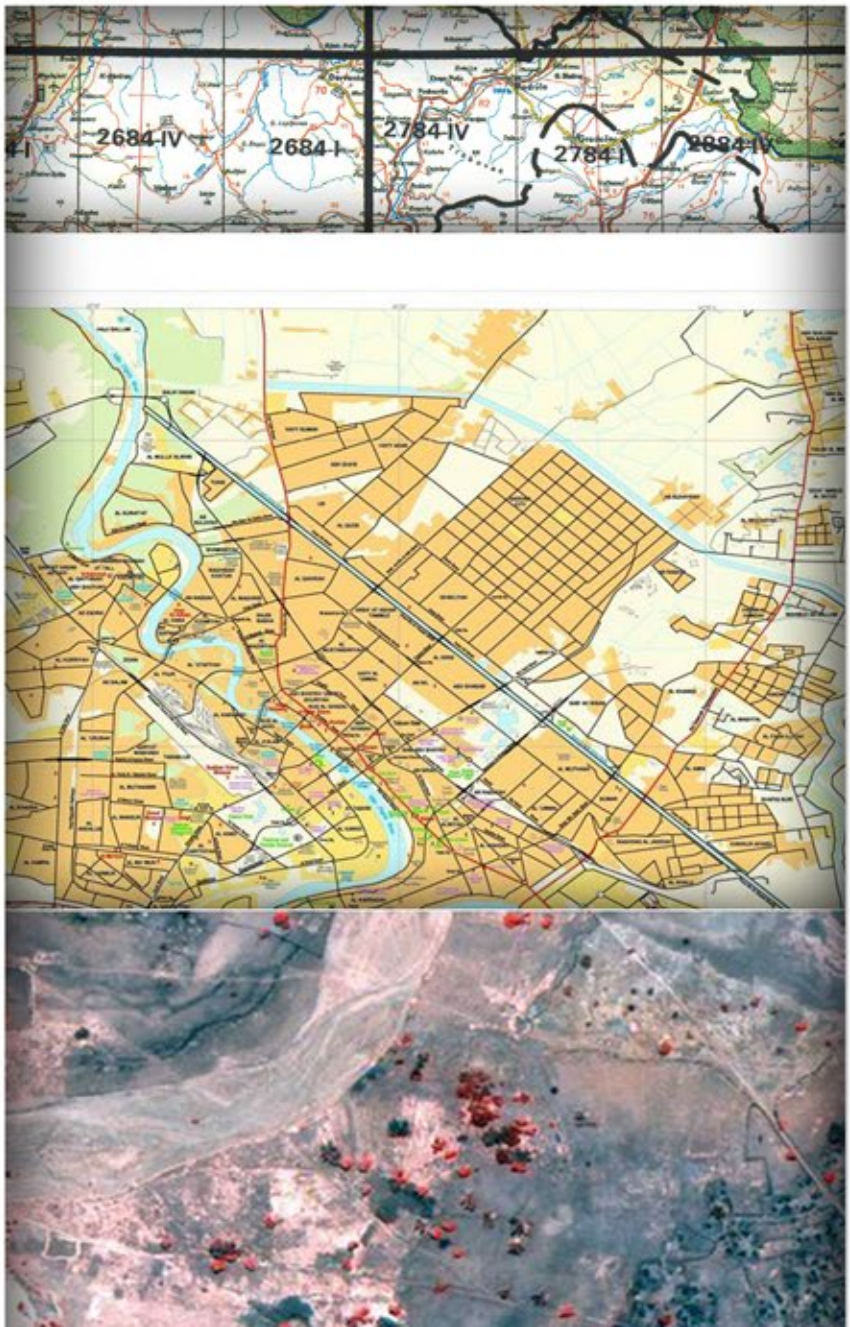
OPERATION ENDURING FREEDOM

In October 2001, in response to the attacks of Sept. 11, American forces launched Operation Enduring Freedom. OEF became a critical proving ground for GEOINT, and within weeks the Taliban and al Qaeda were reduced to isolated pockets of fighters.

NIMA expertise proved essential to the success of OEF, and conversely, OEF forced agency analysts to stretch and evolve. The challenging operating environment in Afghanistan required NIMA analysts to support combat operations on a scale unlike any previously. They were also embedded with warfighters in greater numbers, both in theater and in multi-intelligence fusion hubs in the National Counterterrorism Center and the National Counterproliferation Center.

The operation required new and different types of data and analyses. The Afghan battlespace was complex and the terrain often more urban, which drove the demand for higher-fidelity information. Human geography and human terrain analysis became critical due to the tribal nature of the region. To limit civilian casualties during airstrikes, U.S. forces required precise geospatial data to guide munitions.

NIMA analysts rose to the occasion. They created the Airfield Infrastructure Intelligence Model, a three-dimensional graphical representation of airfield data and intelligence, which was used by combat aircrews on military missions and



for force protection. They also created a digital mapping and reconnaissance tool for situational awareness and force protection. It captured imagery location information vital for mission planning, safety assessments and security decisions. A number of NIMA products, including special maps and aeronautical navigation data, met force positioning and logistical needs. In all, the swift success of combat operations during OEF – due in part to NIMA's increasingly valuable support – proved that GEOINT had earned its seat at the intelligence community table.

HUMANITARIAN CRISIS IN DARFUR

By the time NIMA was renamed NGA with enactment of the National Defense Authorization Act for Fiscal Year 2004, the Darfur region of western Sudan was the site of a different kind of battle, one of terrible violence, death and cultural upheaval. The United Nations has often described the area as "the world's worst humanitarian crisis."

Secretary of State Colin Powell delivered a formal finding of genocide in Darfur to Congress that year. Use of high-resolution satellite imagery was critical to the finding, which documented undisputable destruction of villages in the region. Powell used the same images to brief U.N. Secretary General Kofi Annan. The imagery was produced by NGA and the State Department's Humanitarian Information Unit.

But NGA involvement in uncovering the attacks by the Sudanese Liberation Army and Justice and Equality Movement had actually begun in early 2003, when an IC colleague had requested an NGA analyst to develop a baseline of imagery and maps to document events in Darfur. Other NGA analysts began studying images in the area and noticed changes in population distribution. By spring 2004 they all began to see evidence of the complete destruction of several hundred villages.

The NGA analysts created a series of maps and graphics that combined data about damaged and destroyed villages with commercial imagery and displaced population information. This GEOINT, combined with effective interagency collaboration, revealed a humanitarian crisis that had been hidden to that point from the outside world.

I was there…

DIRECTOR KING LED FROM MY OFFICE ON SEPT. 11

NIMA Director [Army] Lt. Gen. Jim King was conducting a farewell get-together with NIMA Reston Center personnel on that fateful day in 2001. It was one of several meetings to thank agency employees prior to his planned retirement the following week. I was the senior person onsite at the time, and it fell to me to escort and introduce Gen. King.

As we were entering the conference room for the meeting, there was a television in the hallway broadcasting the fire in the World Trade Center. The newscasters were unclear what had occurred at that point, but they thought it was an accidental plane strike on the tower. The director paused for a moment to watch, concerned, and then proceeded into the conference to give his farewell remarks.

Upon completion of his remarks, we again stopped at the television, which just then broadcast the second plane's impact on the other WTC tower. Commentators were by then openly speculating that these were deliberate acts. They were also broadcasting rumors of additional attacks in Washington.

Digesting this information, Gen. King decided he needed to maintain uninterrupted contact with NIMA headquarters, then located in Bethesda. He felt he would be out of contact if he drove back to Bethesda immediately, and so he asked to use my office as a temporary command center.

We watched events unfold on the television in my office at Reston, and additional information started to trickle in, including news of the strike on the Pentagon.

The director's first reaction to that news was one of concern for the safety of NIMA personnel stationed at the Pentagon. Because the folks at the Pentagon belonged to some of my NIMA Customer Support Teams – in particular, the Joint Staff Team and several of the service teams – he ordered me to immediately contact the appropriate team chiefs and do a head count to make sure all NIMA Pentagon staff were safe and accounted for.

Getting confirmation that all of our staff at the Pentagon was accounted for, the director then asked for the status of all deployed NIMA personnel. I attempted to obtain this information, but since we had hundreds of people deployed worldwide, this was not really possible. His inability to have immediate status on all employees was the driver for the deployed personnel database implemented shortly after the transition to Director Clapper.

— Irv Buck, former deputy director, NIMA Plans and Operations

In July 2004, after receiving a briefing from NGA analysts, Sen. John McCain (R-AZ) took NGA maps and data to the Senate floor to bring further attention to the humanitarian crisis. Later that month, with U.S. support, the United Nations imposed an open-ended arms embargo on the Darfur region.

Violence in the Darfur region persists, but NGA-provided GEOINT has helped relief workers locate camps for displaced refugees, facilitate food distribution, quantify the effects of the continuing violence and educate policymakers on the crisis.

RAID ON ABBOTTABAD

NGA facilitated and supported countless other diplomatic and national security decisions as the years passed, but its status as a key intelligence provider skyrocketed in 2011. On May 2 that year, President Barack Obama announced to the world that the United States had conducted a military operation to capture Osama bin Laden, who was considered responsible for the horrific acts of Sept. 11. The president explained that an elite team of Navy Seals had flown in helicopters from Afghanistan to raid the terrorist's compound in Abbottabad, Pakistan, ultimately resulting in bin Laden's death.

Finding bin Laden had been the United States' most pressing intelligence problem for a decade. Senior government officials acknowledged the role NGA had played in pinpointing the location where bin Laden was hiding. The agency had applied a wide range of GEOINT capabilities including imagery, geospatial and targeting analysis. NGA staff reviewed thousands of maps and reams of data to identify several possible locations for bin Laden.

Following identification of the Abbottabad compound as bin Laden's hideout, NGA and other IC specialists worked to create a replica of the compound. The model was used in senior strategy briefings and assisted the military assault force in mapping out its attack.

Letitia Long, director of NGA at the time, watched the mission unfold in real time, alongside other national security partners. The atmosphere in the situation room was tense, she said. She and the others could only wait and wonder if the months of intelligence preparation would pay off. In the end, although not perfect, the mission was a success.

THE SHIFTING STRATEGIC LANDSCAPE

Today's world is fast paced and full of security threats, many as yet unknown. In testimony to a House Armed Services Subcommittee, current NGA Director Robert Cardillo stated that the evolution of GEOINT has allowed NGA "to provide key insight and warning to policymakers and warfighters" to effectively deal with myriad crises and challenges. Among them, he said, are "ISIS attacks in Iraq and Syria, refugee migration, continued threats of aggression from Russia and North Korea, China's moves in the Spratly Islands, cyber attacks from faceless antagonists and international criminal networks."

NGA stands at the ready. As Cardillo often says, the agency exists for one reason: "to enable mission consequence for our customers. We are shaping everything we do to ensure that we are delivering the optimum potential for their success."

FEATURE

FROM BULLETS TO DATA:

I was a fighter pilot stationed in Turkey in summer 2001, preparing to report for what I thought was another flying position. Instead, after a call from [Army] Lt. Gen. Jim King [then director of the National Imagery and Mapping Agency], I was suddenly NIMA's first official senior military advisor and responsible for the agency's military support.

New to the intel world, I had to get spun up on a completely new environment. It didn't make it easier that my first 90 days were also King's last before handing over the agency's leadership to a new director.

One day I got a phone call from retired Air Force Lt. Gen. James Clapper, the inbound NIMA director. An hour later, he was in my office sharing his vision for a complete agency reorganization and asking me to lead it. Clapper's 'now, next, after-next' plan would transform NIMA into a top-tier intelligence agency and drive it into the 21st century.

Then came Sept. 11.

Suddenly we were at war, and I was in charge of securing all NIMA facilities. Clapper, who was in St. Louis at the time, began driving back because all the flights were grounded, and most of the workforce didn't go home for the next 24 hours.

The formal change of command had been scheduled for that week, with high-ranking officials invited to attend. Instead, King transferred NIMA over to Clapper with a handshake in a Bethesda office. There wasn't time for pomp; there was work to be done.

One Saturday about a month later, I was putting in a split-rail fence at my house when my wife, Julie, called me inside to watch televised coverage of

PROVIDING LIFE-SAVING MILITARY SUPPORT

By Retired Air Force Brig. Gen. Mike Lee

bombings in Afghanistan. I went straight to work and began 24/7 operations again.

By November 2001 it was clear that our forward-deployed personnel didn't know exactly what they needed in Afghanistan, but they knew what they didn't have: good geospatial content. Much of the best available imagery was from commercial sources, and most paper maps of the area were in a warehouse in Bahrain. Back at headquarters my team and I were trying to get to Afghanistan to help but were having no luck.

After much discussion with my fellow military officers and the unexpected personal discovery of a distant – but useful – family connection, I was able to take my team downrange to assess the situation firsthand.

We quickly learned that everyone was concerned that the people on the ground didn't have the maps and imagery they needed to adequately support the mission. They were right to be worried – our warfighters were working with paper maps from the late 1950s!

In spring 2002, as my team and I headed for home from the deployment, I boarded the plane wondering how we could solve the problems facing those on the frontlines. Once seated I noticed Lt. Cmdr. Cal Astrin get out his MP3 player and headphones to settle in for the flight. Moments later, Cal and I had our heads together, trying to figure out how many maps the device might hold.

That was how NIMA was brought into the mobile data age – with an idea that began in the back of a C-130 plane on a night flight out of Afghanistan.

While the MP3 player idea was ultimately abandoned in favor of portable hard drives, what mattered was that warfighters could depend on up-to-date data and imagery while in the field. According to George Tenet, who was the dual-hatted director of central intelligence and the CIA at the time, our actions "revolutionized the intelligence support we provide to our men and women in uniform."

Bandwidth remained a major issue. Clapper spent around $1 million to create the first geospatial intelligence library: a broom closet in the Bahrain map depot, equipped with a T1 line [a dedicated high-speed fiber optic line] to St. Louis for pushing the digits forward. From there, once we developed a master, we loaded maps onto six 250-gigabyte Maxtor hard drives at a time and hand-delivered them to the field. Every few

Retired Air Force Brig. Gen. Mike Lee

Air Force Maj. Gen. Linda Urrutia-Varhall

FEATURE

weeks, classified imagery was brought over from the States via courier to Bagram and Kuwait. We were eventually able to load commercial imagery onto the hard drives as well, giving analysts on the ground a second drive to help them correlate what they were seeing on their maps.

This approach worked so well that by December 2002 we were doing the same thing for personnel heading into Iraq. In April 2003 the first five C-17s brought American forces into Baghdad, NIMA personnel integrated among them. By fall we had become the National Geospatial-Intelligence Agency.

Military support didn't have the chance to evolve according to a plan. As global circumstances unfolded NIMA was forced to reinvigorate its combat support role to quickly help those who were going into harm's way.

I sometimes worry that it could be too easy for NGA to forget its roots and why it was created. It's more than an agency that makes maps or analyzes imagery; it was built on the backs of people who came together, combined their talents and united with common purpose: to support and save the lives of warfighters and innocents around the world. Often, as I did, our military members trade bullets for data in the fight for national security, even if it means trading the left seat in a cockpit for the right seat at a desk.

The vision that Clapper shared with me back in 2001 wasn't fully realized on my watch, but I think it's beginning to happen now, enabled by the contemporary structuring of the role of NGA director of operations.

Air Force Maj. Gen. Linda Urrutia-Varhall, the current NGA director of operations – known inside headquarters as Gen. UV – faces many of the same challenges I did, but she is also tackling a different one. While supporting the always-changing needs of warfighters, including providing more and different mobile applications, she also has to "codify what her predecessors put into place," as she puts it, and strengthen the foundation for those who come next.

Such future-focused work is not easy. Managing more than 6,000 people across seven internal organizations is a major challenge in itself. These organizations aren't small either; the DO's office is responsible for the most essential, mission-focused parts of the agency, as well as the office responsible for direct engagement with NGA's many and varied customers.

In addition to all of that, UV is working to move NGA toward a future where decisions get made at the lowest possible level.

"I want to turn NGA into a place where 'what's mine is ours,'" she said. "I want to help all these entities cooperate, coordinate and collaborate on the products and services we present."

That's the attitude that can change the course of history, the spirit that inspires people to do their best work and redefine what's possible. The innovative ideas that will move NGA into the future can happen anywhere, at any time – even, as I can attest, in the back of an airplane heading home.

Retired U.S. Air Force Brig. Gen. Mike Lee continues to support the mission as a national security partner at Blue Canopy in Reston, Virginia. Amelia Cohen-Levy, Ctr., Analysis, also contributed to this article.

"Our amazing past influences the present. We should all be proud to be a part of this unbroken tradition of professional service, devotion to duty and excellence in guaranteeing the information edge."

Lt. General James C. King, U.S. Army
Director, NIMA, Mar. 1998—Sept. 2001

"In looking back…I am proudest of, and humbled by, the magnificent workforce of NGA. I include our government employees, contractors and military members." I am also "proud of our progress in defining and growing the concept of geospatial intelligence as a new intelligence discipline."

Lt. General James R. Clapper, Jr., U.S. Air Force (Ret.)
Director, NGA, Nov. 2003—Jul. 2006
Director, NIMA, Sept. 2001—Oct. 2003

"I think the proudest moments were working with the leadership team and being in St. Louis or the Washington area or all the other places we had people externally assigned – you know, we had more than 2,000 people externally assigned after 2009 – and being able to work with all those people as a team."

Vice Admiral Robert B. Murrett, U.S. Navy
Director, NGA, Jul. 2006—Aug. 2010

GEOINT On the Rise
1996 NGA 2016

NGA AIDED RELIEF AFTER KATRINA

NEW ORLEANS POST HURRICANE
IMAGE DATE: AUGUST 31, 2005
Copyright 2016, DigitalGlobe

Dear colleagues:

Every agency did what it could to support relief efforts following Hurricane Katrina in 2005. Even now Katrina remains the costliest disaster in U.S. history.

NGA supported rescue and relief efforts led by fellow agencies by providing graphics of airports, hospitals, police and fire stations, schools and roads in affected areas. There was a big push to use commercial imagery, even though it was still in its infancy, because folks recognized it could be widely released and shared.

I was the program manager for the Commercial Satellite Imagery Library at the time and responsible for bringing in commercial imagery from vendors and distributing that imagery to requesters. Dissemination was not entirely easy, though; it was still essentially limited to CDs and DVDs.

The night after some of the dams were breached, I received a call at home from a colleague in Source. He said, "Ray, I have someone on the phone who wants to talk to you," and I said, "That's great, bring him on." It was General James Clapper.

Gen. Clapper listened to me for quite a long time talk about how we were limited in how we could distribute the information; limited in the copyright and licensing of the information and data.

He told me to press on and do anything that I could to help get that information out. He explained that people were trying to find out whether their houses were still under water. If we could show commercial imagery out on the web, people could look there, instead of trying to go back into areas that needed to be cordoned off.

It was also at that point that he gave me his home phone number. He said, "If you need anything this weekend coming up, here's my number. Call me."

Talk about empowerment! I've never used his number, but I still have it.

I spent that weekend and the next 29 days between the Defense Intelligence Analysis Center at Joint Base Anacostia-Bolling in Washington, D.C., and Bethesda, Maryland, briefing Gen. Clapper every morning.

One of the most important pieces of the experience for me was that the day after I talked to Gen. Clapper, I initiated the first-ever 'open to the world' unclassified teleconference for imagery sharing. Anybody who had a problem with commercial imagery could call the number and receive assistance. We held it two times a day, and people from all over NGA participated. Anyone from a government agency that needed help or had issues related to commercial imagery could call, and we answered questions and helped anyone on the line.

The open teleconference was a very popular method for everyone to get on the same page as to what was going on with unclassified commercial imagery. I think a lot of people took lessons learned out of our responses in the telecom.

Raymond Bauer
CIO & IT Services directorate

WHITE HOUSE: NGA ASSISTANCE "ESSENTIAL"

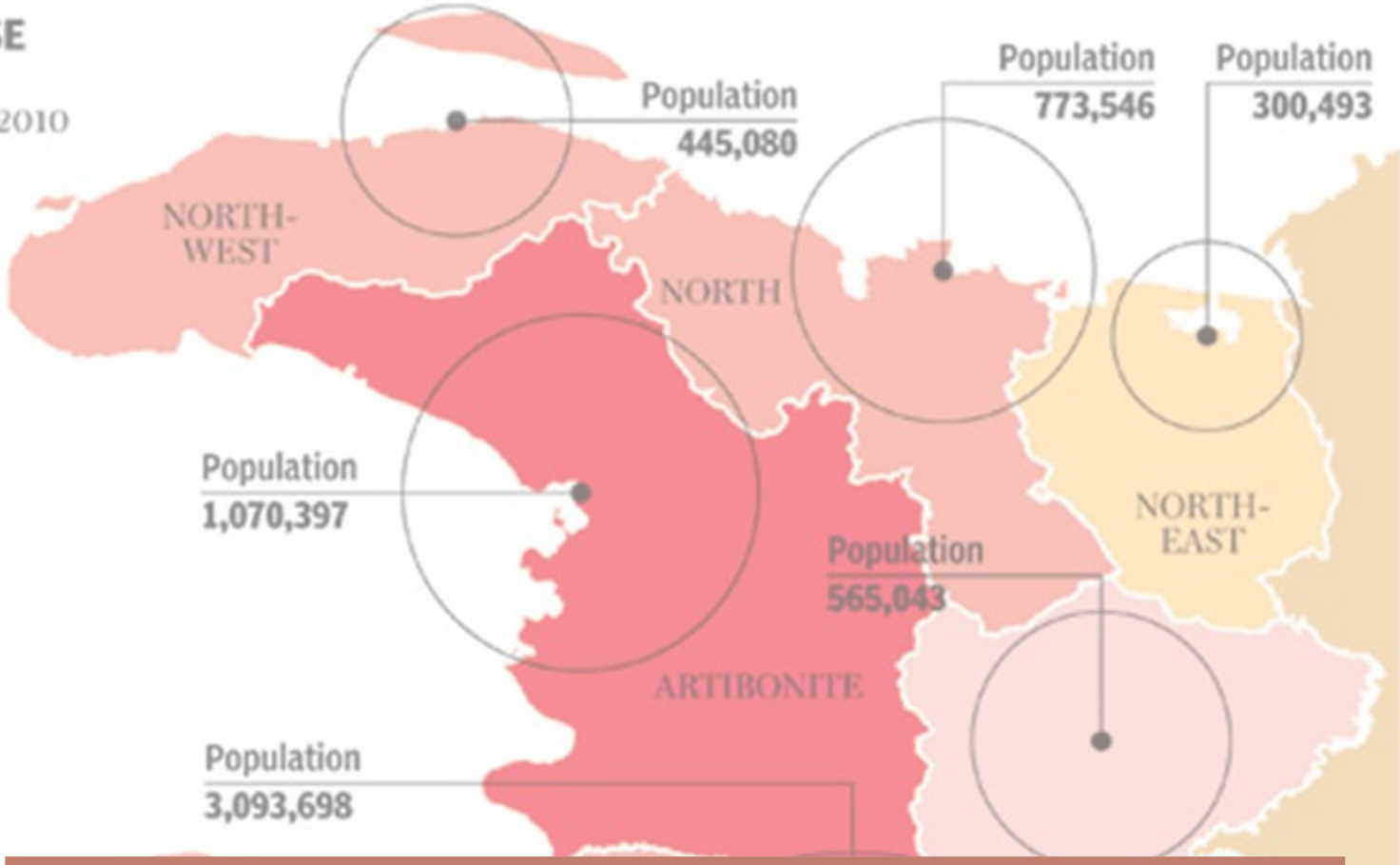
The 2006 White House report on the federal response to Katrina lauded NGA as an invaluable asset to decision-making and restoration of critical infrastructure. By collecting key infrastructure-related data and pre-deploying analysts and mobile systems prior to landfall, NGA was able to provide the first comprehensive overview of the damage caused by the hurricane and flood. By providing hundreds of intelligence products per day immediately following the disaster, the agency aided response teams in affected areas; aided recovery of oil platforms; provided navigation information to the U.S. Navy, Merchant Marine and Coast Guard; and relayed messages from the National Weather Service to people at sea.

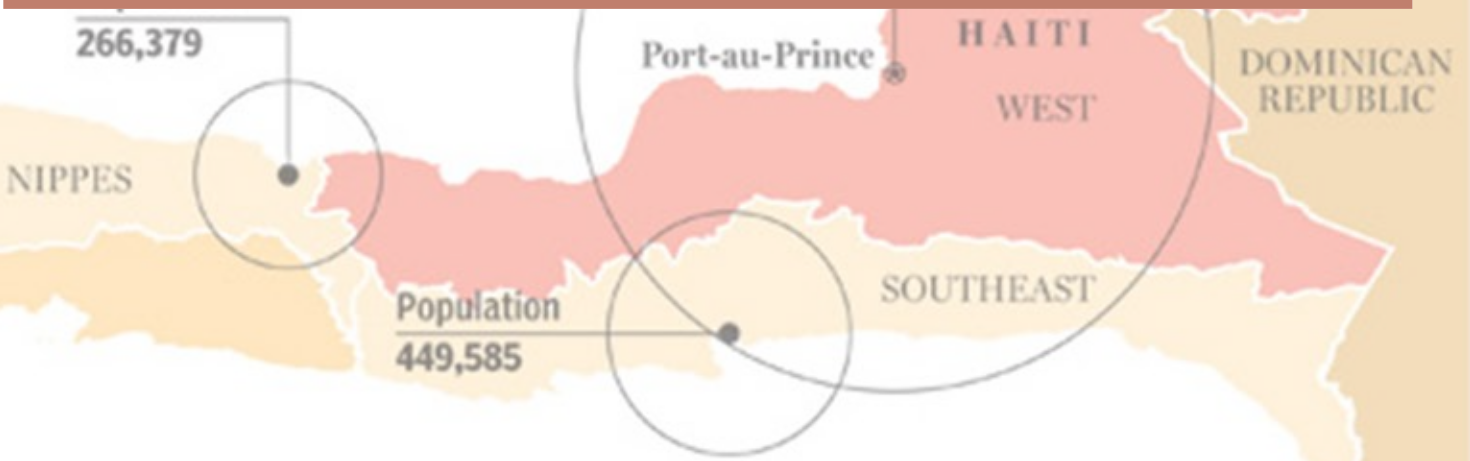
FEATURE

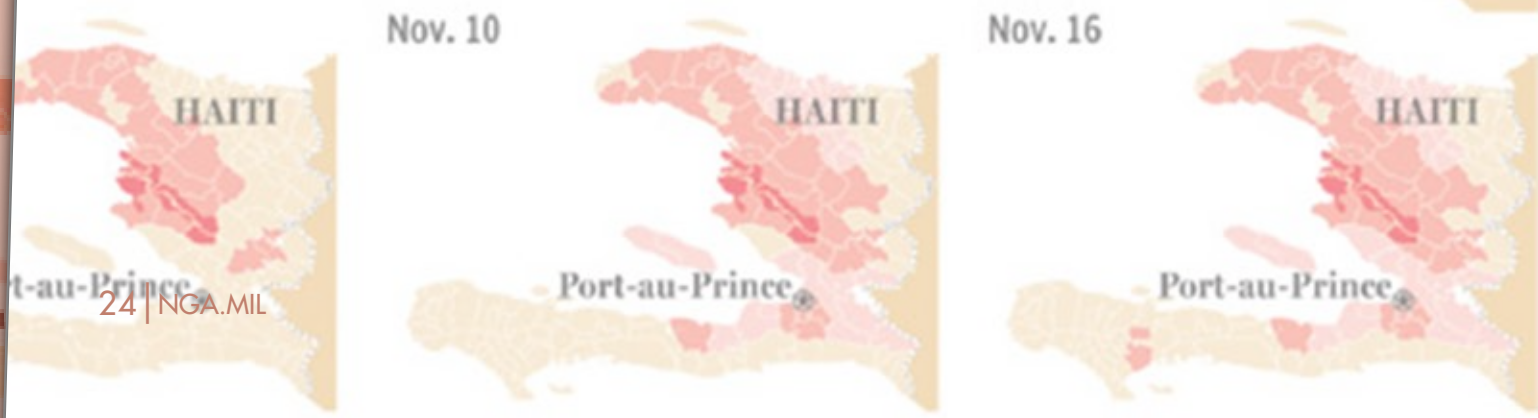
HELPING CITIZENS IN DISTRESS:

NGA'S CONTRIBUTION TO HUMANITARIAN AID AND DISASTER RESPONSE

By Marylou Gjernes and Lisa Wagner, Ctrs., NGA History Department







Never let it be mistaken that geospatial intelligence is only for supporting warfare or locating political adversaries. When citizens of the world suffer a blow dealt by nature, National Geospatial-Intelligence Agency products and services help save lives by tracking patterns of violent weather and the spread of disease, identifying physical changes to the earth and critical infrastructure, and guiding first-responder organizations in getting help to wherever it is needed, whether at home or abroad.

Since its inception as the National Imagery and Mapping Agency in 1996, the subsequently renamed NGA has provided pertinent data and information to partner organizations such as the Federal Emergency Management Agency, U.S. Agency for International Development, the Department of State and the Department of Homeland Security. The agency is not chartered to provide emergency assistance directly, but rather it supports these partners when requested with GEOINT that enables them to perform their missions faster, safer and more effectively.

Hurricanes, tornadoes, earthquakes, floods and wildfires all require imagery-driven damage assessments and means by which to accurately locate and assist citizens in distress. Disaster responses also require organization; if not properly coordinated, goodwill and well-intended efforts can prove debilitating. Organizing and tracking assistance by geographical area helps manage humanitarian aid, and that's one way GEOINT can help. By using NGA imagery and maps with overlays, organizations such as FEMA typically divide affected areas into grids and assign them to teams of first responders. This enables authorities to manage more effectively during the aftermath of a disaster, but it also helps first

I was there…

CONCEPT FOR NGA EXPERT TEAMS DATES TO VIETNAM ERA

The concept of a fielded-expert team was not unique. The Aeronautical Chart and Information Center delivered the original Point Positioning Data Bases to Vietnam with accompanying experts from St. Louis. Thirty years later that notion was embedded in the planned execution of the Global Geospatial Information and Systems initiative, with teams of cartographers sited in customer footprints, as part of the DMA re-engineering plan. When NIMA's operational concept was defined, that element was incorporated and has matured into today's NGA Support Teams.

— *Roberta "Bobbi" Lenczowski retired from NGA as executive director of NGA Campus West in St. Louis; she also served three years as NGA's technical executive and previously was the director of operations for NIMA*

responders focus their efforts and better understand how their work contributes to the overall effort.

GEOINT has been a vital component of the nation's disaster and recovery efforts since Hurricane Andrew ripped through Florida in the summer of 1992, becoming what was at the time the most destructive hurricane in U.S. history, according to the National Weather Service. FEMA requested imagery of the destruction from the National Photographic Interpretation Center, one of several agencies that were merged into NIMA when it was created in 1996.

"Previously, responders had to make their way out to the impacted areas, or wait for images to appear on CNN to start assessing the damage, with no real sense of how to prioritize rescue and recovery operations," said Joe Drummey, an NPIC analyst at the time.

After the standup of NIMA, U.S. disaster and recovery efforts benefited from the new ability to overlay maps on imagery to indicate changes in roads and infrastructure, and support turned global in 1997. In the years since, NIMA/NGA has deployed teams throughout the world to assist local responders and authorities dealing with many types of natural disasters. These teams are assembled for their expertise and provide geospatial information for identifying usable infrastructure and helping to coordinate rescue efforts. They are supported by 24-hour reach-back capabilities throughout the agency, assisting customers with everything from analytical information to equipment needed to perform GEOINT in the field, to declassification authorization.

HURRICANES

NGA closely monitors all hurricanes so that the agency is ready to offer assistance when requested by FEMA. When Hurricane Katrina struck the Gulf Coast in the early hours of August 29, 2005, NGA had been tracking the hurricane prior to landfall, and analysts deployed with regional FEMA teams ahead of the storm's arrival.

Before landfall on Friday, August 26, NGA had forwarded 100 graphics depicting the location of key infrastructures – hospitals, police stations, highways, schools, etc. – for the counties in the path of Hurricane Katrina, according to retired Air Force Lt. Gen. James R. Clapper Jr., who was director of NGA at the time.

By comparing this pre-hurricane data with post-hurricane data, NGA helped to very quickly develop damage assessments of the affected region. (See related story, page 22.)

NGA expertise proved so helpful during the Katrina response that the agency developed a Domestic Mobile Integrated Geospatial Intelligence System in 2006 to provide on-the-ground support to federal responders during a national event such as a weather disaster, or even to support national security during large public events such as presidential inaugurations and major sporting events.

The DMIGS fleet consists of two 44-foot-long vehicles, plus a support vehicle, that integrate GEOINT hardware and software with a robust communication system, enabling NGA to deploy analysts in support of operational requirements. The DMIGS fleet provided support to, among other events, the 2008 presidential inauguration and a string of violent weather events in 2011 – tornadoes in the South, flooding in the Midwest and Hurricane Irene, which devastated large areas of the East Coast as well as the Caribbean.

"Embedded analysts are the best way NGA can bring all our services forward to the customer," said Hector Montalvo from the NGA domestic operating environment office. He believes that, in addition to assisting citizens, the experience offers "the best way we have to train our junior analysts…. It keeps our skills sharp."

By the time Hurricane Sandy struck the East Coast in 2012, technologies had developed to where more data could be shared with first responders via the internet, with fewer analysts deployed. The agency's 'online, on-demand' presentation of data directly to customers saved time and cost for both the end users and a much smaller and more efficient deployed NGA team.

NGA relied on the effectiveness of a team approach in its headquarters support as well. An integrated working group of various subject matter experts devoted to readiness, response and recovery was created at the agency's western campus in Arnold, Missouri. Once again NGA analysts and staff worked around the clock to help identify areas with flood damage or power loss, and check the status of airports, harbors and oil refineries in the affected areas.

EARTHQUAKES

Earthquakes present similar challenges that GEOINT helps to resolve. In September 2009 a magnitude 8.0 earthquake struck the Samoan Islands, spawning tsunamis with waves up to 20 feet. After President Obama issued a disaster declaration for American Samoa, NGA provided FEMA with damage assessment data and information to support relief efforts. NGA analysts in the region, along with a reach-back team stateside, also delivered initial damage assessments and assisted relief teams operating in affected areas in Australia and New Zealand.

NGA's information and data were useful in large part because they provided a common operating picture for first responders and relief workers, which enabled them to do their jobs more quickly and effectively.

NGA also made some images available to the general public through its crisis response portal, NGA-Earth.org, a satellite imagery and map viewer. Originally established in response to Hurricane Katrina, the NGA-Earth site uses the internet to provide a single, easy-to-use entry point for locating GEOINT information in the event of a natural disaster or crisis. In addition to providing a means to communicate critical information to first responders,

the site allows the public to broadly assess property damage without having to physically return to the disaster area.

One year later, when an even more ruthless earthquake hit Haiti, NGA stood up a Haitian crisis action team within a matter of hours, and they began round-the-clock GEOINT operations. Within 48 hours the NGA Support Team at SOUTHCOM had deployed, collected, processed, analyzed, stored and disseminated vital GEOINT products.

Light detection and ranging, more commonly known as LiDAR, proved especially useful in this situation. Through the use of LiDAR, NGA analysts were able to track the location and day-to-day growth of internally displaced persons camps. Analysis confirmed that thousands of the two million people displaced by the event had self-relocated to areas with a high probability of landslides and flash flood during the coming rainy season.

"Unless we did something, we were going to have a second wave of deaths," FEMA's Michael Byrne said in an interview after the event. According to Byrne, NGA's work possibly saved as many as 37,000 people.

NGA's work in Haiti was critical for another reason as well – the imagery provided nonverbal critical information to first responders and rescuers from many nations, who spoke many languages. NGA imagery enabled these responders to collaborate immediately and at all times without having to depend on interpreters.

DISEASE

The disaster in Haiti did not end with the earthquake. Over a year later a cholera epidemic hit the island nation. From October 2010 through February 2011, an estimated 4,500 Haitians died from the outbreak.

NGA's contribution to the anti-cholera campaign involved monitoring, tracing and marking the disease's footprint. Analysis of the visual representation, however, was the agency's most important value-added contribution. NGA looked for patterns that would indicate how cholera was spreading and where it would spread to next.

An examination of this geospatial mapping of the cholera outbreak area revealed that the outbreak had primarily been located outside of the densely populated displaced persons camps. Knowing this, medical and relief personnel were able to disseminate information in these areas to educate the local population about how to protect themselves. Continuous tracking indicated that these educational efforts were largely successful in slowing and eventually halting the outbreak.

NONTRADITIONAL MISSION PARTNERS

Dealing with the Haitian crisis highlighted both the need and the benefit of making geospatial information available to nontraditional partners outside of the defense and intelligence communities. NGA's involvement with its mission partners demonstrated the growing importance of GEOINT for saving lives, easing suffering and halting the spread of disease.

The agency has responded with similar innovative solutions when other pandemics have threatened global health. NGA analysts have integrated classified and unclassified, government and commercial satellite and airborne imagery, to track and combat swine flu in 2009 and the Ebola virus in 2014. More recently GEOINT has been used to track dengue fever, which according to news reports, some researchers are beginning to believe may be linked to the current Zika virus plaguing South America.

All of these examples demonstrate that, just as it does for warfighters and policymakers, GEOINT provides situational awareness and a common foundation to guide the efforts of first responders in the relief enterprise. Commercial imagery, coordinated, used and shared by NGA, has been vital to creating products that can be used in the field to give decision-makers the critical information they need for response and recovery efforts.

DID YOU KNOW?

Warning ship captains and individual boaters of pirate threats is an important aspect of NGA's safety of navigation mission. Twenty-first century piracy in the Horn of Africa and the Gulf of Aden is a symptom rooted in economic deprivation, lost fishing rights and political instability.

Beginning under NGA's first director, Navy Rear Adm. Jack Dantone, the agency has used its human geography and safety of navigation expertise to provide insights that inform counter-piracy measures. In 2014 NGA also became the first intelligence agency to provide public apps, making ASAM, the Anti-Shipping Activity Message app, available on iTunes. The app gives mariners the geographic locations and reported descriptive accounts of hostile acts against ships, crews and passengers, including incidents of piracy, robbery, hijacking and kidnapping.

GEOINT On the Rise
1996 NGA 2016

20/20 VECTOR:

LOOKING TO MY OWN FUTURE HELPED ME TO SEE AN INTERESTING PAST

By Eric Gartman, Analysis

One of the great benefits of working at National Geospatial-Intelligence Agency is continued education. I never dreamed that my own experience would lead me to discover an interesting piece of history relating to NGA – and ultimately to authoring a book about it.

A few years ago I had the opportunity to take part in the 20/20 Vector program, a wonderful initiative in which employees spend half their workweek at the office and use the other half – fully paid – to pursue a master's degree in a related field through the National Intelligence University. After selection into the program through a competitive process, I pursued a degree in strategic intelligence.

The degree required an in-depth thesis. For mine I chose to research the U.S. intelligence community's warning posture of a possible Syrian attack on Israel in the early 1970s – an attempt to reclaim Israeli-occupied territories in the Sinai Peninsula and the Golan Heights. Much of the intelligence community's posture on this issue was based on the joint Egyptian-Syrian attack on Israel in 1973, which caught both U.S. and Israeli intelligence by surprise.

Some of what I discovered in my research came as a surprise.

Several of the most useful documents for explaining what happened in '73 were issued by an NGA predecessor, the National Photographic Interpretation Center. That was not particularly surprising to me; what I did not expect was that NPIC's warnings were largely dismissed.

NPIC analysts had observed a massive buildup along Israel's borders and had warned both U.S. and Israeli officials of the possibility of war. Israeli officials were already aware of the presence of forces, but they had discounted the possibility of war. They believed that the Egyptians and Syrians would not risk an attack due to their inferior air force and armored corps.

This assumption was incorrect. War erupted, and it had major consequences not just for Israel but also for U.S. policy. With the Soviet Union backing Egypt and Syria, and the United States backing Israel during the six-year conflict that ensued, the superpowers moved closer to nuclear war than at any point since the Cuban Missile Crisis.

I found the story not only fascinating, but I couldn't help but think it was a cautionary tale for national decision-makers. I felt that it might interest audiences outside of the intelligence community as well.

The end result was "Return to Zion: The History of Modern Israel." I based the book in large part on my master's thesis, and it was published by the University of Nebraska Press in September 2015.

Some information in the book had never been seen outside the intelligence community. With NGA's full approval, I was able to add this new material to the greater body of knowledge, and the book drew praise from several historians.

All of this was made possible by NGA's commitment to the continued education of its workforce. I'm pleased that I was able to take advantage of the 20/20 Vector opportunity provided by NGA. It led down a road I had never envisioned.

LEADERSHIP:

TAKING CHARGE BY TAKING CARE

By Simmie A. Adams, Ph.D., Ctr., Human Development

An organization working together as one team is instep and strives toward commonly held goals. To get the team synchronized, effective leadership is essential.

At National Geospatial-Intelligence Agency, the Supervisory Council works to help leaders at all levels develop the values and skills needed for long-term success – both their own and the workforce's. The council focuses in large measure on the concept of servant leadership.

Servant leadership is not just the latest fad of various leadership styles; it actually dates back more than four decades. Robert K. Greenleaf established the foundation for it in his 1970 essay "The Servant as Leader." According to Greenleaf, "It begins with the natural feeling that one wants to serve. Then conscious choice brings one to aspire to lead. The best test is: do those served grow as persons…?"

Greenleaf and his followers identified several overarching themes of servant leadership. They are:

- **Valuing people.** Servant leaders believe people should be appreciated; they are not simply a resource to be used for the benefit of the leader.
- **Developing people.** Servant leaders believe others should be nurtured and assisted in their personal and professional growth. They provide a safe environment that promotes learning and rewards risk taking.
- **Building community.** Servant leaders believe in the power of the team. They believe the team's strength comes from its members working together and supporting one another.
- **Displaying authenticity.** Servant leaders hold themselves accountable to all, in an accepting and trusting environment. If they make mistakes they readily assume responsibility for them.
- **Providing leadership.** Servant leaders believe in action and taking on initiatives, while also influencing others to do the same. They are oriented to the future; they envision what can be and should be.
- **Sharing leadership.** Servant leaders promote the ability to brainstorm solutions, make decisions, and develop and implement plans. They create and use performance metrics to ensure results are achieved.

Greenleaf and his followers also identified several major attributes necessary for servant leaders. They are:

- **Listening** – being in tune to both verbal and nonverbal signals, as well as having the ability to understand the message.
- **Empathy** – building compassion by understanding others' thoughts, behaviors and emotions.
- **Healing** – working to enable others to overcome situations, issues and problems that limit their ability to maximize their performance.
- **Awareness** – being able to view and understand the situations, issues and problems facing an organization.
- **Persuasion** – leading not from a position of authority but rather from encouraging, coaxing, influencing and convincing others about what they should do.
- **Conceptualization** – seeing situations, issues and problems abstractly; thinking beyond the current day and imagining what can be tomorrow.
- **Foresight** – leveraging understanding of the past and combining it with knowledge of the present, then applying this information to make decisions for the future.
- **Stewardship** – stressing the use of persuasion and consensus rather than control and a position of authority.
- **Commitment to the growth of people** – encouraging their followers to be active participants in their future.
- **Building community** – actively pursuing the development of teamwork to create a sense of belonging.

The bottom line is that servant leaders are people centered. By promoting servant leadership at NGA, the Supervisory Council believes a greater number of leaders will bring about its benefits for the team at NGA.

WHAT'S YOUR STORY?

Tell us your personal, unclassified version of the work you or your office does for NGA for possible inclusion in the next Pathfinder. Send your 600 word or less account to Pathfinder@nga.mil. Submissions may be edited for clarity and length.

A VERY DIFFERENT INTELLIGENCE PRODUCER:

HYBRID TRADECRAFT HAS OPENED NEW METHODOLOGICAL DOORS

By Gary E. Weir, Ph.D., NGA Historian

On the eve of the National Imagery and Mapping Agency's standup, the two leaders of the steering committee structuring the new agency fully realized the long-term consequences of their recommendations. If successful their effort would, over time, truly change the nature of intelligence.

Navy Adm. William Owens, vice chair of the Joint Chiefs of Staff, and Keith Hall, JCS executive director for intelligence community affairs, realized that placing the tradecraft traditions – the cartography of the Defense Mapping Agency and the imagery analysis of the National Photographic Interpretation Agency – into the same agency would certainly result in interesting hybrid changes. They realized this possibility would unnerve many who would move into NIMA from those two agencies.

Nonetheless, Owens and Hall embraced the very possibility that most at NPIC and many at DMA reportedly feared: that NIMA's character would be "beyond a classical intelligence organization," as they wrote in a September 1995 memorandum to Director of Central Intelligence John Deutch.

Owens and Hall realized that the new NIMA would cause a measure of cultural awkwardness, but they also understood the tradecraft chemistry involved; breaking barriers and combining two elements in a new way would set NIMA on an experimental course. If the combination worked, intelligence could well change – dramatically.

I was there…

INTEGRATION CREATED NEW SYNERGIES

The full integration of our imagery and geospatial analysts in 2001, driven by then-Director Clapper, created synergies that resulted in the emergence of a new tradecraft known today as GEOINT.

— *Steve Wallach, former NGA technical executive; director, Analysis and Production and NGA West executive*

IT WORKED

A mere three years later, NIMA received the Joint Meritorious Unit Award from the Department of Defense in recognition of the agency's outstanding service since its birth, October 1, 1996. During its first years NIMA supported operations in Bosnia, Iraq, Afghanistan, Sudan, Kosovo and Serbia. Under its first two directors – Navy Rear Adm. Jack Dantone and Army Lt. Gen. James King – the agency simultaneously provided imagery and geospatial information to military customers abroad and to federal authorities at home working toward national security objectives.

All the while NIMA wrestled with its diverse origins. It was exactly that diversity of tradecraft, however, that set NIMA on its way to becoming both the National Geospatial-Intelligence Agency in 2003 and a very different kind of intelligence producer.

NOT WITHOUT CHALLENGES

The events of Sept. 11 affected NIMA more than any other agency in the intelligence community. Just 10 days into his new role as NGA director, retired Air Force Lt. Gen. James R. Clapper Jr., moved swiftly to adapt to the new threats. Very quickly, many at the agency began to realize the potential of a multiple-intelligence identity wrapped in a geospatial consciousness. The new director also initiated major organizational and mission changes designed to strengthen warfighter support from home and to project the agency forward into the fight.

Given the specter of 9/11, most of the workforce seemed willing to take a chance with the changes. Sometimes, however, it became difficult to know how to best combine skills or how to ask the best questions of tradecrafts appearing together in the workplace for the first time.

"We were setting up [production] cells of cartographers within imagery analysis footprints to do maps for them, but also to do things that we never thought they could do, because we didn't know enough to ask," said former senior leader Peter Usowski in an oral history interview. "But we had a cell at the Navy Yard. We had a cell at Langley of, you know, five, six, seven cartographers, and even more sophisticated geospatial analysts, that were actually working intel issues and bringing that type of discipline onto the intel problems."

Members of the production cell would initially take the intel information and integrate it with available imagery analysis. Over time they became more confident that what they were doing was actually answering intelligence questions, according to Usowski.

RECOGNIZING POSSIBILITY

Those working within the production cell began to appreciate more fully both the cultural divide between the world of maps and imagery, and the promise of integration. The conflict in Chechnya presented one such promising opportunity.

Wracked by civil war between 1999 and 2003, Chechnya fell under the watch of NIMA's Eurasia Branch, led by Earl Chidester. Chidester turned potential into practice in 2000 by inviting a Bethesda-based cartographer to join the Eurasia group to merge his talent with their imagery analysis.

The Eurasia branch newcomer had come into NIMA from DMA, which had hired him from the map publishing company Rand McNally. He brought to the group a specific talent for displaying information within a thematic context. He soon built a reputation for weaving geospatial information into a graphic story that was easy to understand.

With the successful integration of this geospatial professional, the Eurasia group managed to set aside cultural barriers. They began to listen to each other, share ideas and issue new hybrid intelligence products that had their customers frequently describing the output as phenomenal. By providing intellectual insight into a crisis situation through a tight, complementary symphony of image and idea, they quickly set the standard for this new type of intelligence.

This pioneering group arrayed their early products on a display surface at the Navy Yard that quickly became known as the 'Wall of Fame.' Collaborations like this gave birth to modern geospatial intelligence, or GEOINT. The experimental nature of the NIMA publication cells made it possible.

FURTHER EVOLUTION

The chemistry that Owens and Hall understood was possible when they recommended combining multiple tradecrafts into NIMA allowed for much more creative approaches to addressing the nation's hard intelligence challenges. None were more difficult than Sept. 11.

Activity-based intelligence, or ABI, was created at NIMA shortly after Sept. 11 and quickly emerged as a powerful tradecraft. It began as a joint effort with allies to address the operation of an Al-Qaida cell in the Kurdish region of northern Iraq.

Due to increasing interest in terrorist operations, a NIMA imagery analyst who had a background in geography initiated collaboration with another analyst to explore ways of illuminating the nature and activity of these groups. With the advice and consent of allies, they formed a production cell with the express purpose of combining raw intelligence of all types into a single geospatially presented analytical product.

The hybrid production cell grew from these modest beginnings into a group of roughly nine members after the beginning of Operation Iraqi Freedom in 2003. It included IAs, SIGINT analysts from the military and civilian communities, geospatial specialists and all-source analysts. Cultural experts and linguists rounded out the group.

At roughly the same time, National Security Agency developed a way of intercepting select terrorist transmissions. SIGINT contacts provided the NIMA cell with certain conversations between parties, keeping the linguists constantly busy; conversely, NIMA provided a very informative spatial and temporal component to those exploiting the contacts.

The SIGINT community began linking the transmissions to one another, and the GEOINT community began exploring relationships among the locations from which the conversations emerged. This new activity-based approach contrasted to the traditional target-based approach and opened a number of new methodological doors.

ABI has evolved to become one of the most potent tactical tools in the fight against terrorism. It places people and changing locations within an emerging network of deep geospatial knowledge, which enables the exposure of adversaries who previously would have been able to blend into their surroundings.

If the emergence and success of ABI came as a surprise to some, it would not have been to Owens or Hall. It was thanks to their leadership of the steering committee that structured NIMA at its outset that DMA was included in the agency; the original concept called simply for a national imagery agency. But Owens and Hall understood that the cartographers at DMA could well bring an added dimension to imagery-based intelligence products. Considering the many innovative developments that have emerged under the aegis of GEOINT, the hybrid experiment that began two decades ago continues to work today.

HALL OF FAME HONORS VISION, LEADERSHIP AND ACHIEVEMENT

The term 'geospatial intelligence' was officially coined in 2001. That same year six of the field's visionaries became the first inductees into the NIMA Hall of Fame, a predecessor of today's Geospatial Intelligence Hall of Fame. There are now 58 members, and five more individuals will be inducted in 2016.

This year the agency will also induct legacy World War II civilian women cartographers from the Army Map Service, who were critical in advancing geospatial intelligence, and photo interpreters with the Women Army Corps stationed at Medmenham, England, who were instrumental to the nascent tradecraft of that era.

The Geospatial Intelligence Hall of Fame honors men and women who have made a significant impact on the development and delivery of GEOINT, either by directly contributing to the evolution of processes or production, or by serving as a leader to those practicing the tradecraft. Membership includes several inductees who worked with NGA's predecessor agencies, and even a few who sacrificed their lives for the sake of the mission and were inducted posthumously.

The Hall of Fame expanded beyond the confines of NGA in 2015 to allow induction of persons employed outside the agency or its heritage agencies. Commonwealth partners and other non-U.S. citizens also became eligible for the first time, in recognition of the global and collaborative nature of GEOINT.

Induction into the Hall of Fame is competitive. Nominees must have made a profound impact on the GEOINT tradecraft and made their marks on the industry in unique ways. Nominations are reviewed each summer for induction in the fall.

The Hall of Fame exhibit resides at NGA headquarters in Springfield, Virginia. To learn more about NGA's history, including its Hall of Fame inductees, visit http://www.nga.mil

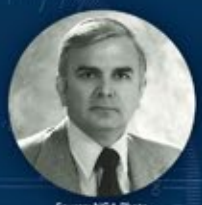
GEOSPATIAL INTELLIGENCE HALL *of* FAME

Source: NGA Photo

2016
Rear Admiral Christian Andreasen

Source: NGA Photo

2016
Mr. John Oswald



Source: NGA Photo

2016
Mr. Lou Decker

Source: NGA Photo

2016
Rear Admiral Joseph J. Dantone Jr.

Source: NGA Photo

2016
Ms. Joanne O. Isham

2016
World War II Female Geospatial Pioneers

GOING DIGITAL:
HOW NGA CHANGED A 135-YEAR-OLD NAUTICAL TRADITION

By Howard Cohen, Maritime Safety Office

Published weekly beginning in 1869, the U.S. Notice to Mariners contained time-sensitive update information for all U.S. government charts and publications to ensure safe navigation around the world. National Geospatial-Intelligence Agency began publishing the notice in digital format in 1999. The agency published the last hard-copy notice in December 2004, ending what had been to that point the oldest continuous U.S. government publication.

But by ending the paper publication, NGA began a new era of more robust service to mariners, providing the most comprehensive navigational information in history to NGA's military and civilian customers around the world.

"NGA has used technology to transform the way our maritime customers receive mission-critical maritime safety information," said NGA's director at the time, retired Air Force Lt. Gen. James R. Clapper Jr., in announcing the change. "Most importantly this has reduced the time for mariners to access time-sensitive information and has also eliminated associated government costs to print and distribute data."

Prior to the transition to digital format, NGA had printed and distributed on average 10,000 copies of the publication each week to customers around the globe. If stacked in a column, the annual volume of U.S. Notice to Mariners would have measured roughly the height of 40 Washington Monuments.

A NEW ERA AT SEA

The new Digital Nautical Chart© became the world's first and only worldwide digital nautical chart. Twelve layers of data, each representing a different type of information, make up each chart. Originally created for the Navy, it provides combat support, situational awareness and marine navigation superior to that of any traditional paper charts.

The Navy first used the DNC on the U.S.S. Cape St. George in 2005. Deputy Navigator of the Navy at the time, Capt. Zdenka Willis, said the use of the DNC was as revolutionary as "going from sails to steam."

The DNC also supports the electronic chart display systems of the U.S. Coast Guard and other government vessels, and is offered to the public for use by commercial vessels in U.S. waters.

Through continuous updating of the DNC, NGA supports mission planning, execution of military operations and safe navigation around the world on a daily basis. Above all, web-based access to maritime safety information supports navigational safety for all mariners, whether government or civilian, whole fleet or individual craft.

Information for this article was also drawn from "A New Era Dawns for Maritime Navigation," published in the May/June 2005 issue of NGA Pathfinder.

THE SCIENCE OF IMAGERY:
NIMA EXPERTS ANALYZE MARS LANDSCAPE FOR LOST SPACECRAFT

Adapted from a 2002 article by James Salacain and the late Ivar Svendsen

It was January 1999. The Mars Polar Lander, one of NASA's small planetary explorer spacecraft, was programmed to enter the Martian atmosphere, perform a soft landing and conduct a 90-day science mission about 800 kilometers from the planet's south pole. The craft shot through space for nearly the whole year to reach its destination, entered the Martian atmosphere – and was never heard from again.

Because the MPL did not have a telemetry transmission capability during atmospheric entry, no radio signals were sent back to Earth that might have revealed to investigators what went wrong. NASA obtained overhead search imagery of the intended MPL landing site from its Mars Orbiter Camera system onboard the Mars Global Surveyor spacecraft, which had been orbiting the planet since 1997. The MOC system operators and analysts at the Jet Propulsion Laboratory also conducted imagery searches.

Then NIMA offered assistance. NIMA's workforce could support NASA's efforts with unique imagery exploitation skills and techniques useful for locating and identifying small manmade objects in terrestrial imagery.

NASA provided its imagery to the team of NIMA imagery scientists and imagery analysts, who began a detailed search of the primary landing area. The team ultimately identified three candidate sites that had pixel returns appearing to match the expected signatures of the lander and its associated landing hardware.

The NIMA team employed a number of scientific and analytic techniques to review the three sites. Methodologies included comparisons of imagery, examination of signatures and pixel intensity values, analysis of surface impressions, and creation of simulated signatures and 3-D models. The team used trace models to determine if the signatures observed in the images could have been created by the MPL configuration.

On the basis of its analysis, the NIMA team concluded in 2001 that the second and most central of the three possible sites had characteristics that resembled the expected MPL configuration, sitting upright on the surface at the intended azimuth orientation angle, with its solar panels in the deployed position. The team believed the craft's heat shield was most likely at the third location, and its backshell – similar to a parachute – was likely at the first site. Imagery signatures at the two outer sites suggested the presence of protective hardware associated with atmospheric entry.

UNSOLVED MYSTERY

The NASA investigation board eventually concluded that the MPL likely crashed because its descent rocket engine quit firing due to a software error, causing the craft to fall to the surface from a height equivalent to about 50 feet on Earth. The fallen spacecraft has never been definitively located, however; the harsh conditions of the Mars polar region have a tendency to erase normal crash site observations and make it difficult to accurately distinguish true signals among false noise signatures.

While it remains unclear exactly what happened to the MPL in 1999, NASA deemed its original mission worthy of additional pursuit. In 2008 the Phoenix lander arrived on Mars and completed what the MPL set out to do all those years before.

To learn the technical details of how NIMA helped NASA search for the MPL, read the original article, "An Imagery Search for NASA's Missing Mars Polar Lander: Lost and Found?" as it was published in Geospatial Intelligence Review, December 2002, available on the NGA website under the Pathfinder tab. Visit http://www.nga.mil

VALIDATION MATTERS: REMEMBERING DUBROVNIK

By Melanie Pittaluga, Aeronautical Navigation Office

April 3, 1996 should have marked the launch of a three-day U.S. Department of Commerce tour to help build trade and repair the economy in the war-torn expanses of the Balkans. Instead, the day ended in tragic loss of life and mission failure.

The U.S. Air Force CT-43A, a modified Boeing 737, carrying the delegation on that rainy day veered off course while attempting to land in Dubrovnik, Croatia, and crashed into a neighboring mountain. The crash claimed the lives of all 35 passengers and crew on board, including U.S. Secretary of Commerce Ronald H. Brown.

The 76th Airlift Squadron had been tasked to provide mission and airlift support to Secretary Brown and his delegation. After close scrutiny and investigation, the U.S. Air Force Accident Review Board spotlighted the use of an improperly designed instrument approach procedure – IAP – as a key factor that led to the deadly terrain impact that occurred. A command-level decision to use the IAP without first validating it also contributed.

This tragedy shook the nation. It also sparked an institutional shift within Department of Defense policy and reinforced what would become the National Geospatial-Intelligence Agency aeronautical navigation office's core mission – to ensure that only accurate and validated data is provided to military aircrews.

The DOD policy memos issued as a result of the 1996 mishap are still in effect today. To meet the DOD requirements, NGA aeronautical analysts validate aeronautical information and data from over 260 military and civil source authorities worldwide. NGA provides updated information to DOD aircrews in a standardized format in more than 1,536 publications every year. This data is available to NGA customers 24/7 via legacy products, various NGA webpages and through mobile application technology.

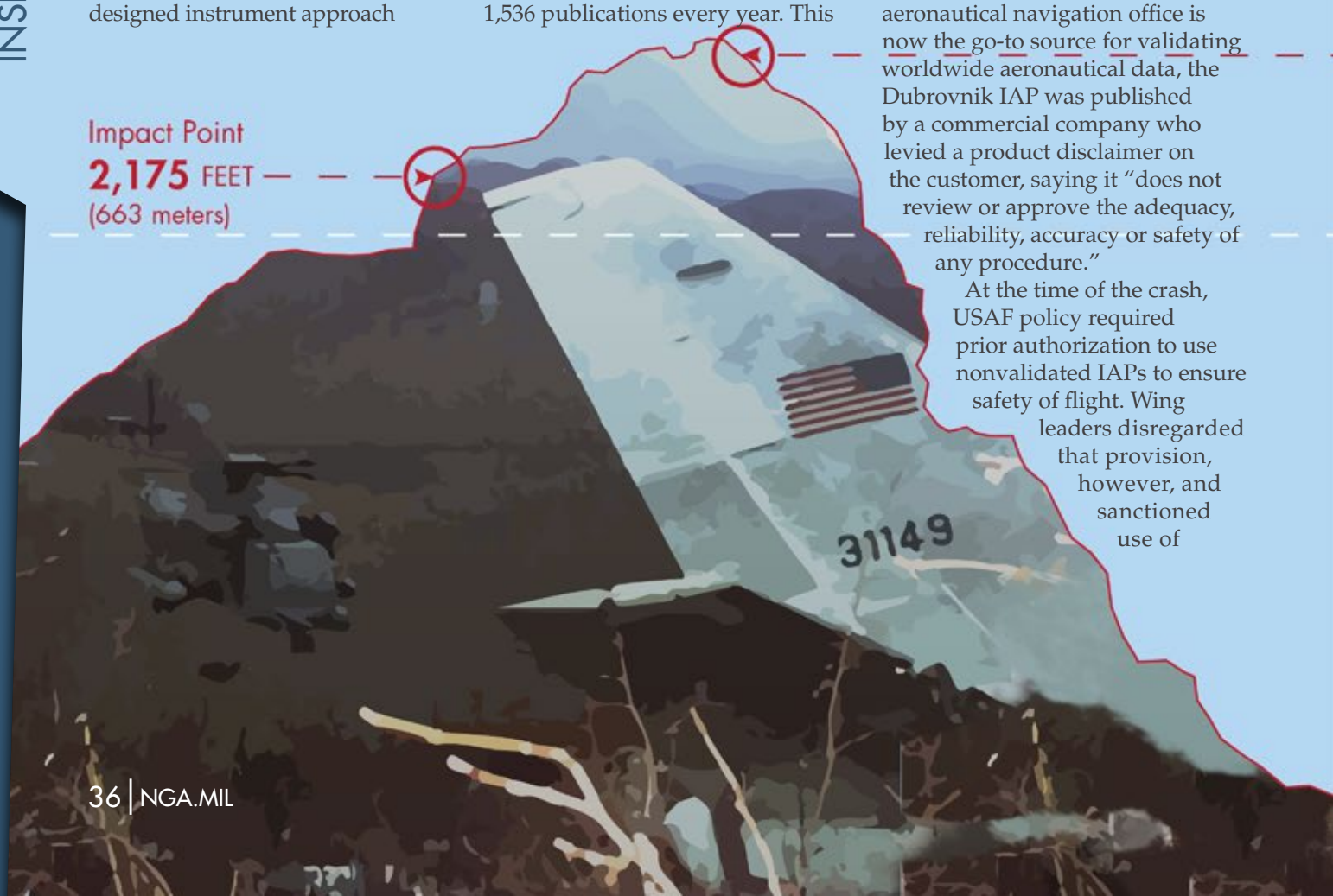
WHY IT MATTERS

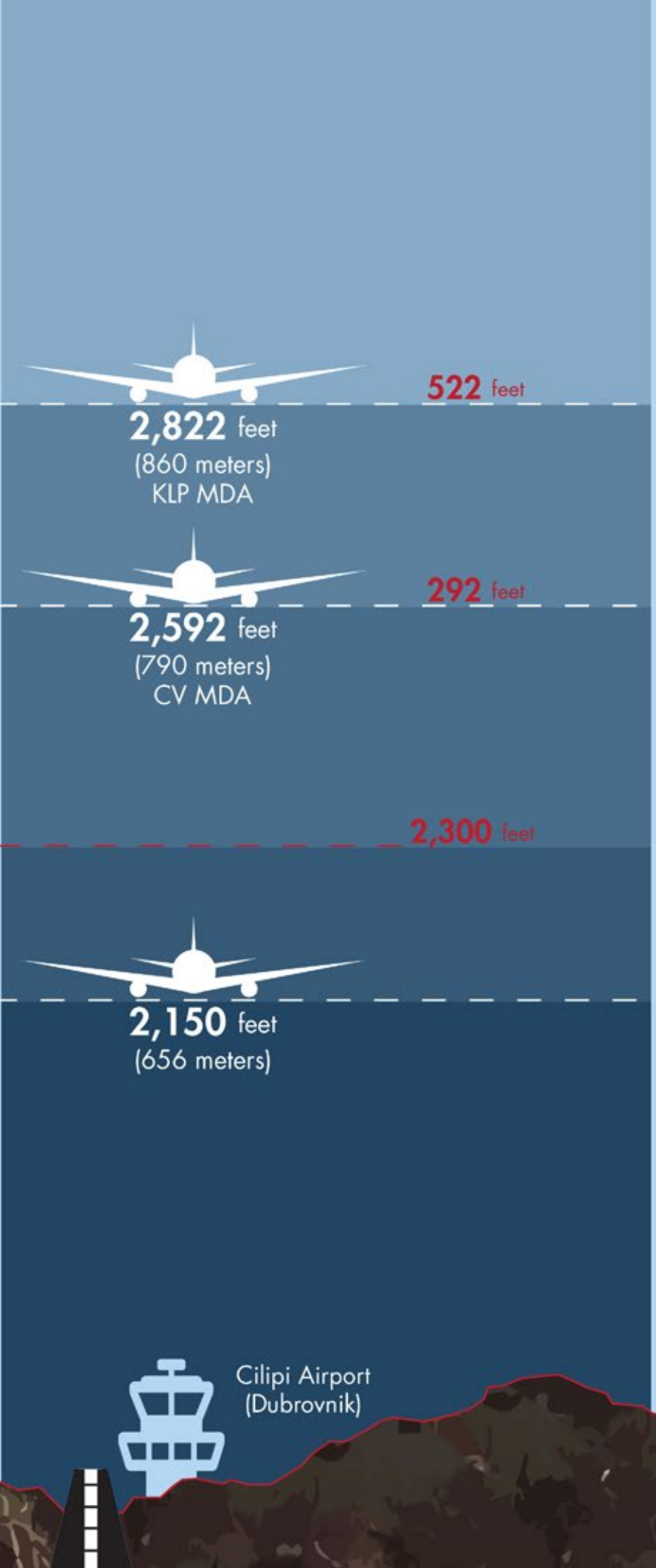
The Dubrovnik tragedy is an unfortunate example of why improper design of an IAP can lead to disaster.

An IAP is a product containing strict guidelines for routing, altitude, obstacle clearance and set maneuvers needed to transition from the en-route airspace to the runway. When operating in adverse weather or limited visibility, an IAP is the aircrew's only lifeline for a safe landing.

The Dubrovnik tragedy occurred six months prior to the standup of the National Imagery and Mapping Agency, which became NGA five years later. While NGA's aeronautical navigation office is now the go-to source for validating worldwide aeronautical data, the Dubrovnik IAP was published by a commercial company who levied a product disclaimer on the customer, saying it "does not review or approve the adequacy, reliability, accuracy or safety of any procedure."

At the time of the crash, USAF policy required prior authorization to use nonvalidated IAPs to ensure safety of flight. Wing leaders disregarded that provision, however, and sanctioned use of





the commercial IAP, wrongly believing that the nonreviewed procedure was safe.

Tragically, the approach procedure included a Minimum Altitude, a height intended to ensure obstacle and terrain clearance, which did not adhere to international safety standards. Coupled with an aircrew navigational error, the MDA was set below the summit of the mountain, which resulted in the fatal crash. Had this procedure been properly validated, as is done today by aeronautical navigation specialists at NGA, the error would have been caught and corrected, ultimately saving 35 lives.

DIRECT TO THE COCKPIT

The aviation industry has evolved over the past 20 years into a completely digital environment. NGA-validated aeronautical data is now ingested directly into flight management systems, where the data literally flies the aircraft. With this expanded reliance on NGA data, it should be apparent why the agency's aeronautical analysts strive to ensure quality, timeliness and accuracy every day to provide the highest margin of safety for DOD aviators. By ensuring fully validated information and data, NGA's aeronautical navigation office reduces both risk and workload on DOD aircrews and planners, thereby enabling combat power projection and increasing focus on warfighting mission success.

An old aviation adage says, "Learn from the mistakes of others; you won't live long enough to make them all yourself." The 20th anniversary of the tragedy at Dubrovnik serves as a poignant reminder of the criticality of reliable, validated information and data in aeronautical safety of navigation then, now and well into aviation's future.

'eNGAge':
MATCHING PEOPLE TO LEARNING EXPERIENCES – INSIDE AND OUT

By Johanne Davis, Ctr., Human Development

In the ongoing relationship between the public and private sectors, a new program is working to bring together subject matter experts from both sides to share ideas, state-of-the-art information and best practices.

Known as eNGAge, the professional exchange program facilitates the inflow of external talent to enhance organizational capabilities within the National Geospatial-Intelligence Agency and the outflow of NGA employees to experience firsthand how the private sector thinks and operates.

"As the GEOINT revolution unfolds, we see a daily proliferation of new commercial GEOINT technologies and data sources," said NGA Director Robert Cardillo. "Our eNGAge program is a way for us to integrate our people with those new capabilities."

Cardillo launched eNGAge at the GEOINT 2016 Symposium, where he knew that he'd be speaking in a target-rich environment during his keynote address. Seated in front of him were leaders of industry and academia -- the perfect candidates for NGA's newest professional exchange program.

"We're looking for people who can help us enhance our perspectives and improve our problem-solving capabilities," said Ellen Ardrey, director, NGA Human Development directorate. "We want to bring in people who can help us bridge the distance between what is happening in the commercial world and what is happening inside the intelligence community."

As for those within NGA who are looking for external opportunities, assignments can last anywhere from six months to a year or more. Team NGA's SMEs can work externally in myriad areas, including research, information technology and even human resources.

After the program's launch at the GEOINT Symposium, NGA began implementing a full-scale informational campaign to solicit unique immersive experiences for NGA team members, as well as to welcome outside talent into the agency. Program managers are reaching out to industry and academia through social media, trade publications and word-of-mouth efforts by NGA leadership. In this inaugural year – May 2016 to May 2017 – the program hopes to boast at least 25 enrollees, be they incoming, outgoing or some combination of both.

Right now eNGAge is targeting SMEs whose skill sets include commercial cloud services, mobility, cybersecurity, big data analytics, enterprise architecture and network services, among others. A full and evolving list can be found on the eNGAge website, accessed through NGA's public site, http://www.nga.mil.

"We will work wherever opportunity presents itself," says Program Manager Elizabeth Hoag. "The goal of eNGAge is to create a truly collaborative GEOINT environment…. This is about collecting a broad scope of experiences."

Hoag stressed this is not a traditional one-for-one exchange, however; companies do not have to host an NGA employee in order to send someone to the agency, nor does NGA have to send someone out to get someone in.

The new program leverages existing workplace interchange and development vehicles such as training with industry and intergovernmental personnel agreements, according to Hoag.

"We wanted to expand what we are already doing to create a strong and sustainable exchange program that fosters partnerships and innovation with industry and academia," said Hoag.

That's no easy task for an intelligence agency. Facilitating the geospatial exchange requires a thorough understanding of the associated ethics and conflict-of-interest guidance, the program and mission requirements, and the processing of security clearances. And that is what eNGAge does; it assembles the organizational resources to meet those needs in a kind of one-stop shop.

Those hoping to join Team NGA are required to have a top secret security clearance with sensitive compartment information before their exchange can start. Those without a TS/SCI clearance will use Standard Form 86 for National Security Positions, available on the OPM.gov site, to begin the process in consultation with the NGA point of contact. All participants must be U.S. citizens.

Agency candidates chosen to participate externally must be permanent NGA employees, with successful performance evaluations of record, and they must meet all requirements agreed to by NGA and the host academic institution or company regarding expertise and band levels.

That doesn't mean all employees won't benefit from the eNGAge program. According to Ardrey, participating employees would return to the same positions they had prior to the exchange, but they would take on the additional role of 'eNGAge ambassador.'

"We hope the experience that employees bring back will be shared to enable others," said Ardrey.

Letitia A. Long
Director, NGA, Aug. 2010—Oct. 2014

"I was especially proud when I would travel and get the feedback that I got. Everyone loves NGA. Everyone loves what they are provided. Everyone loves the NGA ethos – the way all of the employees have that can-do attitude."

Robert Cardillo
Director, NGA, Oct. 3, 2014—Present

"One accomplishment that I'm quite proud of is the process we put into place to select our new campus in St. Louis – very deliberative, very collaborative, very inclusive, in some cases a very difficult decision process that we went through . . . I could not be more proud of how we accommodated all issues, all concerns – serious, open, transparent deliberation – and were able to come to a decision that will ground this agency and our future in St. Louis through the rest of the century. We're now at the exciting part of actually designing a world-class, interactive, collaborative, open campus that will serve today's customers and tomorrow's mission."

ON THE SAME PAGE:
STANDARDIZING ALLIED TARGETING TRAINING

By Lt. Col. Thomas A. Macias, National Geospatial-Intelligence College

The legendary samurai Miyamoto Musashi inspired his fellow warriors by writing, 'You can only fight the way you practice.' Though written in 1645 in Japan, his words still echo throughout modern U.S. military strategy.

Like Musashi, U.S. and European warfighters understand that the first step toward operating effectively together on the battlefield is to train together using a standardized curriculum. Unlike the sword training of Musashi's day, however, contemporary training is far from simple. For starters, it involves studying moving targets through video analysis. It also includes participants from many different nations and systems that aren't always compatible.

The solution? Developing a standard curriculum that teaches Department of Defense and international analysts to systematically analyze collection and then develop and share intelligence products in support of common objectives, especially in global hot spots.

The catch? Such standard curriculums do not currently exist within DOD or in Europe.

MOBILE TRAINING

Responding to a SHAPE/J-3 training request, a mobile training team from the National Geospatial-Intelligence College – NGC – traveled to the Warrior Preparation Center in Einsiedlerhof, Germany, in spring 2016 to provide moving target indicator instruction to four separate European-based military organizations. MTI as a phenomenology is experiencing heightened growth in DOD and among international partners. Relative to other forms of geospatial intelligence, such as full-motion video, or FMV, current MTI training curriculums reflect greater degrees of commonality. As MTI platforms begin to proliferate, however, these commonalities have the potential to separate and diverge into the dissimilar forms of training that characterize FMV.

The most negative outcome of such divergence is that training programs for specific services, collection platforms or organizations are not interoperable between joint or combined partners. Lack of standardization can hinder efforts to federate exploitation, which could led to enterprisewide inefficiencies. Another avoidable pitfall is the wasted expenditure of finite, valuable resources to arrive at an unfavorable outcome.

The NGC Community Geospatial-Intelligence Training Council, known as the CGTC, viewed the European training request as an opportunity to start identifying best practices and establishing a common MTI curriculum standard that can mitigate the emergence of redundant and stove-piped systems of training. Concurrent development of DOD MTI standards, alongside similar efforts with international partners, presents an opportunity to enhance interoperability, with the aim of achieving economies of scale where able.

The fact that the training in Germany was conducted on BICES, the secure information-sharing network America's European partners routinely employ, added to the utility of the training.

BROADER COLLABORATION

CGTC used the spring 2016 Motion GEOINT Community of Practice – MG CoP – gathering at NGA Campus East as an opportunity to reconstitute a working group of MTI subject matter experts to identify common MTI curriculum skills. Working with the Joint Staff, the CGTC issued a data call for MTI curriculums currently used by the services. These were analyzed for commonalities in training subjects and compared with a list of approximately 150 GEOINT skills applicable to MTI analysis, which the MG CoP had compiled in a similar effort circa 2011.

Multiservice subject matter experts from six organizations honed the original list to four general training categories, 15 common topic areas and 60 specific MTI skills that can be used as learning objectives for a curriculum standard. This list is currently under consideration by the USDI chief learning officer as the DOD standard for a fundamental MTI curriculum.

The NGC mobile training team is also gathering input from NGA's allied partners in Europe as it continues MTI instructional efforts overseas. Among eager collaborators is the NATO Alliance Ground Surveillance Program, which recently acquired the Block 40 Global Hawk and a stand-alone exploitation capability. These international partners will richly influence the development of DOD MTI instruction, as they will be positioned to return insights and experiences in global areas where the United States may not have access or a collection history.

Collaboration with international partners also offers cost-effective opportunities to advance the MTI art. Lucrative technologies such as video game-based training are tailor-made for this arena. To overcome the tyrannies of distance, time zones and scheduling, GBT can be made remotely accessible on demand via a portal or tablet. Training can also be configured so that international students can receive technical instruction in their native language or any other language of choice.

Once finalized, the MTI curriculum standard and style guide will serve as both a library and a conduit, where lessons learned and best practices are accessible to all. Most importantly, a jointly developed standard is the first step toward ensuring that partners will fight like they train – together.

QUICK RESPONSE: TRAINING FACILITATES DISASTER RELIEF, BUILDS INTERNATIONAL PARTNERSHIPS

By Sam Wilson, Office of Corporate Communications

NGA's support team at U.S. Pacific Command on Oahu, Hawaii, provides humanitarian assistance and disaster response training, or HADR, to international and local partners to prepare for natural disasters unique to their individual climates.

"Our goal for the training is two-fold," said Adam Pittson, NGA Support Team PACOM HADR training lead. "We want to set a geospatial intelligence assessment standard for HADR operations, and we want to establish and maintain relationships with new and existing international partners."

The one-week course uses commercial imagery and is targeted toward international partners, but it is also available to the Department of Defense and civilians. The course has had 43 students on site in 2016, but trainers have also taken the show on the road, offering two- to five-day courses in Mexico, Japan and Thailand.

Since the first iteration of the course in 2009, NGA has trained analysts from a variety of countries, mostly in the Pacific region. Among them have been Australia, New Zealand, Chile, Mexico, Germany, India, Malaysia, Thailand, Taiwan, Singapore, Japan and Korea.

Experts are brought in from both military and civilian organizations to lead the classes. Staffers from the U.S. Navy's Joint Typhoon Warning Center teach the class about storm events across the Pacific region. Personnel from the U.S. Geological Survey discuss volcanoes and earthquakes. Advisors from the National Weather Service's Pacific Tsunami Warning Center cover earthquakes and tsunamis. Additional groups are brought in as needed to discuss relevant national disasters, depending on the trainees' geographical location.

"The first part of the course is a lot of disaster anatomy," said Pittson. "The HADR GEOINT mission is not your normal account, where you're monitoring static target. Every disaster is different, and you have to understand how all these different disasters occur and how they impact different regions – which goes into your collection planning, and that feeds into your analysis and products."

Following the disaster anatomy portion of the course, the discussion turns to how NGA and PACOM disseminate products. NGA and PACOM provide participants with All Partners Access Network, or APAN, accounts to allow them access to unclassified products when disaster strikes.

"Learning more about HADR operations is what I liked most," said U.S. Marine Corps Lance Cpl. Michael Harris, an intelligence analyst with the Marine III Intelligence battalion. "I found the briefings on damage classification and the different types of imagery and websites and tools for HADR operations beneficial."

Pittson and team solicit feedback from each trainee and incorporate new, tailored information into every course.

"One of the biggest takeaways for the analysts is when we showcase and highlight all the open-source websites for disaster events," said Pittson. "Highlighting a lot of these different websites is one of the biggest things people appreciate; they just weren't aware that a lot of these were open source. Everyone can access them wherever they are."

To Pittson, working the training mission is about more than just serving the DOD or intelligence community.

"To me it's about putting GEOINT into the hands of our international partners, and enabling them, so they can go back and use what we teach them," said Pittson.

The benefits don't stop there. In addition to teaching analysts from a variety of partner countries to prepare for disasters and respond effectively, the training also aids the intelligence community and NGA to engage with nontraditional U.S. partners, according to Pittson.

"We're building and maintaining relationships with our international partners, which usually leads to other avenues of engagement," said Pittson. "It's a foot in the door."

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Fukushima Daiichi Nuclear Power Plant approximately 1 minute before an explosion at the No. 3 reactor building.
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Fukushima Daiichi Nuclear Power Plant approximately 3 minutes after an explosion at the No. 3 reactor building
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IMAGERY PROVIDES NEAR REAL-TIME LOOK AT DAMAGE: FUKUSHIMA

Pointing agility enabled commercial-imagery provider and NGA partner DigitalGlobe to capture these images of Fukushima Reactor 3 immediately before and after its tragic explosion on March 14, 2011. WorldView-1 imaged the plant at a 34.5-degree, off-nadir angle one minute before the event. WorldView-2 shot the same scene four minutes later at a 32.7-degree, off-nadir angle.

The ability to access and disseminate accurate and near real-time overhead imagery speeds responses to emergencies whether natural or manmade. Such imagery is often the first look responders have of a damaged area, and the ability to quickly assess conditions supports both humanitarian assistance and disaster containment. The ease with which commercial data can be shared with international partners also contributes to the increased success of collaborative response efforts.

To learn more about how NGA supports humanitarian assistance and disaster response, visit http://www.nga.mil