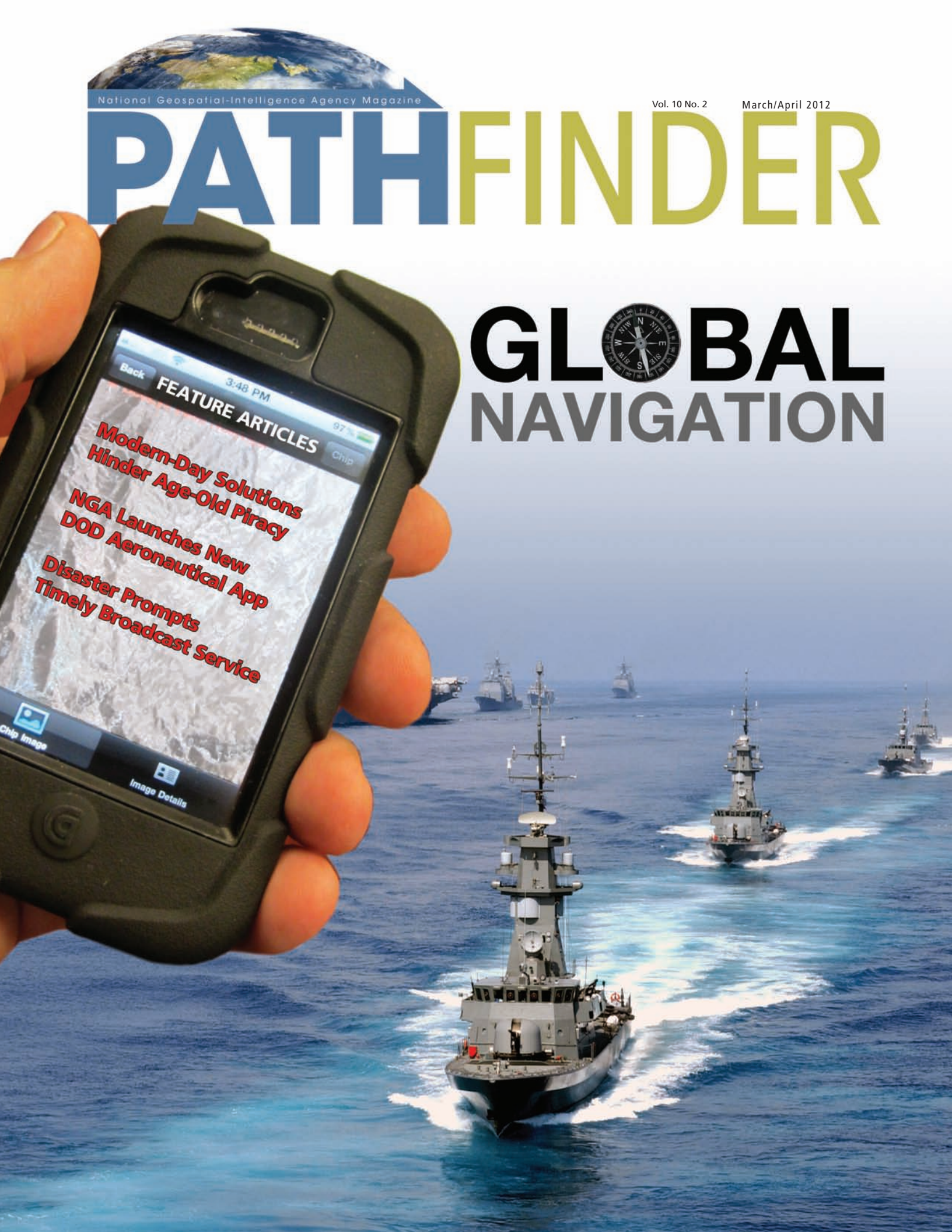


PATHFINDER

GLOBAL NAVIGATION





On My Mind: NGA Transforms Global Navigation

America's foundational knowledge of deep oceans and distant lands rests on the often heroic achievements of mariners and aviators in service to science and security. Today's mariners and aviators have been able to build on this legacy with the benefit of transformative new technologies. GPS has replaced celestial observation and calculation. Digital information on portable devices is turning hard-copy air and sea almanacs into historical artifacts. The National Geospatial-Intelligence Agency (NGA) supports this transformation of global navigation in a number of ways—including enhanced sensing and imagery collection and analysis—using the latest GEOINT (geospatial intelligence). We're also developing creative new methods to deliver our products to air traffic controllers, pilots, port and harbor masters and ship captains working in the commercial, civil and defense sectors.

GEOINT for global navigation is a high-stakes endeavor. As the articles in this issue show, GEOINT products like digital aeronautical and nautical charts provide the literal map to a location and also give early warning of hazards to air and sea navigation, especially for unfamiliar areas. For example, vessels in the Arctic Ocean rely on Digital Nautical Charts to gain a common operating picture of the underwater terrain and vessel traffic. This knowledge reduces the chance of accidents, protecting the lives of the crews, the local environment and the global economy. GEOINT also plays a role in threat assessment and national deterrence. GEOINT anti-piracy applications, for example, increase awareness of high-risk sea channels, helping keep commercial and military vessels out of harm's way and improving law enforcement agencies' ability to bring pirates to justice.

For global navigation, our vision for online, on-demand GEOINT means moving more capabilities to the bridge and cockpit, working in partnership with our customers and the community of university, national laboratory and commercial developers of GEOINT products. Our partnerships with international allies also promote government-to-government cooperation on navigation safety. We engage in a number of cooperative initiatives with our Commonwealth partners, including the Allied Maritime Sub Group, which issues data standards and identifies opportunities for burden sharing on maritime safety areas of mutual interest. We also collaborate with our partners through international fora, such as the International Hydrographic Organization and International Civil Aviation Organization, to exchange vital information to ensure the safety of mariners and aviators around the world.

Delivering new applications in customizable distribution formats is one step toward achieving online, on-demand access to GEOINT. We are also creating open, online repositories to share geospatial information resources produced by our partners and customers. For example, our Global Maritime Photo Database is a one-stop shop for mariners to easily find photos of significant landmarks and other aids to navigation; customers can even contribute their own data holdings to the photo database.

We have earned our customers' high expectations for reliability, accuracy and speed of delivery. NGA continues to meet and exceed those expectations. We will continue to find innovative ways to put the power of GEOINT in our customers' hands so that together we can always put safety first.

Letitia A. Long
Director

4



14



19



2 On My Mind: NGA Transforms Global Navigation

» **FEATURES**

4 Centennial Anniversary of Titanic Tragedy:
Disaster Prompts Timely Broadcast Service

6 Navigational Warning Service Expands Into
Arctic Waters

8 Modern-Day Solutions Hinder Age-Old Piracy

10 NGA Launches New DOD Aeronautical App

12 NGA's Aero Help Desk Adds New Service Tier

14 Maritime Safety Office Provides Information
Online, On-Demand

16 Shared Experiences Benefit Navy, NGA ShipRiders

18 ShipRider Charts Arctic Seafloor

19 Aeronautical Analysts Support Operation
Deep Freeze

» **TECHNOLOGY**

20 InnoVision Develops 3-D Thermal Site Models

» **HISTORY**

22 Geospatial Support in Vietnam

24 Remembering Vietnam 6:
The Defense Mapping Agency, 1972

» **NGA IN THE NEWS**

26 Employees Focus on Value of Mentoring
Partners in Education Host Annual Student Party
NGA Employees Host Science Demonstration for
Springfield Area Students

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The Pathfinder is the National Geospatial-Intelligence Agency publication that promotes awareness and understanding of geospatial intelligence. The Pathfinder is an authorized Department of Defense publication for members of the Department of Defense. Contents of this publication are not necessarily the official view of, or endorsed by, the U.S. government, Department of Defense or NGA. Articles in the Pathfinder may be reproduced in whole or in part without permission, unless stated otherwise. If reproduced, credit the author and the "National Geospatial-Intelligence Agency, the Pathfinder magazine." Any reproduction of graphics, photographs and imagery is subject to the original copyright.

On the Cover: The USS Constellation steams through the ocean with ships in its battle group en route to a liberty port call in Singapore in support of Operation Enduring Freedom. U.S. Navy photo by Petty Officer 2nd Class Timothy Smith. Cover design by Amy Battison.

On the Back Cover: Dedicated Nov. 11, 1993, the Vietnam Women's Memorial in Washington, D.C., on the grounds of the Vietnam Veterans Memorial, honors women's patriotic service during the Vietnam War. New Mexico sculptor Glenna Goodacre designed the multi-figure bronze monument portraying three Vietnam-era women, one of whom is caring for a wounded male soldier. About 11,000 American military women were stationed in Vietnam during the war, 90 percent of them nurses, according to the memorial's website. Others served as physicians, physical therapists and personnel in the medical, air traffic control, military intelligence, administration and other fields. An unknown number of civilian women also served in Vietnam as news correspondents and workers for the Red Cross, the USO and other humanitarian organizations. NGA photo by Rob Cox. Photo illustration by Amy Battison.

Centennial Anniversary of Titanic Tragedy:

DISASTER

Prompts Timely Broadcast Service

By Howard Cohen, Branch Chief, Tactical Ocean Data Branch, Maritime Safety Office

A U.S. Navy submarine transiting under the polar ice field via the Denmark Strait receives a message that an iceberg lies directly across its intended track, 50 nautical miles ahead. It changes course to enter the ice at a different point. A routine safety message has forestalled a potential catastrophe.

NGA's Maritime Watch, directed by Chris Janus, sent that message and screens safety messages national and international sources send to NGA.

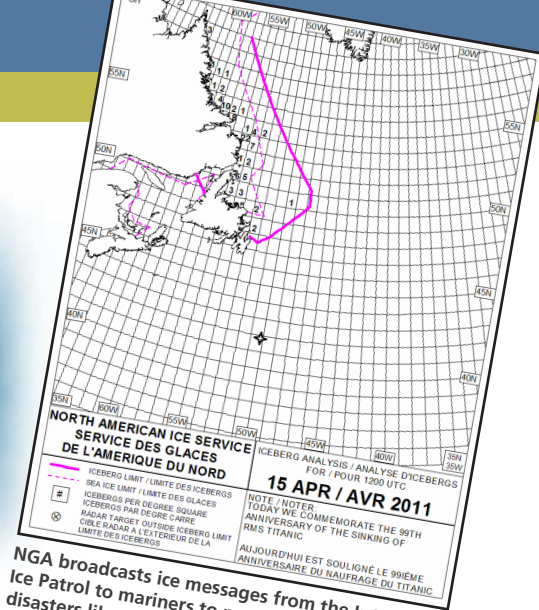
The center is the outgrowth of the international community's reaction to the 1912 sinking of the Titanic, said Janus. That tragedy was responsible for NGA's current role in broadcasting time-sensitive marine safety messages; the center plays an indispensable role in NGA's mission to warn mariners on the high seas of hazards to navigation.

"On April 14, 1912, in the afternoon, the German steamship Amerika spotted two large icebergs in what was then the most-traveled ocean route between Europe and America," said Janus.

"The Amerika wanted to warn the U.S. Navy Hydrographic Office, Washington, D.C., about this danger to safe navigation, but its transmitters were not powerful enough.

"Amerika spotted the 'unsinkable' RMS Titanic on her maiden voyage from Southampton (England) to New York. Amerika requested Titanic to relay the iceberg message to the hydrographic office. The wireless officer, whose main job was tending to passengers' telegrams, sent the message to the hydrographic office via Cape Race, Newfoundland, but never passed the message to the bridge. At 11:40 that evening the Titanic struck an iceberg. The rest is history.

"The message from Amerika via Titanic and Cape Race reached the Navy Hydrographic Office early on April 15, 1912. But, by then the Titanic had sunk, killing more than 1,500 people. The magnitude of this disaster forced the



NGA broadcasts ice messages from the International Ice Patrol to mariners to prevent further maritime disasters like the Titanic. The Titanic sank April 15, 1912, at 2:20 a.m. at approximately 41 degrees 46 minutes north latitude and 50 degrees 14 minutes west longitude (area indicated by the star) after

world to confront the problem of time-sensitive navigation warnings to ships at sea."

The following year, as a direct result of the Titanic tragedy, the Safety of Life at Sea Convention formed, said Janus. The convention led to an international treaty concerning the safety of merchant ships.

The convention initiated several reforms in navigation safety, said Janus. It began the International Ice Patrol to monitor ice conditions along the major Europe to America ocean routes. It required that transatlantic passenger ships maintain a lifeboat capacity to rescue all individuals on board. And, most importantly, it required all vessels at sea maintain a 24-hour radio watch. By 1921, these radio officers at sea were receiving safety messages from the Navigation Safety and Warning Service, maintained by NGA's predecessor organizations.

In 1977 the International Hydrographic Organization established the Worldwide Navigational Warning Service (WWNWS), which divided the world into 16 navigational areas, called NAVAREAS.

"The WWNWS is an international, coordinated global service for sending information by satellite to ships on immediate hazards to navigation which might endanger the safety of life at sea," said Dan Boileau, Maritime Watch operations officer. He and his team determine which messages go "out for the broadcast." The maritime watch center is the voice of navigation safety for the U.S. Navy and merchant fleets. It processed over 200,000 messages last year. Of those, 7,000 were considered vital.

Today, NGA's maritime watch center sends out six types of messages: NAVAREA IV; NAVAREA XII; HYDROPACs; HYDROLANTs; HYDROARCs; and special warnings.

The United States is the coordinator for NAVAREA IV (Western North Atlantic) and NAVAREA XII (Eastern North Pacific). Besides broadcasting NAVAREA messages, the broadcast desk also sends out HYDROPAC, HYDROARC and HYDROLANT messages, covering the Pacific, Arctic and Atlantic Ocean geographic regions, respectively. These are similar in content but worldwide in coverage. NGA thus gives its customers the option of receiving all navigation safety messages from one U.S. source, said Boileau.

Such information includes failure of and/or changes to major navigational aids, newly discovered wrecks or natural hazards (e.g., ice below 52 degrees north latitude) in or near main shipping lanes, military operations, search and rescue, cable-laying, scientific research and various other underway activities. Due to its wide ocean coverage, the broadcast also includes information concerning overdue and missing ships, aircraft or "man overboard" messages.

Specific notifications cancel navigation safety messages when they are no longer pertinent. A message addressing an exercise or event of known duration includes its own cancellation, usually one hour after the conclusion of the event. The Warning Service can also publish a U.S. Notice to Mariners correction for warnings that are sufficiently permanent in nature. Changing navigation conditions are not the only threat to

safety of life at sea; changing political conditions can threaten shipping. NGA periodically broadcasts special warnings to alert customers to any potentially threatening political development.

NGA consults with the State Department, Chief of Naval Operations and other government organizations to determine the scope of the warning. NGA then transmits the special warning to U.S. shipping, government agencies and military commands worldwide.

Civilian marine analysts and Navy quartermasters jointly staff the 24-hour watch. Boileau makes-up the "watchbill" and is also responsible for training watchstanders.

"Training to stand the broadcast watch starts about six months to a year after a new employee arrives," said Boileau. "That is the time needed to gain experience writing U.S. Notices to Mariners. For three weeks, the trainee observes and assists a veteran watchstander completing a rigorous qualification program."

The training culminates with a certification exam that ensures the watchstander is competent to stand the watch solo, said Boileau.

"It's a little bit intimidating at first," said trainee Dave Anderson. "With all the equipment, messages coming in and the phone ringing, it can be hectic at times."

NGA's Maritime Watch Center is extraordinarily proud of its unique position and long-standing tradition of providing vital worldwide safety service to the U.S. Navy and civil mariners, said Janus. ✨

Navigational Warning Service Expands Into Arctic Waters

By Keith Dominic, Staff Officer, Maritime Safety Office

“The potential for accidents and for causing environmental harm through operational mishaps in the Arctic is rising, while the effectiveness of search and rescue services and clean-up resources is inevitably stretched to the limit,” said International Maritime Organization (IMO) Secretary-General Efthimios E. Mitropoulos.

The expansion of the National Geospatial-Intelligence Agency’s (NGA) Worldwide Navigational Warning Service (WWNWS) into Arctic waters, which the IMO Sub-Committee on Radiocommunications and Search and Rescue (COMSAR) formally recognized this past year, signifies global coverage for all navigable waters.

Ships operating in the harsh Arctic environment can automatically receive vital information about navigational and meteorological hazards and other urgent information vital to the shipping industry. IMO and the World Meteorological Organization (WMO) delineated five new NAVAREAs and meteorological areas (METAREAs), respectively.

“With the establishment of these NAVAREAs (navigational areas) the world is fully provided with services to provide navigational and meteorological warnings to mariners,” said president of the International Hydrographic Organization (IHO) Adm. Alexandros Maratos. “We can now say that the WWNWS that started in the early 1970s is complete. A service which is not only very useful but vital to the safety of navigation and protection of the marine environment will be provided to mariners and vessels cruising within this environmentally sensitive Arctic region.”

Established in June 2010, and following a one-year initial operating capacity period, the five new Arctic NAVAREAs/METAREAs are in full operational capacity. Mitropoulos heralded the expansion of WWNWS into Arctic waters as a very significant development that addresses the increased risks to ships from a combination of expanding business activity in the inhospitable Arctic region and less predictable, more extreme weather conditions.

The IMO is the U.N.-specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships.

Dignitaries attending a formal recognition ceremony in March 2011 during COMSAR’s 15th session included Secretary-General of the WMO Michel Jarraud, Maratos and Mitropoulos. NGA’s Peter Doherty, who serves as chairman of the IHO WWNWS Sub-Committee, chairman of the IMO SafetyNET panel, and coordinator for the WWNWS NAVAREA IV and NAVAREA XII, was master of ceremonies.

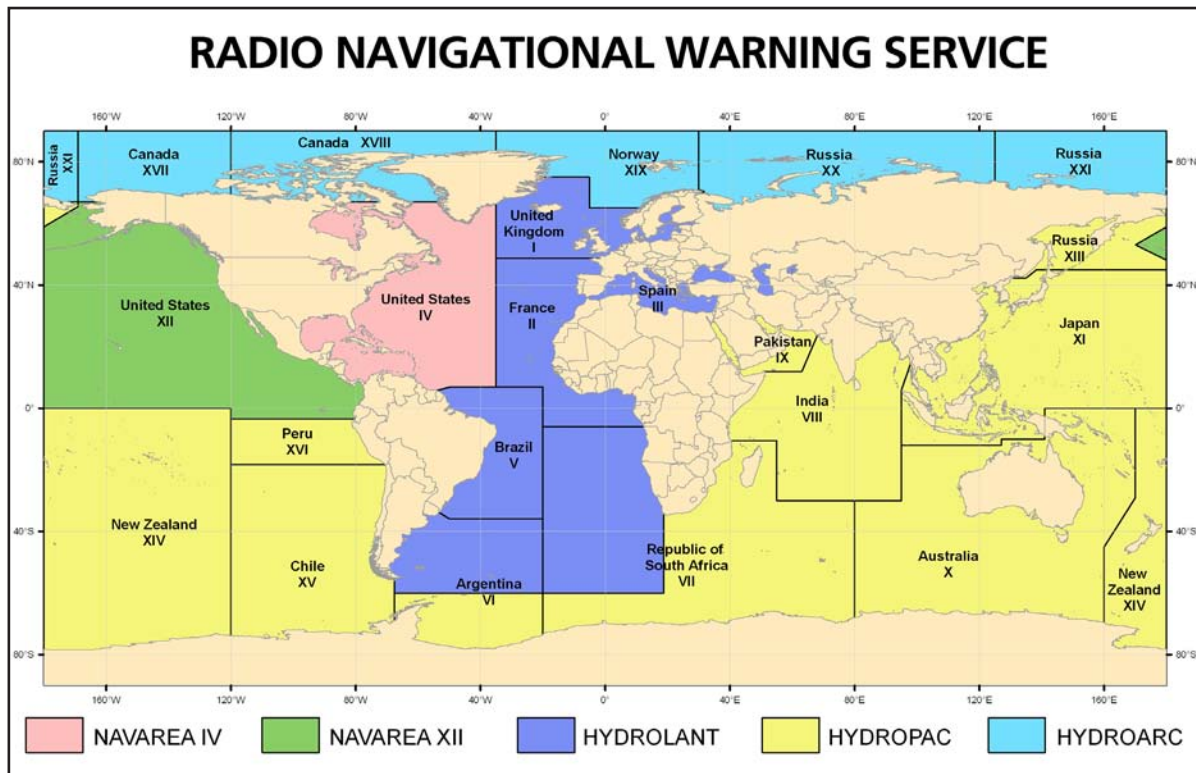
“The opening up of the Arctic will be a double-edged sword,” said Mitropoulos at the ceremony. “Depending on your perspective, it represents either a world of new business opportunities or, on the other hand, an unwelcome extension of the human footprint into areas still, at the moment, predominantly pristine. But I am confident that, balancing the two extremes and with measures such as those we inaugurate today, the pioneering venture in the new frontiers will be met with universal approval. Let us, therefore, work together to create the conditions that will allow the opportunities the Arctic presents to flourish in a framework of utter safety and environmental protection.”

Sea ice is projected to increasingly shrink under all scenarios and for some projections the Arctic late-summer sea ice would vanish almost entirely by the middle of the century, opening unprecedented challenges to maritime safety which were unpredictable just one generation ago, said Jarraud.

The Worldwide Navigational Warning Service (WWNWS) in the Arctic

The IMO first recognized the need to expand this service into the Arctic area in 2005, as Arctic waters became increasingly accessible with less predictable, more extreme weather. The increased risk, as well as potential for accidents and environmental harm, necessitated accurate early warning systems to maximize operational safety and minimize environmental damage.

In 2006 the COMSAR Sub-Committee established the joint IMO/IHO/WMO correspondence group on Arctic maritime safety information services, which selected Doherty as leader. At COMSAR 12 in 2008 the group agreed that the Arctic region required a common broadcast system for maritime safety information. It also agreed that



The Worldwide Navigational Warning Service expanded to include the Arctic in 2011; light blue demarks the newly established HYDROARC areas.

“The opening up of the Arctic will be a double-edged sword,” said Mitropoulos.

until an Arctic satellite service provider under the Global Maritime Distress and Safety System was available, they would use the current system of high-frequency narrow-band direct printing as a viable alternative means of promulgating MSI above the high-latitude limits of INMARSAT – International Marine/ Maritime Satellite – coverage.

In 2009 the COMSAR Sub-Committee endorsed the recommendation of the correspondence group for live testing of the Arctic NAVAREA/ METAREA operations to be held in 2009 and 2010, with a milestone goal of full operational status declared at COMSAR 15 in 2011.

Canada, Norway and the Russian Federation serve as Arctic NAVAREA coordinators and METAREA issuing services as follows:

- NAVAREA/METAREA XVII and XVIII– Canada
- NAVAREA/METAREA XIX–Norway
- NAVAREA/METAREA XX and XXI– Russian Federation

“We met the goal and through excellent international collaboration were successful in establishing an international coordinated service for the promulgation of vital maritime safety information to all vessels within the new Arctic frontier and in doing so have ensured the navigation safety and the safety of life, property and the environment for all nations,” said Doherty, deputy director of the NGA Maritime Safety Office and leader of this five-year international effort. ✨

Modern-Day Solutions Hinder Age-Old Piracy

By Chris Janus, Branch Chief, Early Warning Branch, Maritime Safety Office

In Robert Louis Stevenson's "Treasure Island," if you heard Long John Silver's parrot, Cap'n Flint, call, "Pieces of eight! Pieces of eight! Pieces of eight!" you knew your luck had finally run out—pirates, no doubt, were afoot!

Times have changed. The Stars and Stripes, once a merchant ship's best defense against piracy, no longer serve as an impenetrable symbol. On April 8, 2009, pirates captured their first U.S.-flagged vessel, the container ship Maersk Alabama, 200 miles off the Somalia coast. Her crew's heroic and resourceful actions forced the pirates to abandon ship in a lifeboat, but not before they took Capt. Richard Phillips hostage. U.S. warships arrived April 9, and after a three-day standoff rescued the captain and killed the pirates.

Modern-day pirate attacks, as well as their tactics and strategies, have evolved. The National Geospatial-Intelligence Agency's (NGA) Maritime Watch, part of the Maritime Safety Office, remains vigilant in its global efforts to keep mariners safe and informed of piracy attacks. Within two hours of the Maersk Alabama attack, the Maritime Watch released a message alerting U.S. Navy forces and civilian mariners.

The Maritime Safety Office is not new to the piracy game. It has been in the business for more than 25 years, providing mariners with the ability to quickly access the latest information concerning acts of piracy and areas that pose the greatest risk. Since April 2009, there have been more than 1,400 acts of piracy, 483 in 2011 alone. Today, users can access NGA's maritime safety information (MSI) 24/7 on the World Wide Web and through virtually any Web-enabled device.

"Before access to the Web became almost ubiquitous, in the early '90s users had to compete for, and hope to connect to, one of the office's 12 modems via a toll number to retrieve MSI—but even then the system provided an unmatched capability," said Frank Chamberlain, the Maritime Safety Office's technical executive. "Today the Maritime Safety Office provides worldwide access—at no charge—to its maritime safety information databases and, in 1999, when it first established its Web presence, set the standard for Web access to MSI." NGA's Maritime Safety Information website has user-friendly menu options, allowing customers access to the latest information on U.S. chart corrections, broadcast warnings, lighted aids to navigation, radio navigational aids, offshore drilling units, U.S. Coast Guard navigation information, anti-shiping activity messages (ASAMs) and other maritime-related data.

The ASAM database dates back to 1985; the U.S. government Interagency Group on Piracy and Maritime Terrorism requested it in response to the increase in hostile activity against shipping. At its inception, and for many years, it was the only centralized database of its kind. Today, it still serves as an effective and dependable system for loading, storing and disseminating reports concerning acts of piracy and threats to

ThinkStock Image

shipping worldwide. Sources include the Office of Naval Intelligence, Maritime Security Center Horn of Africa and the International Maritime Bureau Piracy Centre. No other international hydrographic authority maintains a database with similar information.

In recent years, however, piracy attacks off the Horn of Africa have increased dramatically in number and scope, with attacks occurring as far south as Mozambique to just off the southern

“Before access to the Web became almost ubiquitous, in the early ‘90s users had to compete for, and hope to connect to, one of the office’s 12 modems via a toll number to retrieve MSI—but even then the system provided an unmatched capability,” said Frank Chamberlain.

tip of India—an area encompassing more than 2 million square miles. Pirates use everything from speed boats and grappling hooks to scuba gear to board target vessels, according to the International Maritime Bureau. In February 2011, the line separating terrorism and piracy became even more indistinct when Somali pirates hijacked the motor yacht *Quest* and mercilessly killed the entire crew, which consisted of four U.S. citizens, while negotiations for their release were ongoing. The brashness of their actions further highlighted the seriousness of the problem, especially considering the pirates’ complete disregard for the four U.S. Navy warships that trailed the *Quest* in support of negotiations.

Unfortunately, despite the rise in piracy around the world, most governments show little enthusiasm for apprehending well-armed pirates or enforcing piracy laws. Countries no longer summarily execute apprehended pirates. Instead, modern-day pirates are entitled to their day in court. Since most attacks occur on the high seas, the challenge is to determine which court holds jurisdiction. Victimized countries often lack resources, facilities and political will to bring pirates to justice.

While the ASAM database can forewarn—it can’t deter piracy—the key is getting the data to those who need it, when they need it. The Maritime Safety Office is taking the next step to do just that, with a smartphone application that allows users to access and view the most recent piracy attack information. The app will provide the infrastructure to push data, overlay it in real time and interact with the user’s data and displays to create an environment where decisions affecting the safety of life at sea are readily apparent and can further protect a vessel’s cargo as well its passengers.

Users can view the Maritime website at <http://msi.nga.mil/NGAPortal/MSI.portal>. To view the ASAM database select the ASAM search link in the left column. ✨



The Anti-Shipping Activity Messages database contains information concerning acts of piracy and threats to shipping worldwide. Depicted are pirate attacks on merchant ships, annotated by a skull and crossbones icon.

NGA illustration by Chris Janus

NGA Launches New DOD Aeronautical App

By Mario Iván Oña, Contractor, Office of Corporate Communications
 9:02 AM
 PHAERO Beta



The chart page allows users to browse through the worldwide set of DOD high and low altitude en route charts. With one touch users can enter and exit full-screen mode while also zooming in and out.

NGA image by Matt Mayes using the iPhone Operating System simulator.

Forget riding white-frosted turquoise waves in the Caribbean, this kneeboard may just save your life and your money.

Several years ago the commercial airline industry began embracing kneeboards, or tablet computers, such as the Apple® iPad®, pre-loaded with required flight information publications (FLIP). The concept of the electronic flight bag (EFB) caught on quickly in the commercial sector because it was

cost-effective and provided additional capabilities compared to the bulky, hard-copy FLIP paper products pilots are required to have during flights.

About 1 1/2 years ago, the National Geospatial-Intelligence Agency (NGA) set out to develop its own EFB application.

“Our goal from the outset was to provide a free government solution that allows our customers the capability to display our NGA aeronautical data on various mobile devices with our first efforts focusing on the Apple iPad,” said Philip Johnson, NGA military services digital coordinator for the Office of Aeronautical Navigation and program manager for the aeronautical app and EFB initiative.

“We wanted to provide the Department of Defense (DOD) with a government solution that avoided the high start-up and lifecycle costs associated with most of the commercial alternatives,” said Johnson. “Our goal is not only to provide data, products and services to our customers, but also add value by fusing it together for increased effectiveness and situational awareness.”

Johnson became part of the forward-leaning NGA strategic engagement committee shortly after he joined the agency about three years ago. The committee looked at ways to better serve external customers. With his 10 years of experience as an airline pilot and as a recent convert to commercial EFBs, Johnson and the team immediately identified the need to “utilize mobile devices to reduce paper in the cockpit.”

Although the aeronautical app initiative predated NGA’s vision of putting GEOINT into the hands of users and making GEOINT more easily accessible, it was almost custom-made to fit the vision mold, said Johnson. Consequently, NGA’s senior leadership, including Director Letitia A. Long, embraced the initiative almost immediately.

But there were challenges.

“Technology is moving faster than even the civilian community can keep up with, and certainly faster than the government,” said Johnson. “There is simply not a ton of guidance on a lot of the stuff we were trying to do, so that was a major challenge we had to overcome.”

After trailblazing through the “how,” they had to also figure out the “where.” Johnson and NGA EFB lead developer Matt Mayes—also a pilot—along with two NGA InnoVision scientists assigned to the initiative part time, Josh K. and Wes R., had to find a workshop for their development project. They worked closely with the NGA West site security team to designate a small, unclassified space to house the necessary hardware, including iPads, Apple computers and various other mobile devices.

The first iteration of NGA’s aeronautical and EFB app launched in January. The iPad app allows pilots to view electronic versions of NGA’s aeronautical publications and is admittedly rudimentary, said Johnson. Even so, it instantly provides two significant benefits: safety and cost-effectiveness.

Although estimates vary and it is difficult to put a dollar amount on the savings, the dual benefits are clear when considering hardcopy FLIP products can weigh from 50 to 90 pounds, according to various open-source reports. An iPad, conversely, weighs 1 1/2 pounds. Eliminating the additional load equates to a reduction in fuel costs particularly in smaller military aircraft, as well as substantial printing costs, and it also improves safety by providing more space in confined military cockpits and cargo compartments, said Johnson.

Before the EFB even launched, end-users were already enthusiastic about the benefits.

“From the limited testing we’ve done so far, I think it works very well,” said James Taylor, a flight simulator instructor at the 558th Flying Training Squadron in Texas, who was furnished with two NGA iPads pre-loaded with the EFB app. “If this app has the right features, it could be extremely useful to an aviator. Dealing with the approach books in the cockpit is often a pain.”

“Currently, many aircraft are flying around with three-ring binders full of information that can easily fit onto a computer or kneeboard for

immediate, word-searchable access,” said Taylor. “So one of the big advantages of the kneeboard is the ability to electronically have all the regulations and flight manual information the crews need.”

It is conceivable that an iPad may not only be able to store the entire library of aeronautical publications and charts, but also have the most up-to-date versions—another significant safety advantage.

Beyond reducing clutter, the capability of electronically carrying every possible map for any given situation allows aircrews to be more adaptable. In some cases, not having this capability may place troops in a precarious situation.

“There is a chance that you could get called to go support troops in contact and you wouldn’t have the detailed map of that area,” said Lt. Col. William Bufkin in an article by James K. Sanborn in Defense News about using iPads for close-air support missions.

Despite the obvious benefits, Taylor, who is also a retired Air Force pilot with 24 years of active duty and more than 4,000 hours of military flying time, is cautiously optimistic.

“We are excited about helping NGA refine and test the application,” said Taylor, “but if this concept is going to take hold, the pilots will need to be able to get the information they want, when they want it and in an intuitive way.”

Although the app is in its first version and the team will continue to find ways to improve its functionality and ease of use, Johnson and his team are confident that they can continue to build on their product. In future versions, they intend to make the uploading and updating of information seamless and also make the app available on various other platforms, such as Android™.

“We’re breaking new ground,” said Johnson. “At times, it seemed we were the first to arrive at some of these hurdles, so in some ways, we’ve laid the foundation for the development of subsequent apps.”

In their insatiable quest to keep up and embrace the new technology, they are helping open NGA’s door of innovation. ✨

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NGA's Aero Help Desk Adds New Service Tier

By Karen Walker, Contractor, Office of Corporate Communications

The National Geospatial-Intelligence Agency (NGA) introduced a new support service—the Aeronautical Help Desk—for civilian and military aviation customers and other users of geospatial intelligence (GEOINT) last summer. The Aero Help Desk provides a middle tier of customized assistance for Aeronautical Navigation Office customers and GEOINT partners. Its military and civilian customers use NGA flight information publications (FLIP) for safety of navigation.

The Aero Help Desk operates from within NGA's Operations Center-West. In addition to handling phone calls and emails, help desk staff monitor for worldwide open source information concerning volcanic eruptions, seismic activity, potential tsunamis, Pacific typhoons and Atlantic hurricanes that may pose safety of navigation threats. The help desk supported events such as last year's Japan earthquake and tsunami by providing situational awareness on which airfields were operational, and providing en route charts to speed air evacuations and supply logistics.

The help desk also supports stability operations. For example, it aided navigation for defense and relief missions during the Libyan uprising.

"Each morning, we put together a report on airfields that pilots depended on to move people and materiel," recounted Ed Balling, a former air traffic controller and current aeronautical intelligence analyst with NGA's Source Operations and Management Directorate, Aeronautical Navigation Office. "It's not just the condition of runways, but also the size of the apron and how many aircraft it can hold, and whether the landing and takeoff path has sufficient clearance for the aircraft."

By piecing together information about a particular landing site, the Aero Help Desk staff designed a map of taxiways parallel to the landing strip that allowed pilots of cargo planes to safely take off and land.

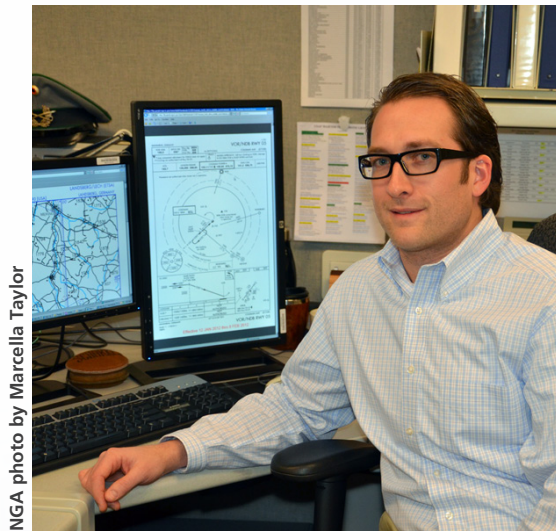
With the creation and staffing of the Aero Help Desk, the Aeronautical Navigation Office now provides NGA and its customers with a consistent level of readiness to provide embedded

support to crisis action teams responding to natural disasters and other worldwide events. From July through the end of December 2011, both senior and journeyman aeronautical analysts spent two weeks apiece at the Aero Help Desk handling calls and emails. The effort was so successful that this year senior analysts will pair up with junior analysts to staff the desk. The help desk's mentoring and peer-coaching approach will ensure a sufficient number of analysts are available to respond if/when the help desk

ramps up to a 24/7 crisis response mode.

NGA announced the Aero Help Desk initiative at the 2011 Mission Planning User's Conference. This annual event draws approximately 2,000 participants from all four military service branches, other government agencies and U.S. military allies. Word spread quickly by word-of-mouth, and the help desk now fields an average of 120 questions a month, received through phone calls and emails. Many aviation tools and products include help desk contact information.

On a typical day, customers will request help with product specifications, ask questions about product quality, inquire about how to obtain late or missing sources, report Web or download issues and a plethora of other issues.



NGA photo by Marcella Taylor

NGA Aeronautical Intelligence Analyst Lance Scharkey monitors online aeronautical account functionality by accessing and checking links to a digital terminal chart. Help Desk watchstanders routinely access flight information products electronically to verify that online services are in working condition and to support any and all incoming questions from the warfighter.

Sometimes requests come in from unusual quarters. Aeronautical intelligence analyst Lance Scharkey picked up an urgent phone call from an air traffic controller at the Kennedy Space Center on the morning of Aug. 3, coincidentally during pre-launch preparations for the Atlas V rocket destined to explore the planet Jupiter. The air traffic controller needed to verify the validity of the Center's Flight Information Publications. Scharkey verbally walked the controller through the help desk's product supports. The help desk's handling of this call ensured that the Space Center controllers had online, on-demand access to the most up-to-date procedural information.

Aero Help Desk veterans and aeronautical intelligence analysts Larry Woods and Scharkey estimate that 70 percent of customer interactions provide quality feedback on safety and navigation. Ed Balling attributes the demand for Aero Help Desk support to its ability to provide

answers as a one-stop shop with guaranteed follow-up.

"Our customers really appreciate the rapid response," adds Steve Buske, an aeronautical intelligence analyst. The Aero Help Desk response to customer requests for aeronautical information may be within minutes of initial customer contact.

Looking forward, Woods and Scharkey plan to develop FAQs and other aids to move more aviation customers from assisted service to online self-help. As a starting point, self-service products will include online tutorials, aviation terms, definitions and specifications and a full index of NGA's flight information product line with detailed explanations and ordering information and support.

The Aero Help Desk operates from 4 a.m. to 8:30 p.m. CST, Monday to Friday, including holidays, at the worldwide accessible number 1-877-817-9134.✶

*"Each morning, we put together a report on airfields that pilots depended on to move people and material."
—Ed Balling, former air traffic controller and current aeronautical intelligence analyst with NGA's Source Operations and Management Directorate.*



The Aero Help Desk produced this image of the Sendai Airport in the days following the Japan earthquake to support U.S. Pacific Command's disaster recovery and reconstitution mission. PACOM relied on these images to guide pilots safely in and out of the disaster recovery zone.

Maritime Safety Office Provides Information Online, On-Demand

By Brandie Schieb, Branch Chief, NGA Maritime's Publications Branch and Jason E., GEOINT Analyst, Maritime Safety Office

The National Geospatial-Intelligence Agency's (NGA) Maritime Safety Office has a rich maritime heritage that traces its creation to the U.S. Depot of Charts and Instruments 181 years ago. From hardcopy to Digital Nautical Charts (DNC®), much has evolved since then. Today the office is moving to the next level—online and on-demand access.

Smartphones already enable users to locate points of interest such as theaters, restaurants or shopping facilities in their defined geographic area. This same technology will help enable the transition to “smart” Sailing Directions. Containing detailed descriptions of landmarks, coastlines, weather patterns and hazards to mariners, Sailing Directions preceded the modern nautical chart, which is dependent upon an accurate coordinate

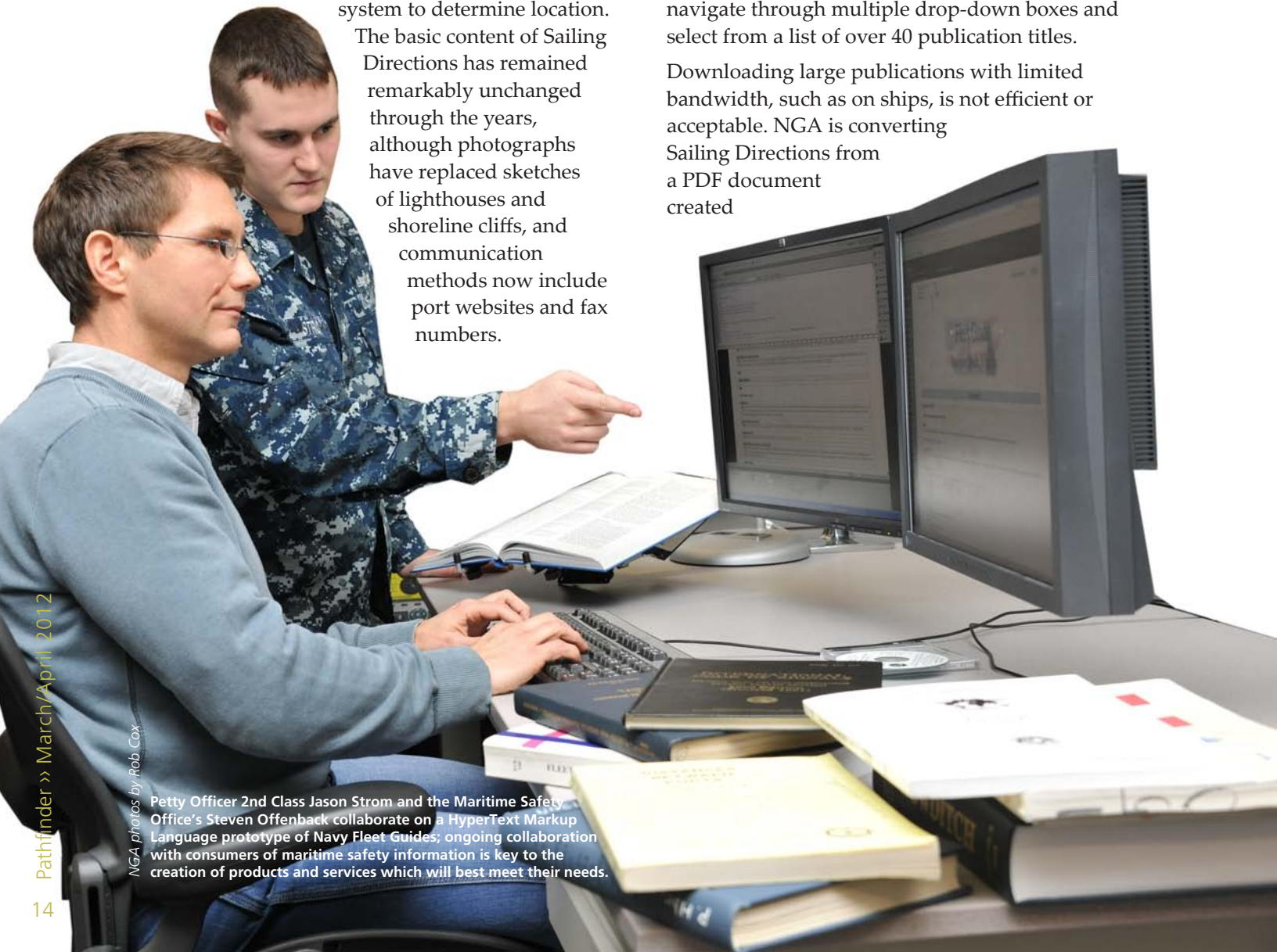
system to determine location.

The basic content of Sailing Directions has remained remarkably unchanged through the years, although photographs have replaced sketches of lighthouses and shoreline cliffs, and communication methods now include port websites and fax numbers.

The book format has also remained relatively unchanged.

The Maritime Safety Office is supplementing the current text of Sailing Directions with geospatial data depicting such items as warning, firing, reporting and sensitive sea areas. The office is also improving the World Port Index, providing information in plain English and cross-referenced with the Enroute Guides and DNCs®. Instead of reading through volumes of text to find potentially hazardous areas, navigators will have the option of seeing this information overlaid on charts, making it easier to correlate information using current and future mobile and Web technology. Current formats require users to know the specific product they need before they can query it for a specific port, navigate through multiple drop-down boxes and select from a list of over 40 publication titles.

Downloading large publications with limited bandwidth, such as on ships, is not efficient or acceptable. NGA is converting Sailing Directions from a PDF document created



Petty Officer 2nd Class Jason Strom and the Maritime Safety Office's Steven Offenback collaborate on a HyperText Markup Language prototype of Navy Fleet Guides; ongoing collaboration with consumers of maritime safety information is key to the creation of products and services which will best meet their needs.

using publishing software to a database that can serve up data both as an HTML website and as a print on demand PDF document. NGA can update publication information within days of receiving new source data, rather than the months it took through the hardcopy patch and new edition process. Web pages will contain active links to databases of photographs and video clips which meet specific navigation criteria and relevance to the ship. This same technology will also provide a two-way interactive process, allowing the user to forward relevant photographs and perhaps video of ports of entry that he or she can share with other users and store in an NGA defined database.

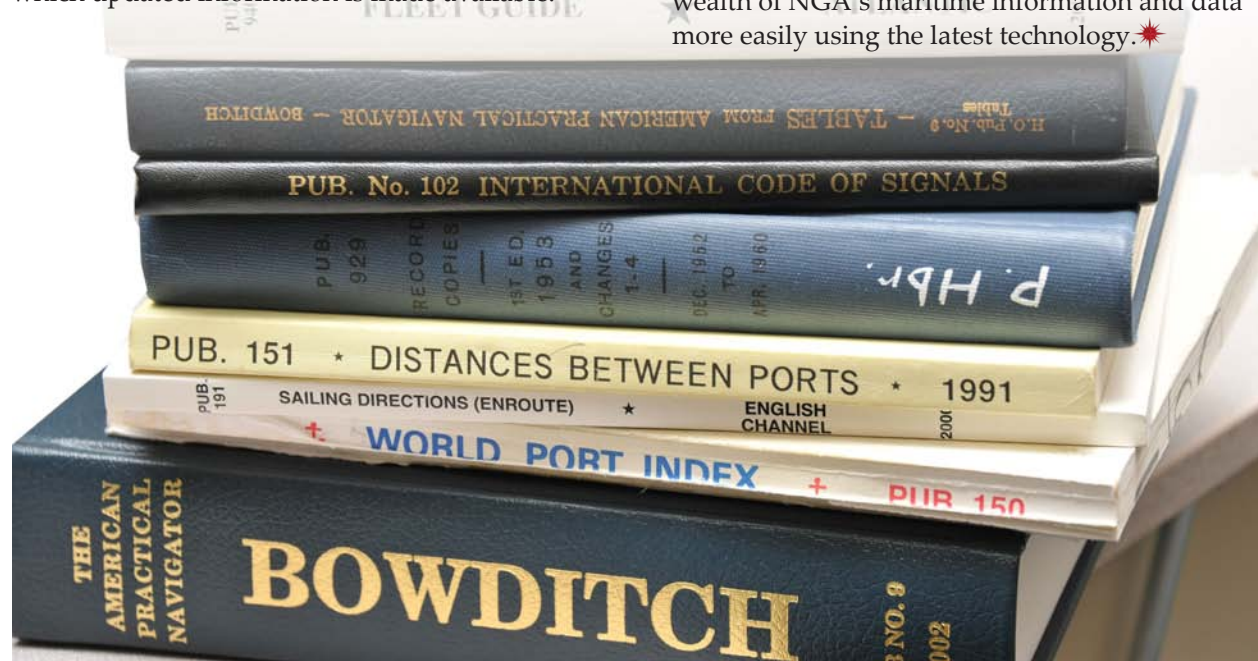
Smart Sailing Directions could eventually provide the platform for a user to navigate and easily find all Maritime Safety Office products worldwide as well as other products and information, such as National Oceanic and Atmospheric Administration Coast Pilots and Charts, U.S. Coast Guard Light list publications and foreign publications.

“The key to publications transformation is the transition from maintaining and updating publications data in proprietary publishing software to an XML database which can be exported to multiple outputs on demand,” said Peter Doherty, deputy director of the NGA Maritime Safety Office. “The goal is to make publications data more discoverable and accessible by the user in a format optimized for Web viewing as well as improve the speed at which updated information is made available.”

App Development

“There’s an app for that” is a common refrain in the technology world. The Maritime Safety Office is following this model through the creation of applications to meet end users’ needs. The office showcased one of these apps, aimed at making piracy attack messages available on mobile devices, at the 2011 GEOINT Symposium. Imagine a ship’s master looking at a tablet computer while sailing the Gulf of Aden to find, and add, new pirate attack information. Further, the ship’s master can display the most current digital chart and reference the latest sailing direction information. All of this contributes to a more complete safety of navigation picture for the mariner. Additionally, mariners will soon be able to use the Maritime Safety Office’s nautical calculators, previously available only from NGA’s Maritime Safety Information webpage and publications CDs. Using one of many mobile platforms, a mariner will be able to calculate great circle routes, convert measurements and measure various distances, all on a mobile device or from a webpage widget.

The Maritime Safety Office is evolving to meet the needs of end users, including the mariner. As an active supporter and participant in NGA’s strategic initiatives, the office is continuing the long tradition of providing timely and relevant maritime domain awareness by using current and emerging technologies to aid in the discovery of and access to this information. In the end, mariners will be able to search, find and use the wealth of NGA’s maritime information and data more easily using the latest technology.★



Depicted are a sample of the legacy hardcopy publications which NGA now provides online and on-demand as part of the Maritime Publications Transformation Initiative.

Shared Experiences Benefit Navy, NGA ShipRiders

By Peter Strzyzewski, USTRANSCOM NST Liaison Officer to Military Sealift Command

“As the NGA (National Geospatial-Intelligence Agency) support team liaison officer to Military Sealift Command (MSC), I was able to gain a better understanding of the command I support,” said Peter Strzyzewski of his ShipRide on the USNS Guadalupe last summer. “Having three NGAers aboard the Guadalupe proved to be beneficial to both the captain and his crew as well as to us. The captain was very interested in what we do for NGA and how we can assist him and his crew better.

“I appreciated seeing one of the MSC’s ships in use,” added Strzyzewski, “albeit one of MSC’s many missions and many ships. I found this experience to be particularly rewarding. The captain took a sincere interest in our business of geospatial production and products and aiding his navigational needs.”

Along with NGA Maritime cartographers Matt Cronin and Justin Fristoe, Strzyzewski assisted the Guadalupe with using NGA’s Digital Nautical Chart services and its Enterprise Print-On-Demand capabilities, which allow the ship to print NGA products at sea.

The USNS Guadalupe is part of the Combat Logistics Force (CLF), MSC Pacific. The ship refuels other naval ships at sea and serves as a Navy logistics asset. The ability to receive fuel and supplies at sea enables warships to remain on station and accomplish their missions for longer periods of time than if they had to pull into port

to refuel and resupply. USNS Guadalupe has a 180,000-barrel fuel oil capacity, including aviation fuel, and refueled three naval ships during the July ShipRide, two simultaneously.

While under way in the Southern California operations area and conducting logistics services, the Guadalupe replenished the frigate HMCS Vancouver of the Canadian Forces Maritime Command with ship and aviation fuel. HMCS Vancouver was en route to support Operation Mobile, the Canadian contribution to Operation Unified Protector, the NATO mission supporting Libya.

The replenishing process began as the HMCS Vancouver pulled up alongside the Guadalupe’s port (left) side. Once both ships maintained a constant speed, the Guadalupe fired a line over to the Vancouver. The crew then attached the line to both ships, which then guided the fuel line. Through a series of pulleys, the crew transferred the fuel line from the Guadalupe to the Vancouver. Once secure, the refueling began. This process, from beginning to end, took about an hour and occurred approximately 15 miles off the coast of southern California in international waters.

Later in the week, while out at sea about 350 miles, the Guadalupe replenished Navy destroyers USS Gridley and USS Stockdale simultaneously. Like the HMCS Vancouver, the Gridley



The Military Sealift Command fleet replenishment oiler USNS Guadalupe and the guided-missile destroyer USS Halsey conduct a replenishment at sea.

approached alongside the Guadalupe's portside. After the refueling began, the USS Stockdale approached alongside the Guadalupe's starboard side. Refueling the Stockdale started before the Gridley completed.

"It was impressive to watch as these two destroyers were refueled simultaneously in the relatively rough seas of the Pacific Ocean," said Strzyzewski. "Both the USS Gridley and USS Stockdale were en route eastward from Pearl Harbor, Hawaii, to California."

While closer to the coastline, NGA's ShipRiders also witnessed Navy SEALs from the San Diego Naval Base practice an assault on the Guadalupe called a visit, board, search and seizure. They also participated in the Guadalupe's muster, fire and evacuation drills during the week at sea, said Strzyzewski. "During the fire and evacuation drill, we donned life preservers and boarded our assigned lifeboats." The crew sprayed a sulfur-infused liquid into the ocean to extinguish the simulated blaze.

"The MSC ShipRide experience enhances the NGA-mission partner relationship and is a great professional development opportunity," said Strzyzewski. MSC offers a number of ShipRide opportunities throughout the year, ranging from an overnight trip to a five-day, four-night voyage aboard an MSC ship. The East-coast voyages generally depart from Norfolk, Va., and West-coast voyages generally depart from San Diego, Calif. These events are more frequent during the summer (warmer) months, as ship schedules will support.



NGA photo by Matt Cronin

NGA ShipRider Justin Fristoe, center, observes crewmembers conducting bridge operations.

MSC operates approximately 110 noncombatant, civilian-crewed vessels daily around the globe, replenishing U.S. Navy combatant ships, conducting special missions, strategically prepositioning combat cargo at sea and transporting military equipment and supplies in support of U.S. forces. MSC provides services to the Navy, Marine Corps, Army and Air Force as well as U.S. Transportation Command, Missile Defense Agency and other government agencies.

MSC ShipRide opportunities are open to NGA employees who want to gain a better understanding of an NGA mission partner, as well as familiarize themselves with NGA's hydrographic products and safety of navigation at sea mission. ✨

U.S. Navy photo



USS Abraham Lincoln, right, USNS Guadalupe and USS Cape St. George conduct a replenishment at sea.

ShipRider Charts Arctic Seafloor

By Jennifer Resio, Bathymetrist, Maritime Safety Office

The U.S. Navy has predicted an increasing tempo of operations in the Arctic Ocean over the coming decade, as the ice conditions permit more frequent and longer voyages. A bathymetrist from the National Geospatial-Intelligence Agency's (NGA) Maritime Safety Office embarked Aug. 15 as a ShipRider aboard the U.S. Coast Guard Cutter Healy for a 44-day voyage to chart the Arctic seafloor.

The author, Jennifer Resio, participated as part of a 30-person science team comprised of people from multiple academic and government agencies. The University of New Hampshire's Center for Coastal and Ocean Mapping (UNH CCOM) provided the lead scientists.

"We were really pleased to have a maritime specialist from the National Geospatial-Intelligence Agency (NGA) on our Arctic mapping cruise this year," said Andrew A. Armstrong, co-chief scientist at UNH CCOM and a retired captain with the National Oceanic and Atmospheric Administration. "NGA is an important partner in the United States Extended Continental Shelf program and a key customer for our bathymetric mapping data. It is very helpful for us to establish direct working relationships with the scientific personnel from NGA who use our data."

The mission for this voyage was to collect multibeam sonar and seismic data to support the Extended Continental Shelf sovereign rights as defined by Article 76 of the U.N. Convention on the Law of the Sea

Treaty. Article 76 defines the extended continental shelf in multiple ways; the bathymetric definition is 60 nautical miles seaward from the foot of the slope. Scientists predict nearly a quarter of the world's undiscovered oil and gas may lie beneath the seabed of the Arctic, making this a hotly contested area. The current mission is an ongoing effort which began in 2003.

The vessel departed Barrow, Alaska, and teamed with the Canadian coast guard vessel Louis S. St. Laurent for joint operations. This teaming allowed alternating ice breaking duty and data collection between the ships, giving one ship at a time the ability to focus solely on data collection. On Sept. 1, just 93 miles from the North Pole, the two ships reached their most northern point at 88 degrees 27.4 minutes north latitude and 159 degrees 15.4 minutes east longitude. The Healy charted a total of 9,187 kilometers (5,708 miles) by the end of the voyage. The trip ended when the cutter transited through the Bering Straits, into the Bering Sea and docked in Dutch Harbor, Alaska.

This was the second time the Maritime Safety Office sent a ShipRider as a guest of the U.S. Coast Guard; the first participant sailed in 2010. Resio participated as an integral part of the science team, standing a daily eight-hour watch in the science spaces. In addition to allowing hands-on data collection, the program also provided a great opportunity to coordinate with NGA mission partners.

"The ShipRider program provides our analysts an opportunity to see firsthand how data is collected for use in our Digital Nautical Charts," said Howard Cohen, Maritime Safety Office ShipRider program manager. "It combines serving as a maritime domain representative, gaining experience in workrole development, observing bridge operations and collaborating with a mission partner. The mission partner benefits directly also as our ShipRiders act as ambassadors for us to provide direct information for a better understanding of who we are, what we do and what we offer."

At the conclusion of this voyage, both the science team lead and the Healy captain expressed their appreciation and interest in continuing this partnership. ✨

The Coast Guard Cutter Healy is the United States' newest and most technologically advanced polar icebreaker.
U.S. Coast Guard photo

Aeronautical Analysts Support Operation Deep Freeze

Two aeronautical analysts with the National Geospatial-Intelligence Agency (NGA) Foundation Geospatial Intelligence Group helped produce and validate 56 instrument-approach procedures at 12 airports Oct. 14-24, allowing the U.S. military to safely resupply personnel and equipment in the region supporting the U.S. Antarctic Program.

Alison Devereux-Naumann and Amanda Yeager worked with Federal Aviation Administration (FAA) and terminal en route procedure specialists at McMurdo Station, Antarctica, in support of Operation Deep Freeze (ODF), resulting in an early completion for the 2011 FAA flight inspection.

ODF is a joint service, on-going Defense Support to Civilian Authorities activity supporting the National Science Foundation (NSF), the lead agency for the U.S.

Antarctic Program, said Lt. Col. Edward Vaughan on the Armed with Science website. Joint Task Force–Support Forces Antarctica (JTF-SFA) carries out the mission and coordinates with inter-agency and international partners to provide air and maritime cargo and passenger transport throughout the Antarctic Joint Operations Area.

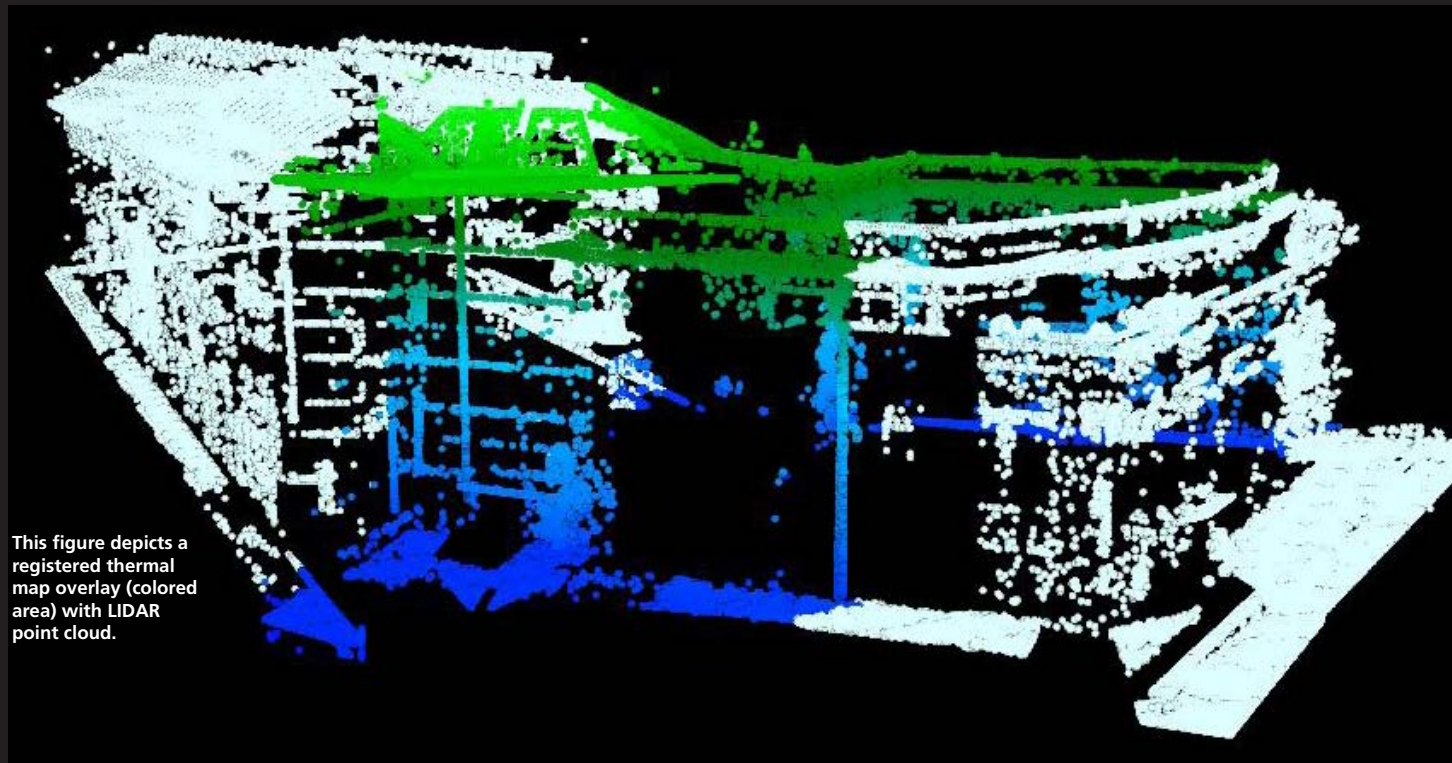
JTF-SFA forces consist of active duty, Guard and Reserve personnel from the U.S. Air Force, Navy, Army and Coast Guard as well as Department of Defense civilians and attached non-DOD civilians. ODF operates from two primary locations situated at Christchurch, New Zealand and McMurdo Station, Antarctica. Under the NSF's lead, ODF works closely with other national Antarctic programs, to include those of New Zealand, Australia and Italy. ✨



Personnel and supplies arrive on a U.S. Air Force C-17 Globemaster at the ice runway near McMurdo Station, Antarctica.
NGA photo by Amanda Yeager

InnoVision Develops 3-D Thermal Site Models

By Nathaniel Ovans, Project Scientist, InnoVision Directorate



This figure depicts a registered thermal map overlay (colored area) with LIDAR point cloud.

When National Geospatial-Intelligence Agency (NGA) director Letitia A. Long announced that she wanted to “fundamentally change the user’s experience by putting the power of GEOINT in the hands of the user,” the NGA senior scientist for photogrammetry went to work.

Todd Johanesen, a recipient of funding through the Director of National Intelligence (DNI) Tech Fellow program in 2010, developed a concept to build and evaluate new methods of fusing thermal infrared (IR) imagery—imagery that shows the heat objects emit—with other geospatial intelligence (GEOINT) data sources to provide improved GEOINT data. He developed a 3-D site model that he could register thermal data to using traditional photogrammetry, transforming different datasets into one coordinate system. The 3-D Thermal Site Model (3-D TSM) is a highly accurate 3-D model of a given facility or scene that integrates spatial, engineering schematic or blueprint and relative temperature information into a single, precise

GEOINT product. Photogrammetry is the science of obtaining information from images using measurements and interpretation.

The operational and intelligence uses for the 3-D TSM are boundless. Accurately combining the different sources of information could help analysts perform infrastructure analysis for critical nodes, aid in planning and rehearsing missions, or even support personnel recovery, said Johanesen.

“One example is the ability to rapidly and accurately pinpoint a sniper while pinned in the sniper’s line of fire,” said Johanesen. “In this scenario, troops employ a simple thermal imager, pinpoint the sniper’s thermal signature, register that to a reference light detection and ranging (LIDAR) point cloud and deliver an accurate description of the sniper’s 3-D geolocation.”

LIDAR is one of the many different phenomenologies that NGA uses to create 3-D ground terrain maps. NGA’s Photogrammetry

and Image Science Division (IBP) led research into the acquisition, fusion and visualization of data to support 3-D TSM generation. The TSMs combine known information from a photogrammetric site model with thermal data captured from hand-held, airborne and/or spaceborne perspectives. The key is establishing metadata elements of all sources, to include the thermal imaging system, to integrate additional data points such as temperature.

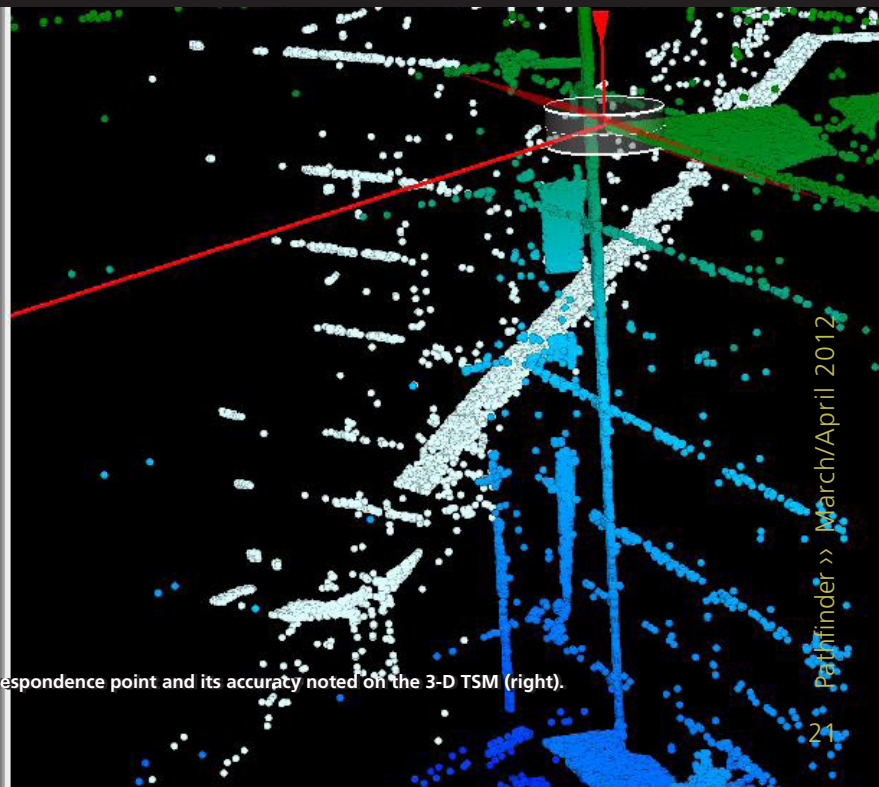
To investigate the potential, IBP acquired a highly accurate (photogrammetric) commercial-off-the-shelf hand-held long wave IR camera and developed a sensor model for it. This sensor model supports current research on fusion of thermal data from this camera with LIDAR point cloud data. Scientists manually register datasets today, but IBP is researching automated methods of registering the datasets to support a more timely and automatic capability. This combination yields thermal data with predictive estimates of the data's absolute accuracy relative to actual position on the Earth and facilitates more accurate fusion with other data sources.

IBP scientists tested the data in the field, using an IR camera, an optical camera and a terrestrial (land) LIDAR system to image buildings of different materials and shapes along with scenery. "The camera was easy to use compared to other similar sensors and is portable, it has UAV (unmanned aerial vehicle) application,

and the application of using the camera in an unattended mode looked promising," said Robert Lund, former Southern Command NGA Support Team deputy director.

Using the collected data, IBP was able to register a building's LIDAR point cloud with its thermal profile creating a 3-D TSM. IBP was also able to characterize an efficient collection system for gathering thermal data and incorporating it into a 3-D TSM as well as create a prototype software tool for 3-D TSM creation and accuracy assessment. The prototype allowed IBP to make an initial assessment on the value of 3-D TSMs, which became apparent when the model highlighted and georeferenced unseen building attributes.

IBP continues to explore the potential use of IR applications and the desirable attributes of the 3-D TSMs used for reference data. The current focus is to broaden community awareness, increase collaboration and conduct additional research. A key goal is to calibrate current operational IR sensors and develop sensor models so that scientists might use operational IR data to generate 3-D Thermal Point Clouds to support time-phased analysis like change detection. Additionally the team will continue to explore the structure and content of photogrammetry-based 3-D TSMs to increase the value of the GEOINT reference products used to fuel thermal fusion. ✨



This figure depicts a point on a thermal image (left) with its correspondence point and its accuracy noted on the 3-D TSM (right).

Geospatial Support in Vietnam

By Allen Anderson, National Geospatial-Intelligence Alumni Association

The opinions expressed in this article are the author's and do not necessarily reflect the views of the National Geospatial-Intelligence Agency (NGA) or the U.S. Department of Defense.

The French, who were ousted from their French Indochina colonies (Vietnam, Cambodia, Laos) by the Japanese early in World War II, met with resistance when they tried to reclaim them after that war. By 1954 the French forces found themselves encircled by Ho Chi Minh's army at Dien Bien Phu, a remote valley of northwestern Vietnam. The Vietnamese managed not only to surround the French without their knowledge but also to bring up artillery through the jungles and onto the heights overlooking the French encampment. This was the final turning point in their colonial war, and the French were soon forced to surrender. Meantime, U.S. military authorities decided to prepare a contingency plan, in the event that President Dwight D. Eisenhower chose to send in a relief force.

Following termination of the U.S. occupation of Japan, the U.S. Army Pacific had retained a G2 geographic analysis unit and Army Map Service (AMS), Far East (AMSFE) on the outskirts of Tokyo. AMSFE, in addition to its mapping and surveying roles had a terrain analysis unit. These units were tasked to rapidly produce analyses of routes that a relieving force could use, entering either through the Saigon or Hanoi area. Eisenhower decided against any intervention, but this was the first U.S. geospatial intelligence activity in Vietnam.

After the French departed in the mid-1950s, AMS Washington and AMSFE extended their mapping and geodesy program to include South Vietnam, Cambodia and Laos. Cooperative agreements were negotiated with the three countries that called for the United States to fly precision mapping photography, conduct geodetic and field

classification (ground truth) surveys and produce bilingual maps at standard map scales. AMS contracted the mapping photography to a U.S. company, while AMSFE assumed responsibility for survey operations and overall coordination with the local mapping authorities. Relying mainly on Filipino surveying companies, trained years earlier during U.S. postwar mapping of the Philippines, survey parties were first sent into South Vietnam where they proceeded to survey the entire country under AMSFE on-site supervision. Concurrently, Americans provided training to the Vietnamese Service Geographique. AMS and AMSFE began production of 1:50,000 scale maps in 1960. Large-scale mapping of North Vietnam, necessarily less accurate in the absence of field access, employed older aerial photos flown by the French. The mapping of South Vietnam was largely completed by the time that U.S. combat forces were introduced in March 1965. For the first time Army mappers could provide accurate, ground-truthed large-scale topographic maps at the outset of a U.S. conflict.

Cambodia field operations, begun shortly after the Vietnam operations began, were completed well before the Khmer Rouge coup in 1975, so AMS/AMSFE could produce good quality maps over that country. However, the Laos operations, the last to commence, were soon disrupted by the political turmoil. When a coup unseated the Lao government in 1960, the U.S. embassy directed AMSFE and its contractors to evacuate. Lacking adequate survey data, the resultant topographic maps were not of comparable accuracy, but a vast improvement over the sketchy smaller-scale French maps they replaced.

As the Vietnam War got under way, the forces soon found that conventional line maps did not provide sufficient detail in the largely undeveloped and jungle-covered interior. AMS quickly responded by developing a new product, the pictomap, a photomap at 1:50,000 scale produced with an edge-enhancing camera technique that facilitated map-reading and navigation. The 29th Engineer Topographic Battalion in Hawaii also produced 1:100,000 scale line maps and AMS furnished reproduction material, the color-separated map and chart negative films from which they made press plates



This aerial photo shows Bien Hoa Air Base in 1964. NGA Historical Research Center image

for rapid updating and tailoring of maps by the in-country Army topographic unit. In the late 1960s, AMS and the Aeronautical Charting and Information Center (ACIC) responded to a need for more precise positioning of aerially sown sensors and other devices that would monitor and attack enemy movements into South Vietnam—the so-called McNamara Line. They developed a technique using photogrammetry to better calibrate LORAN D (a short-range, high-accuracy, low-power, tactical system designed for use as a bombing aid) over land areas. The technique enabled monitoring and periodic reseeded of the devices.

The Vietnam conflict also gave rise to new target positioning techniques developed by ACIC. The warfighters needed highly accurate latitude/longitude/elevation positions for targets, navigation and other purposes, often in jungle areas that were largely featureless on the maps. ACIC had the technology: precision optical measuring instruments and highly classified satellite imagery in a computer-intensive process. The problem was how could the warfighter describe the desired position and get rapid turnaround from St. Louis, since neither the imagery nor the technology could be deployed.

ACIC developed several innovative techniques. The first was to deploy minimally classified U2 and SR-71 imagery, optical measuring devices and civilian technicians to operate and train military personnel. This was fairly successful. Another involved satellite transmission of annotated imagery from in theater to the

United States, with transmission back of ACIC solutions. This was too slow to be useful. The real answer came with a rather simple technique. Deployable imagery with an arbitrary grid was sent out to the theater along with ACIC teams, and a duplicate set of the gridded imagery was maintained at ACIC. The user could determine the coordinates of the desired position and transmit them to St. Louis. ACIC exploited satellite imagery, precision optical equipment and computer power to rapidly send an accurate position back to the user. As a footnote, the large computers of the time had about one-tenth of the power of today’s personal computer.

The geospatial support was massive and utilized both the conventional technology of the time and rapid target-positioning innovations that were further developed and deployed in later years to support U.S. forces. ✨

NOTE: Allen Anderson served in various capacities with the Defense Mapping Agency and its predecessor organizations. His final position was deputy director for programs, production and operations. This article is based upon his and others’ personal experiences in supporting the Vietnam War effort. He is a member of the National Geospatial-Intelligence Alumni Association.

The Pathfinder makes space available for NGA alumni groups to provide content that may be of interest to the current NGA workforce. NGA does not endorse any particular alumni group or any other outside organization.



The graphic depicts Halong Bay. ThinkStock image

Remembering Vietnam 6: The Defense Mapping Agency, 1972

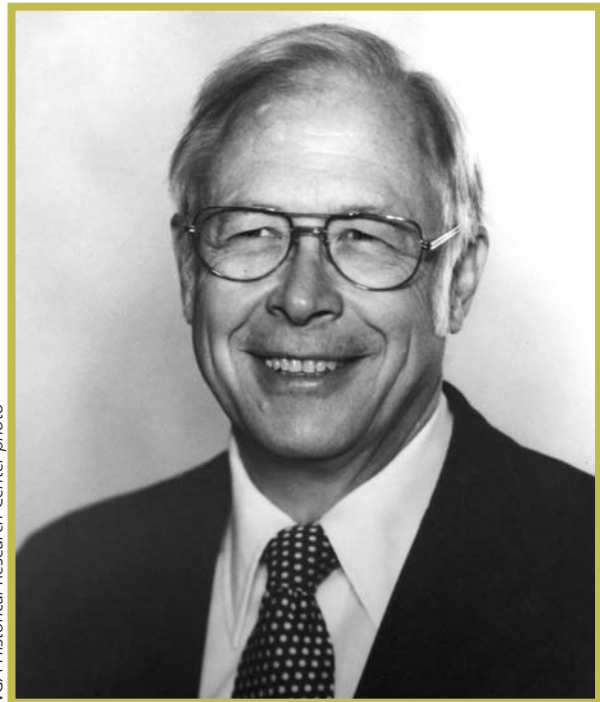
By Dr. Gary E. Weir, Chief Historian, Office of Corporate Communications

On the 50th anniversary of the first direct American military involvement in Vietnam, the Department of Defense (DOD) has called upon our country to remember with respect and gratitude those who served in Southeast Asia. This concludes a series of six articles designed to illuminate the significant role played in Southeast Asia by people in the communities of practice that now comprise the National Geospatial-Intelligence Agency (NGA).

In the spring of 1971, during the American involvement in the Vietnam War, President Richard M. Nixon signed a directive reorganizing the Intelligence Community and recasting its relationship to DOD. Very few people realized that at the same time, the president approved a consolidation of the mapping, charting and geodesy functions (MC&G) within DOD.

As far back as the late 1960s the Office of Management and Budget (OMB) toyed with the idea of transferring these vital functions from the military services to a single, dedicated agency. As a driving force behind the possibility of consolidation, Wilkie Donaldson of OMB wanted to take a closer look at the idea and the added benefits it might provide. As one veteran of the time described Donaldson's viewpoint, "He was thoroughly convinced that there was a waste of assets in MC&G. There was duplication, and the MC&G community of the three services was really not delivering what the services needed. He felt that, if the assets were brought together, it would be a far more efficient and effective organization." Donaldson sought to enhance already excellent products and services by further concentrating resources.

The deputy secretary of defense signed a memorandum on Dec. 27, 1968, that instructed the Defense Intelligence Agency (DIA) to examine the nature and variety of MC&G functions in DOD; the agency eventually decided to propose a consolidation plan for general consideration. One senior official at the Defense Intelligence Agency who worked with Wilkie Donaldson through the Bureau of the Budget and found himself constantly justifying his

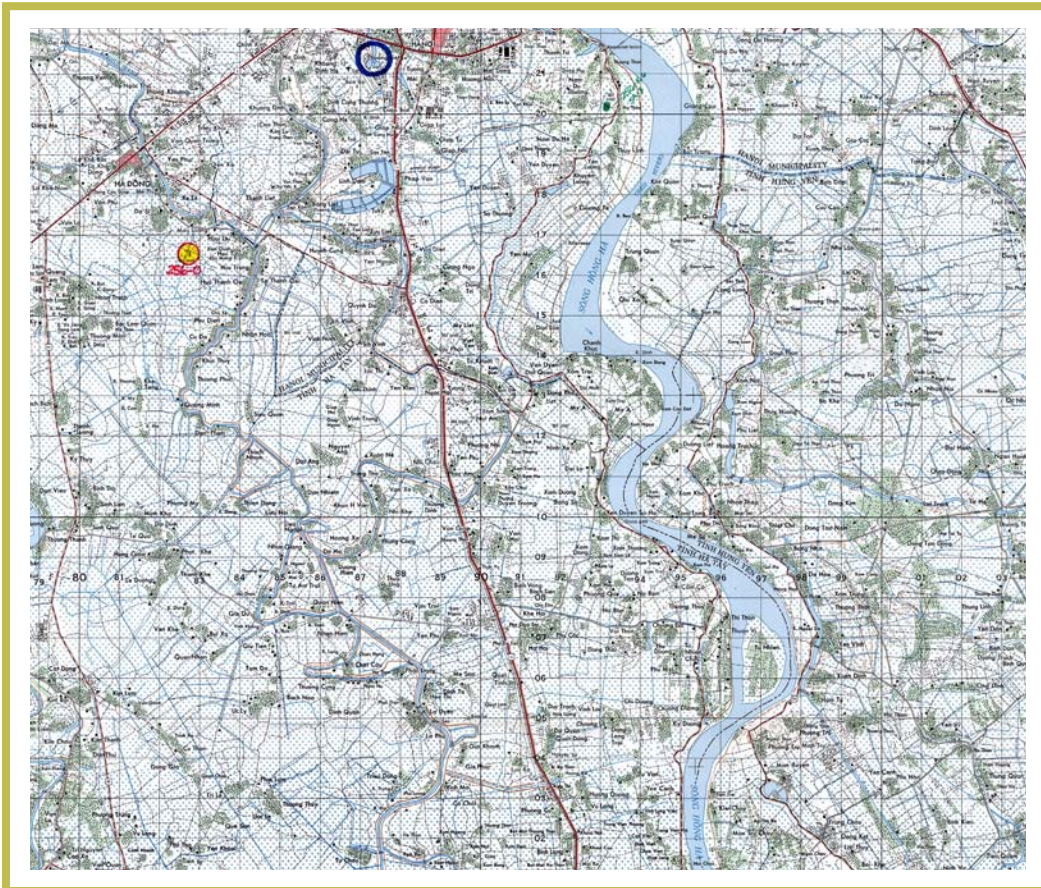


NGA Historical Research Center photo

Dewey Pegler

own resource requirements now received an unexpected call. At DIA's behest Dewey Pegler composed a team to conduct an independent study examining the proposed consolidation.

Completed in 1971, the study strongly recommended unification, concluding "that significant benefits, particularly unanimity of purpose, would accrue to DOD if MC&G were consolidated into a single agency, and recommended that a separate MC&G agency be established." The period of coordination with the services and agencies involved brought almost immediate and unanimous resistance to the recommendations, each entity desiring to control these precision products, always so essential to the mission at hand. With this nearly universal negative reception, the director of DIA, Army Lt. Gen. Donald Bennett, sent the report forward to the deputy secretary of defense without his support, according to DMA consultant Robert H. Kingsley in a 1979 history of DOD MC&G. Donaldson became Pegler's only regular attentive audience and the two discussed in detail the report's findings and recommendations, as well as possible consequences and economies.



NGA Historical Research Center image

Both sides of the debate drew many of their talking points from experiences in Vietnam. One veteran of these discussions recalled that Pegler's report "presented both economic arguments for consolidation and presented case studies (from Vietnam) where the ground forces were not on the same reference system—and there were cases where our airplanes hit our own troops because the geodetic positions were on different coordinates. There were cases that came forward very clearly that you needed to pull the MC&G activities of DOD together. When the Army, Navy and Air Force were all arguing for more money to carry out their mission and targeting, the belief was that, if you took the money that was being spent collectively and put it into one organization, you could get a lot more MC&G data by avoiding duplication. ... That was all part of the argument that led to DMA." Thus the Vietnam experience strongly suggested consolidating the considerable talent of the MC&G community to enhance valued capability even further.

Given the report's reception and fully expecting his effort to land inconsequentially on the shelf, Pegler went off to a training class. During his first day of instruction he received a telephone call from Donaldson at about 11 a.m. informing him that text OMB prepared and placed into the presidential directive before signing had authorized the creation of a defense mapping agency. Pegler's report would profoundly inform a new, dedicated federal agency for MC&G.

The president's action caught by surprise many who expected to retain the status quo. It also severed some relationships between individuals on opposite sides of the debate. However, the effective agency that emerged after 1972 from the implementation effort became a pillar of the defense establishment and one of NGA's most important predecessor agencies.

Beginning in late March the NGA museum in St. Louis will host an exhibit commemorating NGA's roots and celebrating the 40th anniversary of the Defense Mapping Agency's creation. NGA shall explore its roots, its legacy to NGA and its significance both to the national defense and the Intelligence Community. ✨

NGA IN THE NEWS

NGA Employees Host Science Demonstration for Springfield Area Students

Story and Photo by Laura L. Lundin, Office of Corporate Communications

Researchers with the National Geospatial-Intelligence Agency's (NGA) InnoVision Directorate spoke to more than 200 West Springfield High School (WSHS), Springfield, Va., students about Light Detection and Ranging, or LIDAR, during a science and technology presentation Dec. 19 as part of the agency's Partners in Education (PIE) program.

The presentation, which was the first event under NGA's new PIE partnership with WSHS, highlighted the basic scientific principles of LIDAR while showing its real-world applications in areas such as geospatial intelligence, or GEOINT, environmental management, mapping, geology and even archaeology.

"[The students] were amazed and surprised, as many of them never even knew this type of technology existed," said Benjamin Matthews, WSHS Advanced Placement Environmental Science teacher. "And many students thought it was interesting to see how LIDAR supports both military and environmental programs."

LIDAR, a technology that uses light to measure and create 3-D images of objects, their locations or even speeds, is frequently used by NGA to provide detailed geospatial information about what is happening around the world.

U.S. Air Force Capt. Michael "Andy" Lundin, with NGA's InnoVision Directorate, speaks with students at West Springfield High School, Springfield, Va., about Light Detection and Ranging, or LIDAR, during a science and technology presentation Dec. 19.



Employees Focus on Value of Mentoring

By Kathi Ghannam, Contractor, Office of Corporate Communications

More than 100 employees learned about the National Geospatial-Intelligence Agency's mentoring programs at the Human Development Career Development mentoring fairs at NGA Campuses East (Springfield, Va.) and West (St. Louis) Jan. 12, held in conjunction with National Mentoring Month.

"Of all the relationships possible during one's lifetime, mentoring relationships are some of the most informative and have the capacity to change careers and even lives," said Judy Wolf, Mentoring Program manager, who helped coordinate the events.

Informal mentoring has long played a large role at NGA and its predecessor organizations as a means of career development, but its formal programs have not been well known, said Wolf. Events like these are invaluable, energizing networking opportunities where people from every key component can come together and make connections, making it easier to participate in and make effective use of the program.

Participating protégés had the opportunity to engage experienced mentors and gain perspective about the value of the mentoring experience, while mentors had the opportunity to learn more about what the workforce wants from a mentoring relationship, said Wolf.

The voluntary program is open to all government civilians and military members, said Wolf. It is designed to be a flexible, convenient way to facilitate career and professional growth of the workforce while supporting the mission of the agency.

Partners in Education Host Annual Student Party

By Sam Wilson, Office of Corporate Communications

Volunteers from the National Geospatial-Intelligence Agency (NGA) Partners in Education program held their annual party Dec. 21 for students at Hodgen Elementary School in St. Louis, where NGA West employees have been volunteering for more than 20 years.

Twenty-three third-grade students made personalized ornaments, with the assistance of NGA volunteers, and enjoyed food, drinks and presents donated by NGA employees.

The students are enrolled in Hodgen's Excellent Academic Reading Tutors (HEARTs) program, a community volunteer tutoring initiative. NGA has nine volunteers who tutor at the school.

"I really enjoy being part of the program," said Steve Maneikis, an NGA HEARTs volunteer who helped at the party. "It's always fun working with the kids."

Partners in Education encourages NGA employees to volunteer with local schools in the community. Volunteers meet with their student for one hour every other week to help them develop their reading and comprehension skills.



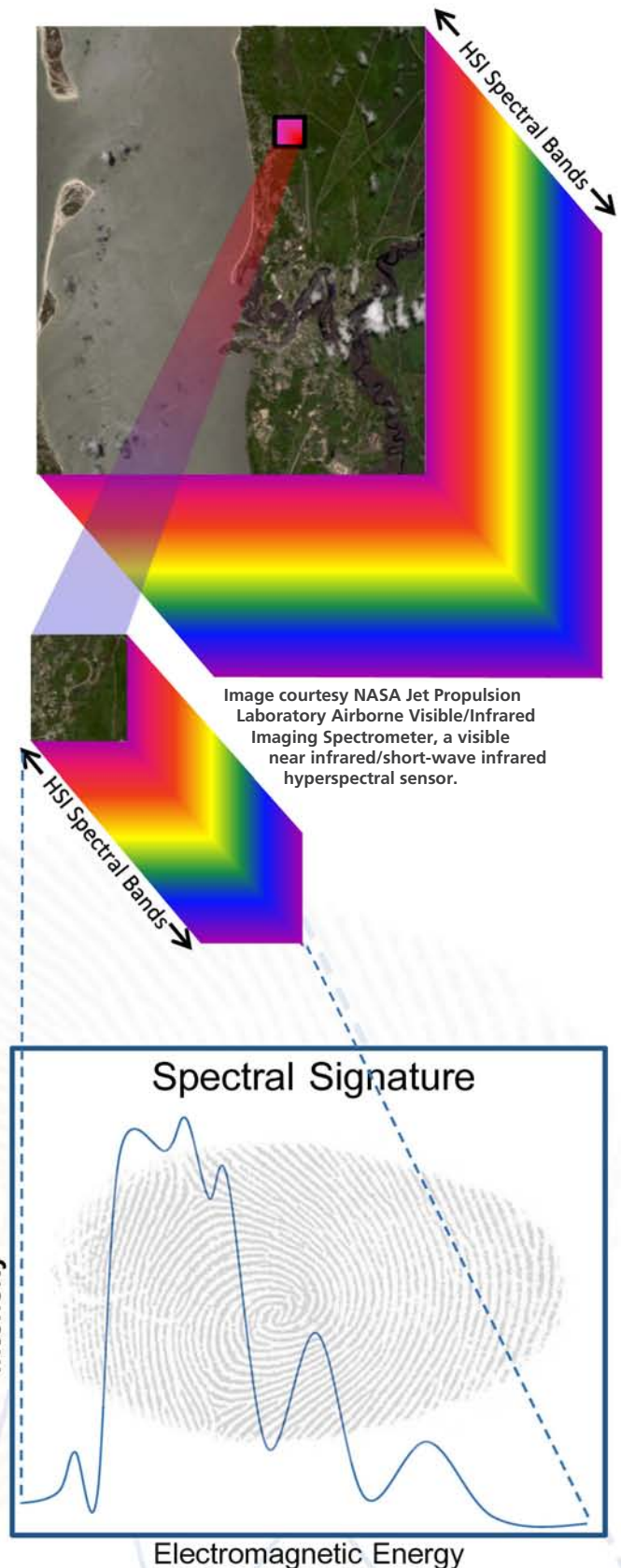
Third-grade students show their ornaments during the HEARTs holiday party. NGA photo by Julia Collins

HYPERSPPECTRAL IMAGING

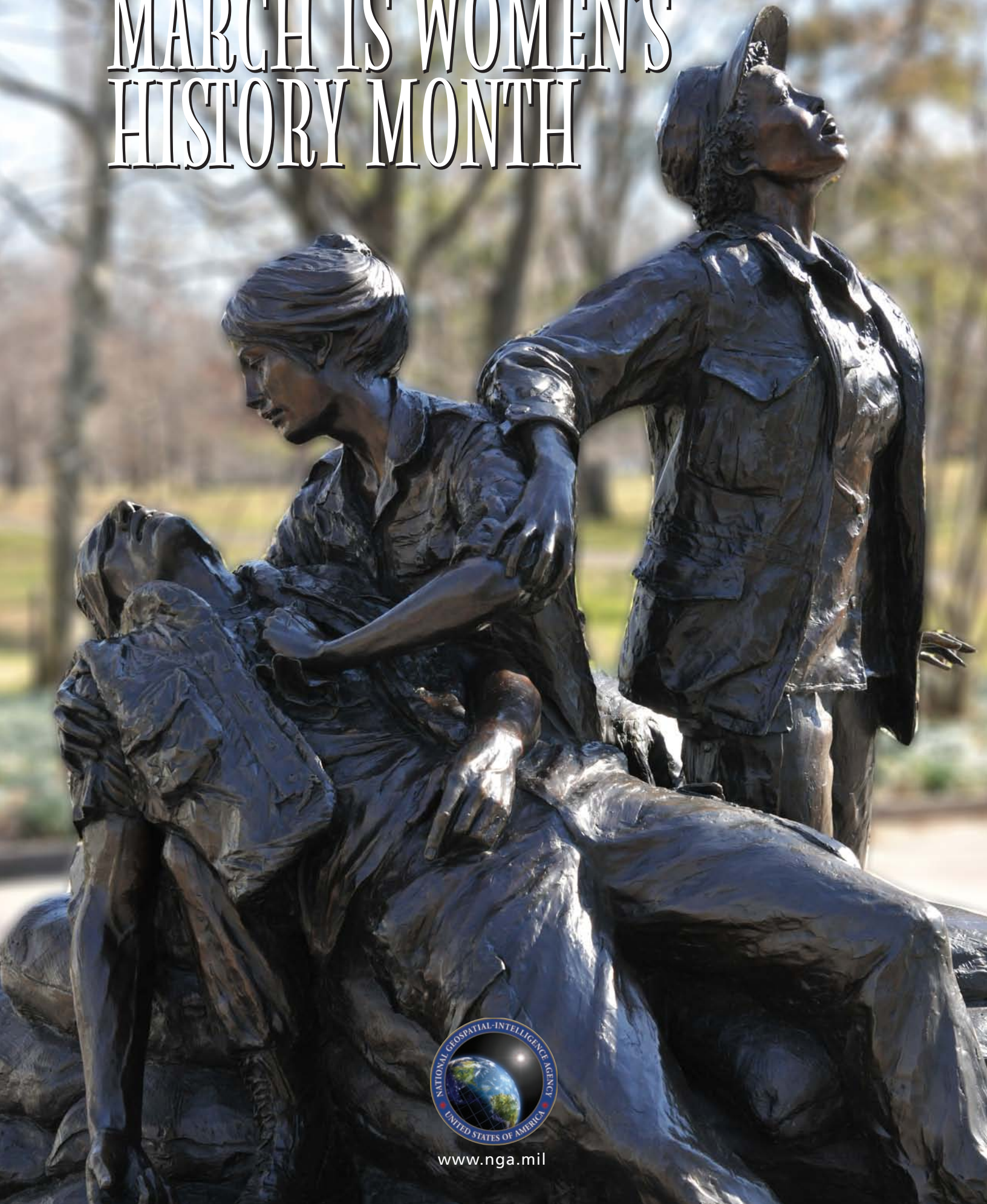
What is... HSI

No two materials are identical. Materials, much like fingerprints, have their own unique characteristics. One important and unique characteristic is the way in which a material interacts with different types of electromagnetic energy, such as light and heat. Measuring this interaction yields information that analysts can use to identify the material.

Hyperspectral imaging (HSI) technology provides a way to measure the interaction between a material and hundreds of different types of electromagnetic energy. NGA graphically represents these measurements as a unique spectral signature or fingerprint. Analysts use these signatures to detect and identify materials. HSI is a powerful tool that can aid in distinguishing between materials that may look the same to the human eye, but have different spectral attributes that cause them to interact differently with energy. Whether conducting mineral identifications, monitoring crop health or identifying unknown surface materials, HSI technology is an innovative way NGA uses the power of geospatial intelligence to find solutions to intelligence problems.



MARCH IS WOMEN'S HISTORY MONTH



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