

THE NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

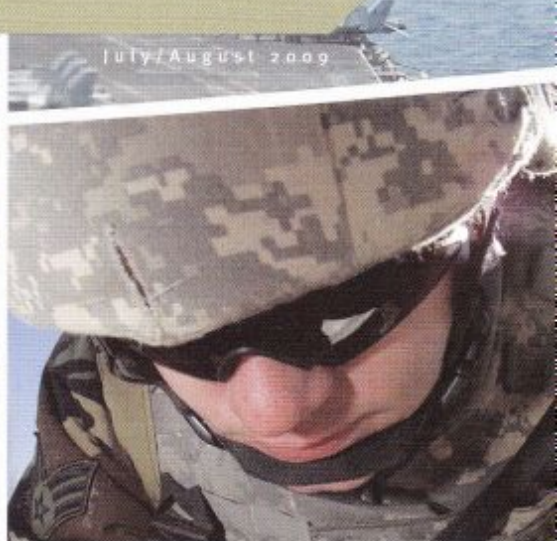
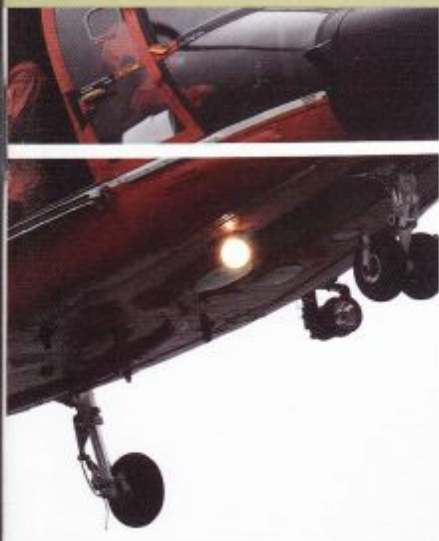
Vol. 7 No. 6

# PATHFINDER

THE GEOSPATIAL INTELLIGENCE MAGAZINE

SERVING THE FRONT LINE

July/August 2009



# GEOSPATIAL IN ACTION





ON MY MIND

## The Evolving Mission of Our Warfighters

We are a nation at war. American combat forces, alongside our allies, are operating in Iraq and Afghanistan. Events on the ground have led President Obama to announce a responsible drawdown of combat forces in Iraq, while increasing our attention to the violence in the tribal regions of Afghanistan and Pakistan. As part of an integrated team, NGA is prepared to provide the highest level of geospatial intelligence (GEOINT) our warfighters need to continue in their evolving mission.

### Transitioning Our Efforts Around the World

As the United States withdraws combat brigades from Iraq over the next year, NGA continues to support our warfighters and the intelligence mission. The U.S. military's new focus there will increase GEOINT requirements at this critical time for Iraq. With resources and forces moving from Iraq to Afghanistan and Pakistan, all of these regional security forces will need support more than ever.

The U.S. military is uniquely prepared to deploy around the globe in many different capacities. An important element of our mission in Afghanistan and Pakistan, and elsewhere, is to protect the populace. GEOINT can provide crucial aid to this mission, identifying groups of internally displaced people, analyzing threats to infrastructure and ensuring safety. Imagery can be a powerful tool in discovering drug fields and supply routes. The versatility of GEOINT adds tremendous value for our warfighters.

### Streamlining Our Efforts for the Future

The NGA deployment program continues to show success in integrating analysts with operational forces, working directly with our mission partners. Our deployed analysts work on site, providing analysis in real time and directly contributing GEOINT for military missions and future operations. Service GEOINT Elements (SGEs) serve as another component of GEOINT reachback and reachforward capabilities. SGEs facilitate integration across the National System for Geospatial Intelligence, particularly the military services, by helping to expand the collection and distribution of GEOINT to deployers, Intelligence Community (IC) partners and our warfighters.

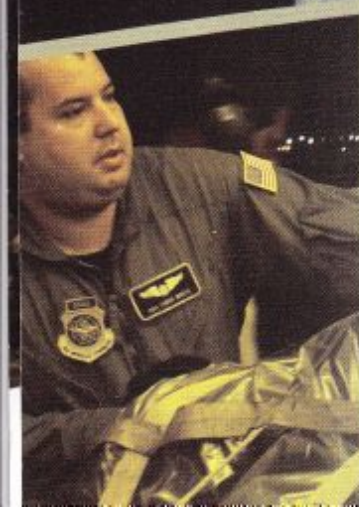
To continue to enhance and consolidate GEOINT capabilities, we have established the Office of the Director of Military Support (ODMS). ODMS comprises support efforts from the Military Executive, the Office of Global Support, the Combat Operations Support Team, the Office of Military Support and the Office of Future Warfare Systems. Combining these organizations enables NGA to improve the world-class GEOINT that saves the lives of our warfighters. ODMS's broad responsibilities cover the range of Department of Defense (DOD) operational missions. Joint exercises improve our military's effectiveness and preparedness while simulating the international environment we must often work in. Managing these exercises represents another example of the support NGA's ODMS provides.

Last month the president approved the recommendation on the next generation of electro-optical satellites. These new electro-optical satellites provide an opportunity to improve our support to our military, the IC, and policy makers. As Director of National Intelligence Dennis Blair said, "When it comes to supporting our military forces and the safety of Americans, we cannot afford any gaps in collection." Along with our partners in the IC, DOD and commercial sector, we are moving forward to improve our overhead constellation and ensure the success of our mission.

As NGA continues to improve our support for warfighters, our deployers are having a significant impact in combatant commands across the world. Our reachback capabilities continue to enhance GEOINT at home and abroad. By realigning and restructuring our military support organization, we are improving our responsiveness and effectiveness. NGA and our mission partners will continue to work in collaboration and remain vigilant in providing the best GEOINT to the engaged forces.



ROBERT B. MURRETT  
Vice Admiral, USN  
Director





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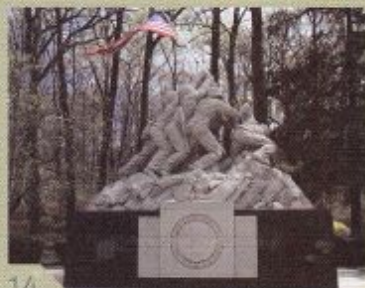
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### ON THE COVER

Military warfighters on the front line maintain the safety and security of the United States and its allies. NGA ensures that soldiers, sailors, airmen and Marines all receive the geospatial intelligence (GEOINT) resources they need to perform their essential missions. GEOINT answers the needs of men and women in uniform from every service who must meet challenges whether above or below the Earth's surface. Cover photos provided by the Department of Defense. Cover design by Anika McMillon.

### More to the Story?

The online Classified Pathfinder, which is accessible by members of the Intelligence Community, may include additional information and expanded sections of some Pathfinder articles. The Classified Pathfinder provides a forum for reading and discussing topics at the level of "Unclassified//For Official Use Only" or higher. For information please contact the Classified Pathfinder editor, Heather Cox, at 301-227-2290.



## LETTER TO OUR READERS

### GEOINT in Action

The indispensable contributions of American and allied warfighters range from combat operations to humanitarian work around the globe. Geospatial intelligence (GEOINT) often enables the completion of successful missions. The duty to protect freedom weighs heavily on servicemembers, and NGA stands beside them, refining its partnership with each military service.

Warfighters apply their craft to many tasks, aided by the analytic skills and expertise of NGA professionals. This agency accepts the obligation to sustain military operations that require GEOINT. The following sketch highlights only a few examples.

The commitment to front line forces extends not just to combat. A remarkable recovery effort in the Himalayan mountains promises the return of airmen lost in World War II, in part due to GEOINT resources provided by this agency. The Wounded Warrior Fellowship Program assists wounded or injured servicemembers to acquire job skills and experience to smooth their transition to civilian life. Analysts ensure that military weapons hit their marks, while geodesists and terrain experts develop gravity models and better tools for navigation. The Marine Corps refines GEOINT for specific uses, assisted by embedded NGA analysts and other professionals.

The agency looks beyond present-day missions as well. NGA helps prepare future military and civilian leaders, sending personnel to instruct and train with military colleagues at the Army's Command and General Staff College. The agency continues to expand GEOINT access and delivery through enhanced digital technology, such as Web services, which retrieve specific data. NGA seeks the best-qualified candidates to advance future needs, participating in an annual model U.N. conference that draws students from historically black colleges and universities.

These and other stories are developed further within this issue. The reader need only explore. The September/October issue will emphasize the exceptional work performed by NGA within the realm of global navigation.



*Jennifer A.K. Daniel*

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#### GETTING PUBLISHED

All members of the geospatial intelligence community are welcome to submit articles of community-wide interest. Articles are edited for style, content and length. For details on submitting articles, send an e-mail to pathfinder@nga.mil.

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## Realignment Streamlines Military Support

BY JUANITA H.

NGA Director Vice Adm. Robert B. Murrett recently announced the standup of a new NGA element, the Office of the Director of Military Support (ODMS), and named Army Brig. Gen. Brian Keller as the first director of military support. At the same time, Murrett announced the establishment of the Military Operations Group (MOG) within NGA's Analysis and Production Directorate.

### Office of the Director of Military Support

The standup of ODMS culminated an effort that began in October 2008, when Murrett asked Army Brig. Gen. Brian Keller to serve as NGA's military executive, instructing the general to "organize for combat." Keller named a four-person military study team to determine how to reorganize NGA's geospatial intelligence (GEOINT) combat-support structure to work more effectively and efficiently. The result of their study, ODMS, com-

prises an Expeditionary Operations component and a Military Readiness component.

Expeditionary Operations pursues two missions—ensuring that NGA has a superior cadre of trained deployers ready to support combat operations and synchronizing and integrating NGA's GEOINT support to combat forces.

Military Readiness looks to the future. This component coordinates the integration of GEOINT into the training agenda for military servicemembers preparing to deploy. This component also coordinates GEOINT planning and production with military service elements to ensure that GEOINT fully supports future warfare systems.

### Military Operations Group (MOG)

In January 2009, Murrett put together an additional study team to examine how to synchronize NGA's GEOINT support to the combatant commands (COCOMs). The team identified the need to integrate COCOM strategic GEOINT support activities with related activities, such as developing policy guidelines for the NGA Support Teams (NSTs) that serve the COCOMs and acquiring GEOINT information technology.

Murrett approved the team's recommendation to establish the MOG to address these needs. Once the MOG is fully organized, a single MOG manager will oversee all 10 NGA COCOM NSTs and serve as the Analysis and Production Directorate's primary liaison to ODMS.

### Benefits of the Reorganization

ODMS eliminates the organizational separations dividing the different combat-support responsibilities within NGA, focuses the efforts of the two new components—Expeditionary Operations and Military Readiness—on clearly defined mission areas, and enhances NGA's synchronization with the COCOMs in developing policy and providing GEOINT training, service and support.

This realignment, enhanced by the collaboration between MOG and ODMS, will facilitate even greater coordination between the work of the GEOINT analyst and the requirements of the military partner. ■

Juanita H. is a public affairs officer with NGA's Office of Corporate Communications.



## GEOINT Aids Recovery of World War II Airmen

BY CHRISTINA P.

What happened to six American planes that went down on Jan. 25, 1944, while flying a special mission over a section of the Indian Himalayas known as “the Hump”? This question haunts the widows, siblings and children of the airmen, who flew for the U.S. Army Air Forces, predecessor of the U.S. Air Force. NGA is assisting the Joint Prisoner of War–Missing in Action Accounting Command (JPAC) to provide answers.

JPAC crisscrosses the globe fulfilling its mission to achieve the fullest possible accounting of all Americans who go missing as a result of the nation’s past conflicts. One of the planes lost in the Hump during World War II, a B-24 bomber that carried 1st Lt. Irwin Zaetz and eight crew members, disappeared during a supply run to Kunming, China. JPAC called on NGA to help locate the bomber, the crew’s remains and the likely sites of the other wrecks.

JPAC investigates leads that might help recover and identify Americans who were killed in action but never brought home. Preparing carefully for a JPAC operation, which can last 45 to 60 days, is essential because so many tools are required for success. Treks can be dangerous, so JPAC leaves nothing to chance. A recovery team may bring equipment as varied as durable four-wheel-drive vehicles or mountain-climbing equipment to scale steep faces. Teams sometimes travel with supplies

weighing up to 10,000 pounds. JPAC needed NGA’s help to determine the best way to maneuver its personnel and bulky excavation equipment across the harsh Himalayan environment.

NGA provided terrain analysis products to assist JPAC in planning the safest ground routes into and out of the Himalayan Range and to identify possible helicopter landing zones and aerial drop zones to resupply the JPAC team. Additionally, NGA supplied elevation and hydrography products and a variety of maps for mission planning, including maps of India, its railways and adjacent countries and even travel maps.

With geospatial intelligence products in hand, JPAC personnel led a mission to find these planes in October 2008. In the northeastern Indian state of Arunachal Pradesh, the team found two of the aircraft, including the bomber containing the remains of Zaetz and his crew.

NGA received two letters of appreciation from JPAC officers thanking the agency for its contributions to this highly visible mission. NGA’s work with the successful JPAC recovery effort underscores the agency’s commitment to all warfighters, whether fighting today’s conflicts or those of years past. P

*Christina P. is the team lead for South Asia and South Central Asia in the GEOINT Foundation Office.*

Photo by Getty Images



## Wounded Warriors Participate in NGA Fellowships

BY JAY K.

Military servicemembers recovering from injuries or illness may face months of medical treatment before getting back on their feet. Recuperation can be a confusing and frightening time for these "wounded warriors," who often wonder what's in store for them.

One serviceman, a U.S. Army captain who deployed to Iraq in 2004, expected a lifelong military career. That dream shattered when he was injured in the line of fire. After numerous surgeries and three years of recovery at Walter Reed Army Medical Center, he faced the end of his military career. During his recovery, he pondered a career change—something he never thought he'd need to do. That's when he decided to apply to the Department of Defense's Operation Warfighter program, which places servicemembers in temporary work assignments at U.S. government agencies as they recover.

The Army captain completed an Operation Warfighter internship at the National Reconnaissance Office (NRO), the agency that builds and operates U.S. satellites, before getting a full-time job at NGA. He drew from what he learned at NRO to help NGA start its Wounded Warrior Fellowship Program as part of Operation Warfighter.

Concerns about careers, health and finances can be stressful for injured servicemembers. Through the NGA program, the agency does its part to relieve this stress by jumpstarting wounded servicemembers' careers, whatever their long-term plans. Like other participating agencies, NGA takes injured servicemembers under its wing and offers them work through fellowships. Most NGA fellowships are in the National Capital Region due to the large number of wounded warriors recovering in the area. Experience in geospatial intelligence is useful but not required to apply to NGA's Wounded Warrior Fellowship Program. The main purpose of the program is to reintroduce wounded servicemembers into the work force and, in some instances, help them discover a new career interest.

The fellowship program places recovering servicemembers in positions related to their career interests where they often receive training in new job skills. Though servicemembers must receive appropriate security clearances before starting their fellowships, NGA's security office fast-tracks the clearance process for these appli-

cants. NGA also works with the wounded warrior fellows to ensure that their work schedules do not interfere with any medical treatment they receive.

Already nine wounded warriors have either come onboard with NGA or are awaiting the green light to start working in fields ranging from counterintelligence to intelligence analysis. Wounded warrior fellows currently work in NGA's Security and Installation Operations Directorate, Source Operations and Management Directorate, and Analysis and Production Directorate. Other examples of past or potential NGA fellowship positions include warfighter support, intelligence reports and analysis, source collections analysis, imagery analysis, acquisition, finance, human resources and staff officer. The fellowships are unpaid but give participants valuable work experience, networking opportunities and the security clearances necessary to seek permanent positions within the Intelligence Community or at other government agencies if they leave military service.

"It allowed me easy access to a community that I normally wouldn't have access to," the Army captain stated. "It's not easy to get into the Intelligence Community, especially without having someone to train you. When I was found medically unfit to do my [Army] job, I had to change my career. [The wounded warrior program] allowed me to continue to serve."

The captain isn't alone. One NGA fellow obtained a permanent job at the U.S. Nuclear Regulatory Commission, which oversees U.S. nuclear facilities, in large part due to his fellowship with the Analysis and Production Directorate early this year.

The Recruitment Center, Special Programs Office, recruits and identifies potential wounded warrior fellows from among applicants to the Operation Warfighter program. The program manager, a wounded warrior herself, matches warriors with fellowships, coordinates clearances and acts as a liaison with fellows during their time working at NGA. For more information on Operation Warfighter or the Wounded Warrior Fellowship Program, contact the NGA program manager at [NGAWoundedWarriorProgram@nga.mil](mailto:NGAWoundedWarriorProgram@nga.mil). P

Jay K. is a staff officer in the Office of Corporate Communications.




## Analysts Take Flight to Certify Targeting Accuracy

BY MARTHA B. AND GREG A.

It's not every day that NGA analysts get to test their geospatial intelligence (GEOINT) work in person, but the opportunity can be memorable. Returning to Naval Air Station North Island in San Diego, California, following their visit to the USS Nimitz aircraft carrier in March, two NGA targeting experts experienced the sights and sounds of twin turbo engines from the back of a C-2A Greyhound aircraft. Feelings of anticipation were muted in a split second as the effects of g-force pushed them backward and the plane achieved the velocity needed to avoid plunging into the wintry waters of the Eastern Pacific. They had just completed an audit of the ship's target coordinate mensuration programs.

Audits like this support the U.S. Navy's goal of entering accurate coordinates into precision-guided munitions like the Joint Direct Attack Munitions. Visiting the USS Nimitz was just one part of an ongoing NGA effort to help mission partners such as the Navy obtain accreditation in the geospatial science of target mensuration.

Accreditations are crucial to the warfighter because they help maximize the effectiveness of weapons systems, minimize threats to the U.S. warfighter, and cut the risk of collateral damage. Accreditations also establish a standardized methodology for target mensuration across services and commands in the National System for Geospatial Intelligence (NSG), ensuring that the warfighter receives the best targets, no matter who produces them.



NGA targeting experts audited the target mensuration programs of the USS Nimitz.  
Photo by Lawrence K.





*During their visit to the USS Nimitz, analysts flew aboard a C-2A Greyhound.*  
DOD Photo

Since August 2006, NGA's Office of Targeting and Transnational Issues has had the responsibility for accrediting NSG partners' target mensuration capabilities. Before getting NGA's seal of approval, partners must go through a four- to six-month accreditation process to document their training and certification programs and show how they provide accurate coordinates for precision-guided munitions. These reviews and audits enforce the standards and accountability for this DOD targeting function.

The NGA accreditation team relies on technical expertise in target mensuration and business process management to advise organizations across the NSG on how to pass muster when exam time arrives. This expertise enables NGA to verify that organizations provide accurate mensuration data for the precise targeting coordinates used for coordinate-seeking weapons. The organizations that NGA accredits have the authority to contribute targeting coordinate information into a central database.

When it comes to the desire to become certified in target mensuration, the Navy does not stand alone. In July 2008 NGA awarded its first such accreditation to the U.S. Central Command (CENTCOM). NGA awarded its approval following an extensive review of CENTCOM's certification program documentation and a visit by an NGA-Joint Chiefs of Staff audit team to CENTCOM's headquarters in Tampa, Fla.

NGA provides informal staff assistance visits to accredited organizations as well as scheduled two-year and four-year certification reviews. NGA also performs periodic reviews of the MIDB target detail records, provides feedback to producing organizations on errors and provides quarterly metrics on quality to the Joint Chiefs of Staff. These exchanges help ensure that the targeting community can effectively manage the challenges of constant deployment schedules and changing military staffs. Complementing this achievement is the added trust that the NSG has gained in the warfighter community as NGA analysts deploy to theater and collaborate on time-sensitive operations.

When the USS Nimitz launched the C-2A Greyhound in the Eastern Pacific, other U.S. carrier groups were likely launching strike aircraft from waters not nearly as friendly as those off the coast of California. Fortunately these aircraft were armed with the weapons, targeting expertise and confidence required to execute operational plans predicated on precise coordinate-seeking weapon systems. NGA ensures the NSG community produces targeting GEOINT that achieves national security objectives. P

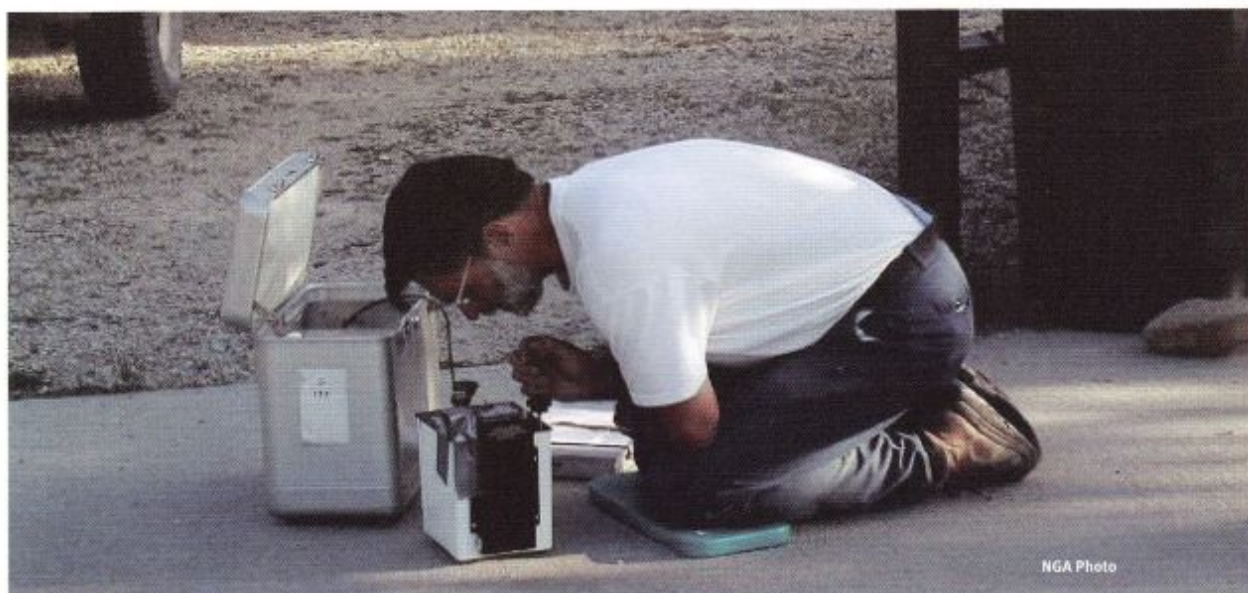
*Martha B. is an accreditation program manager for the Precision Engagement Division.*

*Greg A. is a special issues manager for the Precision Engagement Division.*



## Good Gravity Data Elevates Warfighters

BY JOSHUA K. AND JOHN F.



*A geodetic surveyor records a measurement from a relative gravity meter.*

Whether for precise targeting or securely anchoring imagery and navigation satellites in the Earth's orbit, the force of gravity influences every aspect of military operations and the geospatial intelligence (GEOINT) behind them. It should be no surprise, then, that for more than 50 years, gravity analysts in NGA's Office of GEOINT Sciences have made knowing gravity their mission.

More than 300 years ago, Sir Isaac Newton explained how gravitational forces affect moving objects of different sizes and masses. Worldwide variations in gravitational forces act upon moving objects on or near the Earth's surface, such as aircraft, submarines, missiles and spacecraft. Therefore, understanding these gravitational forces and compensating for their differences dramatically improves the accuracy and performance of certain military vehicles and weapons system platforms.

### Gravity Data Collection

Different geophysical features such as mountain ranges, faults, and rift zones cause changes in Earth's topography and variations in the density and distribution of masses in the Earth's crust. Consequently, the Earth's gravity varies significantly across the globe. In order to understand gravity variations, scientists use gravity meters to measure gravity around the world.

More than 60 million measured gravity points now reside in NGA's Point Gravity Anomaly (PGA) Database. NGA uses this comprehensive library of gravity information to develop Earth Gravitational Models (EGMs) and to support submarine launch fire controls and aircraft navigation systems.

On July 30, 1964, the Defense Mapping Agency Aerospace Center, an NGA predecessor organization, was designated as the Department of Defense (DOD) depository for all gravity data. Today NGA continues this legacy through an active acquisition program that acquires much gravity data through informal exchanges with private industry and research groups. For example, private oil companies measure and collect gravity anomalies, or changes in gravity, during the oil exploration process because anomalies can indicate the presence of geologic features such as folds or salt domes that trap oil within the Earth. Researchers also collect gravity data used in environmental research such as climate and ocean studies. NGA's partnerships with geophysical organizations, universities, research institutes and foreign and domestic government agencies have resulted in significant acquisition of open source gravity data.



NGA's gravity meter loan program is another method for acquiring gravity data. NGA possesses one of the world's largest inventories of gravity meters and loans them to organizations in exchange for the collected gravity data. International collaboration on scientific endeavors such as EGMs and the Arctic Gravity Project also contributes data to the PGA database. Other sources include gravity measured or derived from satellite systems such as the Navy GEOSAT altimetry mission and the Gravity Recovery and Climate Experiment.

To maintain the highest data integrity, a gravity evaluation team checks newly acquired gravity data for uniqueness, potential discrepancies and agreement with surrounding data sources before the data enters the PGA database.

### Gravity Data Support for the Warfighter

NGA uses a global reference frame, the World Geodetic System 1984 (WGS 84). The WGS 84 reference system provides the common operating picture for all GEOINT and includes a Mean Sea Level (MSL) model developed from analysis and modeling of Earth's gravity, especially from Earth Gravitational Model 2008 (EGM08), the latest global gravity model. This MSL model establishes the standard vertical reference surface for many NGA elevation products.

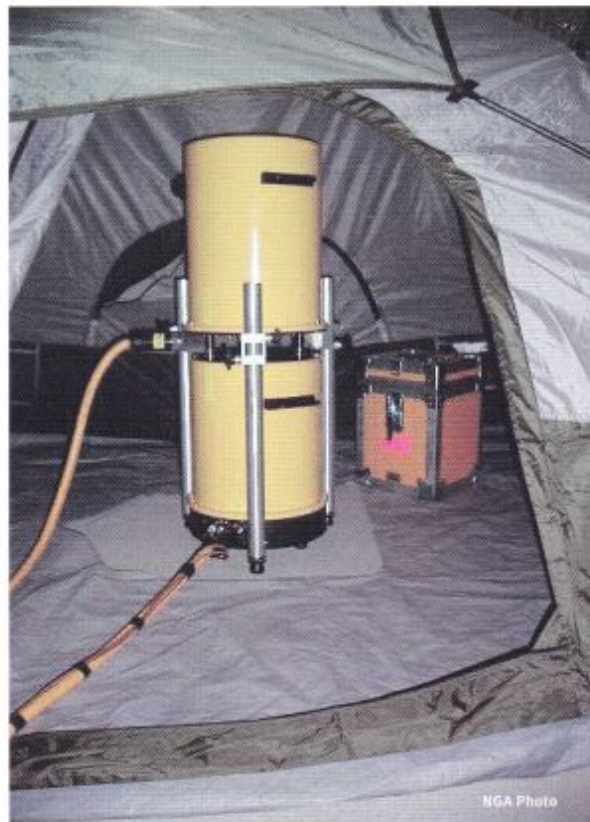
For many years, NGA has also provided military customers with gravity anomaly and gravity disturbance products for use in inertial navigation systems (INSs) onboard aircraft, submarine and weapons system platforms. An INS employs accelerometers, gyroscopes or other motion sensors to continuously measure position, orientation and velocity of a moving vehicle. High-accuracy INS systems are standard equipment for military systems that require corrections for the effects of spatial variations in the gravity field. NGA works with DOD system engineers and contractors to implement gravity data sets that will support the requirements of these systems, resulting in significantly improved navigation.

Gravity data also supports the warfighter in the absence of Global Positioning System (GPS) data. The military relies heavily upon GPS navigation systems for position and velocity updates. However, within a military theater of operations, if GPS jamming occurs or a submarine is unable to surface for a GPS update, gravity data help mitigate the degradation in the navigation system,

keeping planes and submarines on course or ensuring that ordnance is on target. When GPS accuracy is fully available, combining gravity and GPS yields an even greater level of accuracy.

Through its meticulous acquisition, analysis and exploitation of gravity information, NGA's Office of GEOINT Sciences has become a world leader in the application of gravity products to mapping, targeting, navigation and weapons system performance. No matter how the Earth changes, warfighters can confidently depend on the gravity GEOINT foundation layer that literally lies beneath their feet. P

*Joshua K. and John F. are geodetic earth scientists in the Office of GEOINT Sciences.*



NGA Photo

*An absolute gravity meter weathers the elements during a gravity survey.*





## NGA Collaboration Team Educates Army College Students

BY RALPH E. AND MARSHA M.

"Emerging military leaders are gaining more geospatial awareness that increases the quality of their decisions because NGA analysts are deeply integrated and fully embedded in exercises," retired Army Lt. Col. Robert Garven of the Army's Command and General Staff College (CGSC) reported recently.

Students at the CGSC in Fort Leavenworth, Kan., have an intellectual demand for prompt and accurate geospatial intelligence (GEOINT) as a part of their leadership education. These leaders grasp the value of GEOINT in their decisions as they learn to lead large forces in military operations or to support civil authorities.

Through its Intermediate Level Education (ILE) program, the CGSC offers a graduate-level joint professional military education to mid-career U.S. and international military officers and exceptional civilian agency leaders. CGSC prepares graduates to be adaptive leaders, balanced warriors and creative thinkers capable of operating in joint military, interagency, intergovernmental and multinational teams in the 21st century.

The NGA Support Team (NST)-Army is fully engaged and embedded with the Army mission partner. Assisting the CGSC with delivering GEOINT education, it assembled an NGA-wide collaboration team that has made tremendous advances in its GEOINT-ILE collaboration and was integral to the development of more than 2,500 agile leaders in 2008 and 2009. The team consists of NGA Analysis and Production Directorate and Source Operations and Management Directorate geospatial analysts, imagery analysts, regional analysts, cartographers and data stewards who were embedded in CGSC classrooms during the ILE division exercise. Participating in 11 exercises, the collaboration team analysts served as GEOINT educators, created numerous specialized GEOINT products, built proficiencies in advanced analytical competencies and learned from peer review and feedback.

Significant NST-Army achievements in 2008 and 2009 included the development and delivery of a 1:100,000 scale map and integration of an NGA Google Earth™



Chairman of the Joint Chiefs of Staff Navy Adm. Mike Mullen speaks to students at the Army's Command and General Staff College.

DOD Photo



## Army College Amplifies Students' Military Insight

By Maj. Christian M., U.S. Army, and Ken F.

While NGA teams assist the Army's Command and General Staff College (CGSC) with geospatial intelligence (GEOINT) education, other NGA personnel attend the college as students. As part of their career development, agency leaders can apply to attend military Senior Service Schools, and the CGSC is one of them.

Every year, the college offers its graduate-level curriculum to over 1,200 officers from the Army and other military services, foreign officers from over 50 countries, and U.S. government civilian employees. Students are mid-level leaders for joint military, inter-agency and multinational operations. In addition to completing the curriculum, students may also pursue an optional Master of Military Art and Science degree.

During the yearlong curriculum, students study team development, advanced critical thinking and military decision making, leadership case studies, lessons from military history, and a review of national strategic policy and how it drives military operations. Students gain multinational experience, increase their understanding of how the military works, and practice

optimizing the capabilities available within a broad interagency environment. Interagency students also learn by comparing the organizational structures, career paths and leadership models in their home organizations.

Since 2007, NGA has sent students to attend the CGSC. As participants in the course's rigorous exercises, NGA students develop their knowledge of land warfare and military decision making. As the agency's ambassadors, NGA students contribute to the courses by building their classmates' understanding of GEOINT and NGA's partnerships with military, multinational and civilian intelligence agencies. Prepared for NGA assignments that will take advantage of their unique CGSC experience, graduates return to NGA as stronger leaders, better able to anticipate GEOINT needs on the battlefield to more effectively serve the agency's partners. ▢

*Maj. Christian M. is a U.S. Army physician.*

*Ken F. is a staff officer in the Office of Asia Pacific. The authors were classmates at the Army Command and General Staff College.*

server on the CGSC intranet. The map enabled the college to retire a 1978 Russian map because the college had a quality NGA-developed replacement. The networking of the Google Earth™ server employs a mainstream GEOINT exploitation tool that is available in operational environments today.

Several collaboration team members in recent exercises who have either deployed or are preparing to deploy stated that the CGSC experiences gave them the self-confidence to know exactly what analysts could generate in addition to standard GEOINT products. Exercise participation can help analysts get ready for deployments to NGA mission areas.

As NGA Director Vice Adm. Robert B. Murrett recently stated, "GEOINT is at the heart of preparation and success for virtually every mission set in which our intelligence, defense and other partners are involved." At CGSC, the NST-Army has established a GEOINT education foundation for military leaders and NGA analysts. ▢

*Ralph E. is an NGA liaison to the Army Training and Doctrine Command at Fort Leavenworth, Kan.*

*Marsha M. is a geospatial analyst in the Office of Eurasia-Africa.*



## Web Services Boost Warfighters' Response

BY THOMAS W. AND CHERYL W.

As technology has become faster and more powerful, NGA has developed a suite of Web services that enable the warfighter to discover accurate geospatial intelligence (GEOINT) data efficiently. These advances will be incorporated into GEOINT Online (GO), NGA's unclassified Web service tool that supports homeland security, defense, global navigation and other operations.

Web services filter, retrieve and project the specific data required in a standard Web application or browser as a viewable digital map. For example, roads, traffic, airports, dams and contour lines are popular data overlays displayed by Google Earth™, which retrieves these various data from Web services. A few examples of NGA Web Services include Country Name Service, which identifies countries that fall within a specified geographic point or area; Distance Bearing Service, which can calculate the distance and direction between geographic coordinates or additional coordinates based on distance and direction; and Coordinate Parse Service, which interprets and converts strings of coordinates from degrees, minutes and seconds to decimal degrees. Each of these services provides data useful to geospatial analysis.

Web services can work for the warfighter in many ways. When a sergeant drawing up plans for a raid in Afghanistan needs situational awareness of the environment where his troops will deploy, the sergeant reviews digital maps of the terrain. Using the same digital maps, he then determines the best route for his platoon to travel and flags areas where his troops face danger.

Previously, the sergeant would have needed to sift through hundreds or even thousands of CDs to find the two or three with the maps he wanted or request the CDs from a base on the other side of the globe. As another example, an analyst who wants to display airfields and ship locations near a particular port and calculate the distance to each can compile or link data from several Web services.

NGA has also devised a method to obtain information quickly from Web services in several alternative formats: Geospatial Really Simple Syndication (GeoRSS) feeds timely updates to online map generators so analysts can get data out to warfighters swiftly; Geography Markup Language (GML), which encodes geographic data, and Keyhole Markup Language (KML), used to visualize geographic data, enable analysts to receive up-to-the-minute details on geographic points of interest; and Hyper Text Markup Language, used by all Web browsers, displays results on a nicely formatted Web page.

Web services put important data at the warfighter's fingertips during crises. The warfighter no longer needs to search archives or modify formats before displaying the data required. These tools better prepare analysts and warfighters to confront the nation's enemies, making the warfighter more agile and responsive when faced with a crisis. □

*Thomas W. is a contract employee supporting the development of NGA Web services.*

*Cheryl W. is a Web content services manager.*



# ONLINE

Photo by Getty Images

Pathfinder >> July/August 2008



## FOCUS AREAS

# Model U.N. Conference Affords Recruiting Opportunity

By JEANNINE W.

*NGA Focus Area: Invest in our people, with a commitment to diversity, to preserve our nation's GEOINT advantage.*

During March 26–28, 2009, NGA and the North Carolina Consortium for International and Intercultural Education (NCCIE) cosponsored the 20th Annual Model United Nations Conference in Durham, N.C. Each year, the Model U.N. Conference brings together students from historically black colleges and universities for three days, giving them an opportunity to work on resolving a simulated world crisis through debate, discussion and negotiation of the problems surrounding it.

The consortium created its first Model U.N. in 1989 to address the need for greater minority involvement and participation in the international arena and to better prepare students to become full participants in the global community. Over a decade ago, several NGA employees who were former participants in the event encouraged NGA to become a cosponsor. NGA has provided funding and personnel support ever since. In return, the annual conferences have served as an effective resource for recruiting highly qualified candidates, with NGA representatives conducting interviews of prospective students for consideration for NGA assignments and sharing information on the agency's student internships, co-op programs and career opportunities.

On the first day of the 2009 conference, student attendees were assigned to working groups. Within these groups, students became representatives for specific nations. They participated in simulated U.N. Security Council sessions and actively debated and negotiated to try to resolve the preassigned crisis situation. During the conference, the students were evaluated on their diplomatic skills and received awards for outstanding performance.

Throughout the event, students attended presentations on international security issues provided by experts in the field. The NGA Recruitment Center coordinated a number of this year's speakers, including the keynote address by Cardell Richardson Sr., director of NGA's Source Operations Group. Richardson provided an overview of the broad scope of NGA's products and customers, touching on monitoring international conflicts such as the one in Darfur, national security support for the presidential inauguration and other high-profile events, national disaster support and scientific mapping of the polar ice caps for climate change studies.

Richardson concluded his remarks saying, "What this means is that we need future leaders like you—with your critical thinking, problem solving, analytic and diplomacy skills—to join our ranks and help solve these tough challenges." Another senior NGA employee, a student at the very first NCCIE Model U.N., also spoke about how the conference prepares students for an active role in the world.

Building on the success of the conference, NGA and the North Carolina Consortium hope to arrange for Model U.N. students to visit one of the agency's facilities. The 2009 conference, as have conferences past, provided NGA with the opportunity to reach out to and engage the nation's next generation of leaders at this inspiring training ground. ☐

*Jeannine W. is a human development consultant in the Recruitment Services Office. Members of the recruitment team contributed to this article.*

Photo by Getty Images



## PARTNERSHIPS

# GEOINT Guides the Few and the Proud

By Tom C.

During Operation Iraqi Freedom, a U.S. Marine Corps colonel fired one round into a locked-up laptop, declaring, "There, now I have a doorstep." Firing a second round dead-center into his mapboard, he emphasized, "But, I still have a map." This story, possibly fictitious, highlights the reality of geospatial intelligence (GEOINT) for the Marines: the often sparse conditions within which they operate require GEOINT in many forms, from electronic to printed, cartographic products.

The Marine Corps Intelligence Activity (MCIA), the Corps' intelligence component, aided by a small team of dedicated NGA analysts, prepares the type and quantity of GEOINT products the Marines require, demonstrating the advantage of Unified Geospatial-intelligence Operations (UGO). As part of the National System for Geospatial Intelligence (NSG) and a member of the Intelligence Community (IC), MCIA fully embraces the UGO concept, which coordinates and aligns GEOINT resources throughout the IC.

MCIA recently established a Geospatial Intelligence Directorate, or GID, with a mandate to provide reachback for expeditionary Marine forces worldwide. Augmented by NGA imagery and geospatial analysts, the GID provides GEOINT for training Marines prior to deployment and stands ready to produce tailored products as required for forces in theater. MCIA maintains close GEOINT coordination with various Marine commands at Marine Corps Base Quantico, Va., intelligence battalions, which have both imagery and topographic platoons, and the Marine Expeditionary Forces at Camp Pendleton, Calif.; Camp Lejeune, N.C.; and Camp Courtney, Okinawa, Japan. These commands and units also enjoy onsite access to NGA through embedded analysts, liaison officers and technicians. Together, MCIA and NGA's "GEOINT ambassadors" support overall Marine Corps intelligence production through collaborative and integrated UGO.

Providing GEOINT support to the Marines requires a combination of talent, training, a good operational mindset and piercing foresight. The Marine Corps maintains its own cadre of imagery and topographic analysts who

receive their basic tradecraft training at either Goodfellow Air Force Base, Texas, or at the NGA National Geospatial Intelligence College at Fort Belvoir, Va. Regardless of follow-on assignment, their focus remains tactically oriented on beach and route studies in anticipation of a myriad of assignments that could arise worldwide, ranging from humanitarian relief to full combat operations. Because the Marine Corps usually responds first to national-level operations and its initial forces are expected to be en route within six hours of alert, there is often little preparation time. Consequently, the initial hours and days of operations are "come as you are," supported by whatever GEOINT is available at the time.

Operations often occur in unanticipated places, where available GEOINT is frequently large-scale and only marginally effective in supporting the operations to which Marines are assigned. For this reason, the Marines maintain their own GEOINT analytic experts at all levels of command who continually comb databases worldwide to produce geospatial products at a very high level of accuracy and resolution. These map-like products, which can contain such details as drainage culverts, ditches and footpaths, are then disseminated to the front line. MCIA emphasizes the geospatial analysis of its GEOINT products. While detailed feature data is a critical GEOINT component, it is equally vital for the analysts to provide insight into how terrain may affect impending operations regarding potential ambush sites, lines of sight, etc. Where effective information networks exist, digital geospatial data may be sent for display in command and control systems. In more austere environments, usually the norm, geospatial products are printed on large plotters and physically delivered to the units that need them.

Marines also recognize the importance of understanding the cultural environment in which they may operate. Although MCIA produces an abundance of country studies and handbooks, representing regional and cultural nuances on a map is daunting. To meet this challenge, MCIA chartered a geospatial cultural team comprising dedicated geospatial analysts with backgrounds that include history and anthropology.





MCIA is on the cutting edge of providing visual products that answer many of the questions Marines need, often in a hurry. The Marine Corps' unique GEOINT resources serve Marines well at all levels of operation, from strategic, worldwide analysis to tactical operations on the ground. The dedicated Marines and embedded NGA analysts are proud of their accomplishments in providing the GEOINT necessary to sustain Marine forces whenever and wherever they may deploy. P

*Tom C. served as chief of the NGA Support Team at the Marine Corps Intelligence Activity.*

*A replica of the Marine Corps War Memorial stands near the entrance to Marine Corps Base Quantico, Virginia.*

**Photo by Kathy Reesey, Marine Corps Base Quantico**



21ST CENTURY

## Terrain Intelligence Revolutionizes Operations in Theater

BY GREG A.

The scent of juniper and mulberries lingered in the air as the sergeant crossed the Afghan nightscape on a low-level flight path that masked the arrival of the Black Hawk carrying his special operations forces team. Though the sergeant faced a new target, his sense of déjà vu was unmistakable. He had last seen this terrain hours before he left his base when he studied target information from his NGA counterpart half a world away.

Terrain intelligence, a composite of imagery, elevation and feature data, is at the heart of the interactive scene visualization a pilot uses to steer a Black Hawk into the valleys of Afghanistan or to launch a successful strike against a high-value target holed up in a cave. Knowledge of terrain and enemy forces is imperative when battling an adversary. In fact, dominance of terrain intelligence has been decisive in conflicts from the Civil War to World War II and beyond. Today's analysts craft imagery and elevation data from unmanned aerial vehicles into terrain intelligence products.

### Terrain Revolutions and Evolutions (1970–2000)

Though contour lines are often taken for granted, they are fundamental to understanding the battle space. In fact, contour lines, which depict the elevation of the Earth on mission planning maps, are the building blocks of terrain intelligence; they graphically convey strategic, tactical and operational terrain intelligence to the warfighter. NGA's ability to provide effective terrain intelligence to the warfighter has grown exponentially since the early 1970s. In the 1970s the Defense Mapping Agency (DMA), an NGA predecessor, led the first revolution in terrain intelligence since the

birth of photogrammetry and stereocompilation in the 1940s. This advance rode the coattails of the information technology industry. Cheap, high-speed computers were its engines, facilitating the development of terrain compilation and flight simulation software, navigation and attack profiles, and Terrain Contour Matching (TERCOM) navigation systems.

Revolutionary computer applications enabled commanders to fire cruise missiles effectively just as they helped sergeants visualize terrain. A sergeant's team needs terrain intelligence to hone in on high-value targets the same way a commander needs terrain data to fire a missile. Owing to the demands of both the sergeant and the commander, spending on Digital Terrain Elevation Data (DTED®) spiked from the late 1970s to the late 1980s. This funding increase for DTED® products provided cartographers with information needed to develop the Topographic Line Maps (TLMs) that military operations planners use.

The transition to digital production systems and the growth of terrain data collection and systems from the late 1980s to the late 1990s marked the start of the second revolution. These technology advancements enabled automated data processing systems to calculate terrain elevation without human guidance. Terrain analysts abandoned photo labs, once considered necessary components of terrain compilation.

The third revolution in collection and exploitation of terrain data started in the late 1990s and continues today. Technology advances of this period allowed analysts to precisely analyze underground facilities and

An Army team patrols near Zabul Province, Afghanistan. Military operations benefit from revolutionary advances in terrain intelligence.

Photo by Staff Sgt. Adam Mancini



to collect and analyze high-resolution, high-accuracy terrain data. Access to such high-definition data, unheard of 10 years ago, allows mission planners to hone in on key tactical targets while minimizing collateral damage. In the 10 years between Operation Desert Storm and Operation Enduring Freedom, DMA tremendously enhanced its ability to capture and analyze terrain data.

### Terrain Today (2001–Present)

NGA's ability to develop terrain products for its customers reflects both its experience supporting the warfighter over the past decades and the utility of the products it creates for theater operations. For example, on the one hand the agency's TLMs help mission planners prepare for deployments to the field. On the other hand, the TERCOM data sets NGA produces underlie the U.S. Strategic Command's work building cruise missile guidance and targeting systems.

Likewise, the U.S. Intelligence Community (IC) uses High Resolution Terrain elevation (HRTe) data to analyze underground facilities and develop tactical applications that support counterterrorism, counterproliferation, urban warfare, weapons of mass destruction and special operations assessments. Successful counterinsurgency operations in Iraq in 2005 and 2006, aided by precise, mission-specific data, attest to the value of these types of terrain intelligence to both decision makers and warfighters.

### Terrain Tomorrow (2009–2016)

Terrain intelligence has caught the attention of Department of Defense leaders, who focused on it during a recent national security review. That report indicated that time-sensitive terrain data give U.S. forces an edge when they confront national security threats including terrorism and urban warfare. Because of these threats, special

operations forces will continue to use terrain data when preparing to face their adversaries.

The explosion in digital technology that drove the development of better terrain analysis has increased the expectations of the warfighter. Human monitoring of advanced terrain computing systems to verify that the systems perform accurately therefore remains necessary in preparing terrain products that meet U.S. and IC partners' requirements. The advances in data collection, processing and analysis systems require a highly trained workforce to ensure the interoperability of these systems and to analyze mission-critical terrain data.

The 19th century military strategist Carl von Clausewitz recognized terrain as a key component of military and geospatial intelligence (GEOINT). Clearly, terrain data remains paramount to NGA's GEOINT customers. P

*Greg A. is a special issues manager for the Precision Engagement Division.*





WORKING FOR NGA

## Observer Attests to Decisive Deployer Partnership

BY HEATHER C.

In early spring 2009, I was given a rare opportunity to observe NGA deployers in Iraq and Afghanistan. The experience of seeing these men and women in action altered not only my professional perspective but also my life. NGA deploys personnel to over 150 locations worldwide. This all-volunteer cadre performs a wide variety of assignments to ensure accurate, timely geospatial intelligence (GEOINT) support to the warfighter and civilian.

Part of my mission in going overseas was to gauge the level of GEOINT integration into the warfighter's operational picture, and I had the opportunity to tour facilities, attend briefings, and meet with some of the NGA Support Team deployers and listen to important feedback. I absorbed success stories and made note of challenges at all steps in the effort to win against violent extremism, and those in positions of authority offered many spontaneous testimonials. One commander noted, "We couldn't do this without GEOINT." While I understood and appreciated this academically, it was my firsthand experience with that support that brought it all home.

Regardless of location, U.S. military bases never sleep. In the chaos of war there are a few constants—the roar of fighter aircraft, the crunch of gravel under tires, the unforgiving glare of the sun in the afternoon. During my time abroad, I noted another significant constant—a certain look in every American's eyes. There was steeliness, a particular set of the jaw. For both warfighter and civilian, there was work to be done.

Even at rest, no one was wasting time. They moved with purpose. I watched military and civilian personnel stand in rustic, windowless rooms with the threat of improvised explosive devices, surface-to-air missiles and suicide bombers all around them. I watched NGA deployers sitting beside their military brethren, sharing desk space, energy bars and a commitment to the mission, despite all of these distractions. One evening I observed the power of seamless integration: an NGA analyst spotted something on the video feed, which led to a sudden flurry of phone calls to home agencies, combatant commanders and instant messages to other analysts. As this played out, I soon forgot to keep score of which agency was doing what, and in the end it really didn't matter. Every participant in this ballet knew his or her role and performed it quickly without regard to personal credit. Beginning with that one analyst's attention to detail, the warfighters engaged, capturing another enemy of coalition forces. Lives were likely saved and the world became a better place because of the danger that deployers and warfighter's together had removed. I saw GEOINT in action—people sacrificing time at home with family because what they were doing was greater than what they were feeling.

The commitment and acceptance of sacrifice do not change with location—the mission is still the mission, and it will get done. Purpose stands strong, and NGA deployers and their military partners stand together. ▣

Heather C. is a public affairs officer in NGA's Office of Corporate Communications.

Photo by Getty Images



## OUR HERITAGE

# Aerial Imagery of Neuve Chapelle Yielded Battlefield Intimacy

BY DR. GARY E. WEIR

How in the world can you lead forces into battle from a desk? A great many general officers asked themselves that question in the opening months of the Great War, World War I. This conflict seemed to depart from the textbook, from the type of confrontation many of these men knew and expected. Using maps that seemingly covered acres of conference tables, NGA's cartographic forebears exposed for planners the violent events of late 1914, reducing hundreds of miles of front and millions of soldiers to a manageable reality. Trained in the wars of the previous century, very few generals felt comfortable with the map, the table and the moveable symbols representing forces. Many sought action at the front because their professional standards and the traditions established by Napoleon and Frederick the Great of Prussia seemed to demand it. Among the Germans, British and French, 204 generals met their end before November of 1918.

The generals sought to communicate instructions firsthand, in a way that demonstrated their leadership style and effectiveness. Could a leader actually achieve the required intimacy with the conditions of battle and those fighting across miles of front simply by using an exquisitely rendered map? It seemed obvious that the map needed a complementary source to bring the fighting to the planning table in a compelling and immediate way.

Preparing for the battle at Neuve Chapelle, a small village in northern France near the border with Belgium, revealed that aviation and aerial photography could well provide the intimacy required by those old-school officers. Through the opening months of the war, the Royal Flying Corps (RFC), which would in time evolve into the Royal Air Force, began

systematically using handheld cameras to photograph the frontlines that the British shared with the Germans. By early 1915, the RFC could illuminate that real estate to a depth of 1,500 yards behind the German lines.

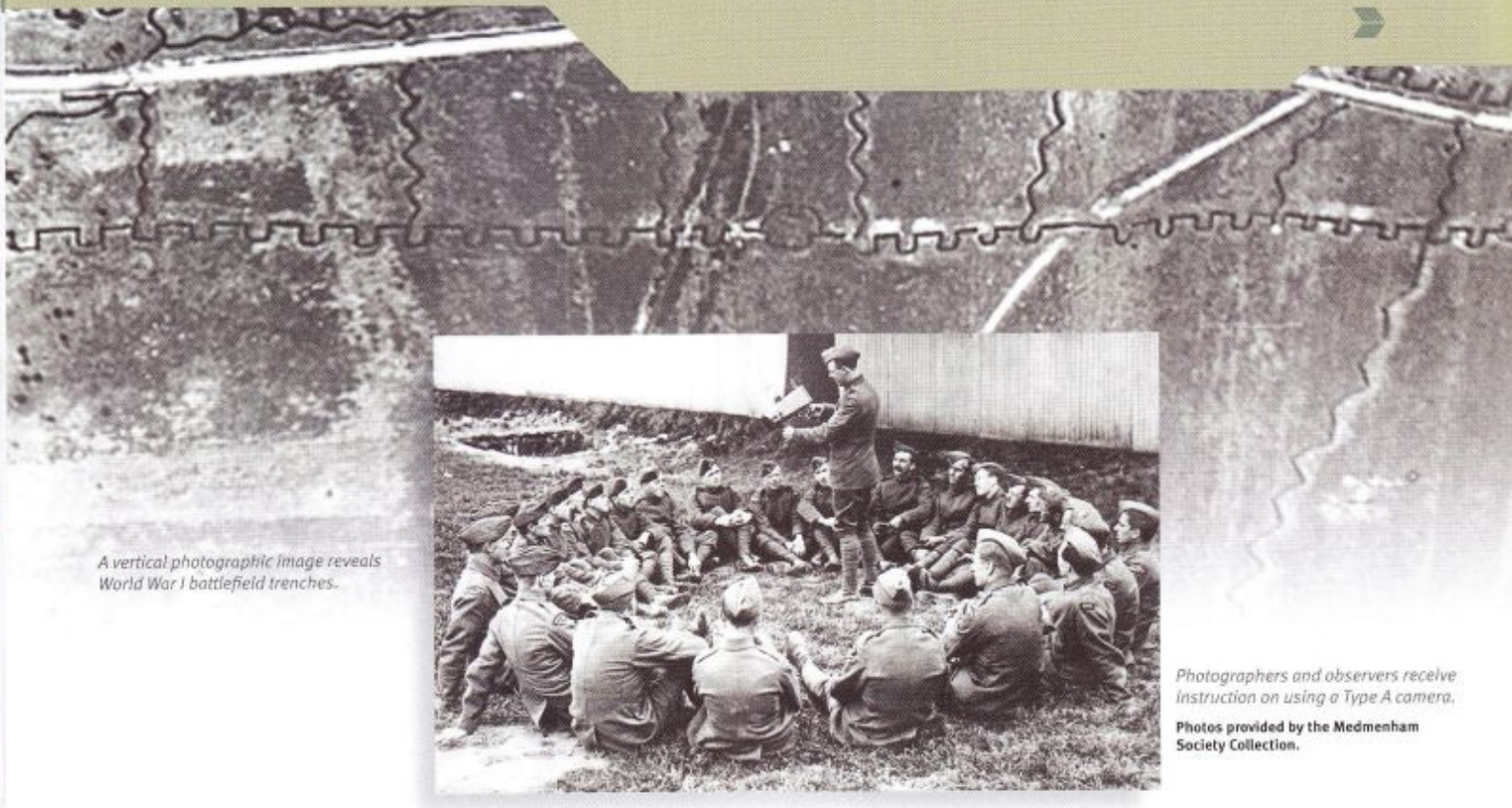
When planning for Neuve Chapelle first began, RFC No. 3 Squadron received a series of inquiries regarding the German trenches just opposite British forces in the planned area of operations, which included brickfields and a railway junction just south of the LaBassée Canal. The level of detail provided by successive photographic reconnaissance sorties over that area revealed new German trenches under construction. When presented to British and French staff officers, it became clear to them that the Germans also had an attack in the planning stages. The photographs revealed their basic intent

*Crewmen load a Type A camera prior to a photographic reconnaissance sortie.*

Photo provided by the Medmenham Society Collection.







A vertical photographic image reveals World War I battlefield trenches.

Photographers and observers receive instruction on using a Type A camera.

Photos provided by the Medmenham Society Collection.

as well as those points at which the opposing forces would likely meet in battle. The revelations offered by this source and its ability to bring the front immediately to the map table made instant converts of those who used it.

After this initial success, RFC No. 3 Squadron managed to exceed already heightened expectations. One of the squadron's particularly talented photographic observers, Lieutenant C.C. Darley, proceeded to accelerate the collection of aerial photographs of the planned battle area with the full support of the general headquarters staff. He and his colleagues very soon had resources sufficient to assemble an aerial map or photo mosaic of the Neuve Chapelle area. His commanding officer, Maj. John Salmond, immediately saw the significance of the new tool and brought both it and Darley to meet Col. Hugh Trenchard of the RFC staff, an influential proponent of airpower in these early years of military aviation. The colonel took Darley to a Neuve Chapelle planning meeting where he met the commander of the French Army, Gen. Joseph Joffre, who immediately adopted the collection, combination and interpretation of aerial photographs as essential to battle planning.

Gen. Douglas Haig, appointed to command the British forces in the Neuve Chapelle assault, became a convert due to the intercession of his intelligence officer Brig. Gen. John Charteris, who pushed the RFC to revise and

update the photo mosaic regularly as planning proceeded. Building on these orders, the RFC aviators began composing actual maps of the German trench system from the constantly improving mosaic. The British Army's professional cartographers soon took over this innovative combination of map and photo, producing 1,500 professional trench maps at 1/5000 scale and distributing them through the forces involved in the attack. This may be the first, true common operating picture ever taken into battle by a modern army.

Although voice communication and telegraphic shortcomings left the British to snatch defeat from an initially successful campaign at Neuve Chapelle in March 1915, the intelligence lessons from the battle proved monumental to the British and French as well as the American newcomers in 1917. Gen. Billy Mitchell, considered the father of the U.S. Air Force, Air Force Lt. Gen. Lewis Brereton, photographer Eduard Steichen, military historian James Barnes and other photographic veterans of the U.S. Army Signal Corps matured in this environment and helped the United States learn from the best European experience. While the habits of generals would prove hard to break, aerial photography allied with more effective cartography provided the planning-table intimacy they sought with both their soldiers and conditions on the ground. ♣

Dr. Gary E. Weir is the NGA Historian.



# NGA's WOUNDED WARRIOR FELLOWSHIP PROGRAM

Operation Warfighter, sponsored by the Department of Defense, places injured servicemembers who are undergoing treatment in temporary, volunteer work assignments during their recovery. The program provides servicemembers with meaningful activity outside the hospital environment and offers them a formal means to transition back into the workforce.

As part of Operation Warfighter, NGA is proud to host fellowships for wounded warriors interested in gaining experience in NGA's mission. Fellowship hours and length of time depend on the wounded warrior's availability. Medical treatment and the road to recovery are the first priority.

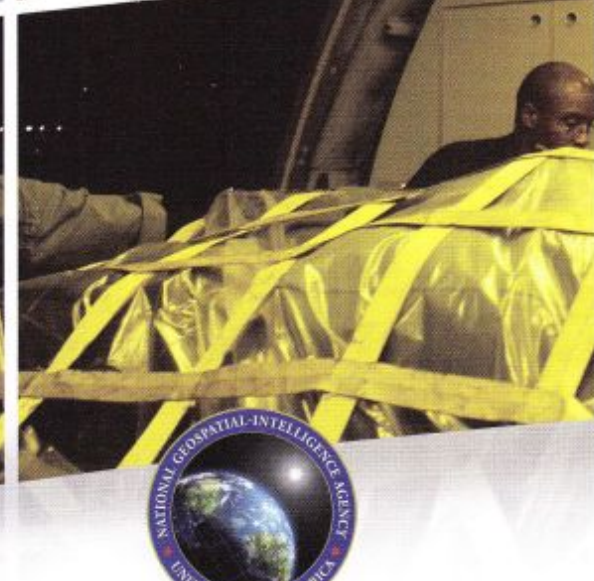
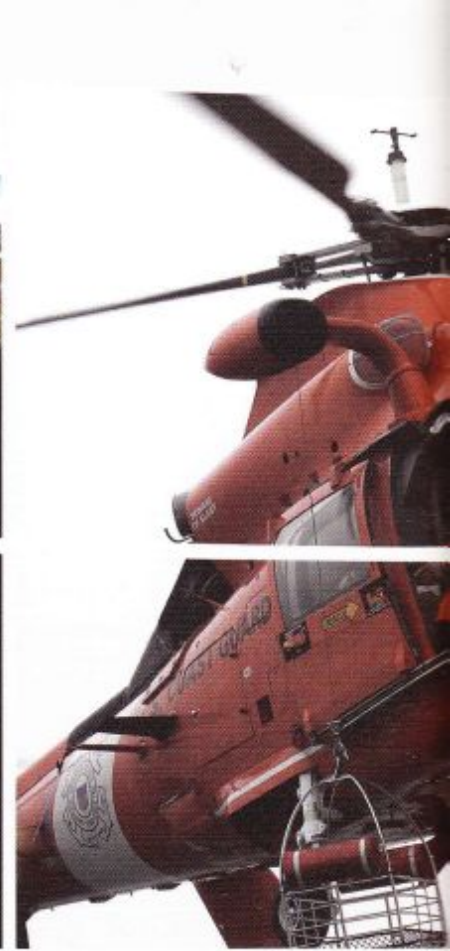
## Examples of NGA fellowship positions include:

- Warfighter Support
- Intelligence Reports and Analysis
- Source Collections Analysis
- Imagery Analysis
- Acquisition
- Finance
- Human Resources
- Staff Officers



**For more information contact**  
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[www.nga.mil](http://www.nga.mil)