National Geospatial-Intelligence Agency Magazine

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PATHFINDER

On My Mind:

Partnerships Prepare NGA for Future National Security Challenges

The global security environment continues to evolve at an unprecedented rate. In the wake of the death of Osama bin Laden, the Arab Spring and the Obama administration's call for more robust engagement in the Asia-Pacific region, the National Geospatial-Intelligence Agency must prepare for newly emerging national security challenges, and we must do so in an era of fiscal austerity. Partnerships are key to NGA's ability to maintain the capability and the agility required to support our multiple mission demands.

Partnerships help us advance NGA's vision of "putting the power of GEOINT in your hands" by making geospatial data more easily discoverable and usable through online, on-demand access. Our work with industry to digitally display aeronautical information on the flight deck of an aircraft is just one example of how our partnerships help make that happen. Over the long term, partnerships will allow NGA to continue to explore the benefits of crowd-sourced information and forge new ways of using open-source geospatial data, like providing support to the volunteer technical community as it responds to natural disasters like the earthquake in Haiti.

Partnerships help NGA take full advantage of emerging science and technology, and enhance our ability to discover, leverage, adapt and adopt GEOINT-related research and development across the enterprise. Benefits that flow from NGA's partnership arrangements range from advances in basic research to the transfer of novel and near-to-market capabilities that allow NGA to maintain a strategic advantage over the nation's adversaries.

We build partnerships through several pathways, including welcoming innovation from small businesses through the Mentor-Protégé Program, encouraging out-of-the-box thinking through the Industry Interaction Program and harnessing scientific discovery to hard problems in GEOINT. These programs share a common characteristic: resources — including expertise, data, technology and people — flow both ways.

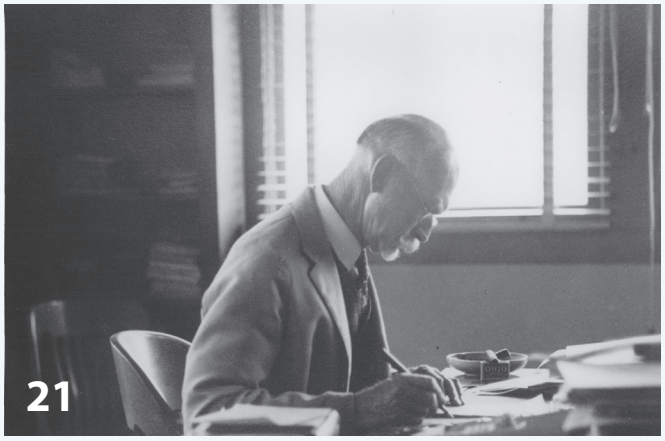
As we progress toward our goal of broadening and deepening analytic expertise to produce new value, partnerships increase professional development opportunities on all sides, promoting the sharing of knowledge and best practices in analytic tradecraft and bringing fresh perspectives to analysts' education and training.

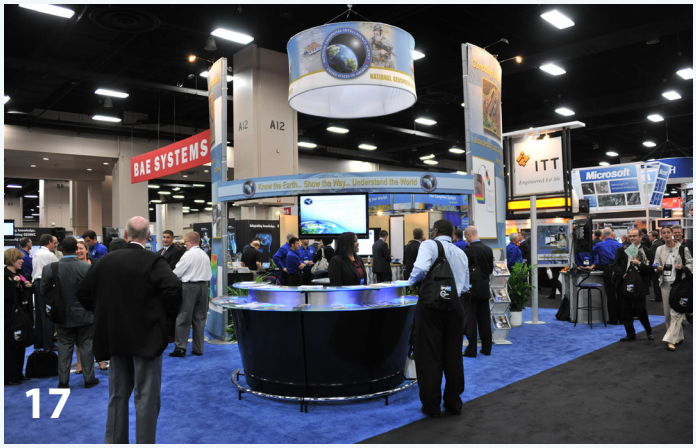
Looking to the future, NGA is supporting public-private initiatives that equip and encourage the younger generation to pursue geoscience and related careers in the U.S. government where they can bring their skills and talent to the mission of supporting this nation's security interests.

The benefits of our partnerships are wide ranging, and there is a reason for this. When NGA enters a partnership, our decision is guided by our long-term goals and objectives as presented in the NGA 2013-17 Strategy (see related article on page 4). Through strategic partnerships, we demonstrate that our twin commitments to effective resource management and to mission performance are mutually reinforcing and together help us put the power of GEOINT into the hands of our users as they work to save lives and support our national security.

Letitia A. Long

Letitia A. Long
Director





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On the Cover: Partnerships help NGA advance its vision of "putting the power of GEOINT in your hands." Cover design by Maurice Smith.

NGA Director Unveils 2013–17 Strategy

By Jay M. Belles and Corry M. Robb, Office of Geospatial Intelligence Management

National Geospatial-Intelligence Agency Director Letitia A. Long unveiled the agency's overarching strategy for 2013-2017 May 14, providing direction and guidance aimed at increasing efficiency, value and integration of the geospatial intelligence discipline during the next five years.

Aligning with the strategic priorities outlined in the U.S. National Intelligence Strategy, the U.S. Defense Intelligence Strategy and the U.S. Secretary of Defense strategic guidance titled "Sustaining U.S. Global Leadership: Priorities for the 21st Century Defense," the NGA strategy will help propel GEOINT forward as a key enabler of U.S. national security interests, actions and decisions around the globe.

"The NGA strategy establishes the strategic goals and objectives that will guide our efforts to fulfill NGA's mission and vision," Long stated in the opening letter of the strategy. "In doing so, [we] ensure that NGA continues to lead the community in providing relevant, timely and accurate geospatial intelligence in support of national security."

The strategy helps respond to today's global landscape and fiscal environment by demanding better governance and deliberate planning to maintain critical GEOINT community capabilities while preserving resources for future mission development.

To achieve this success, efficiency and integrated intelligence through the leveraging of collective resources is crucial to meeting mission demands.

"Working together, in the context of a shared GEOINT vision, is the only means through which we fulfill our mission," said Long.

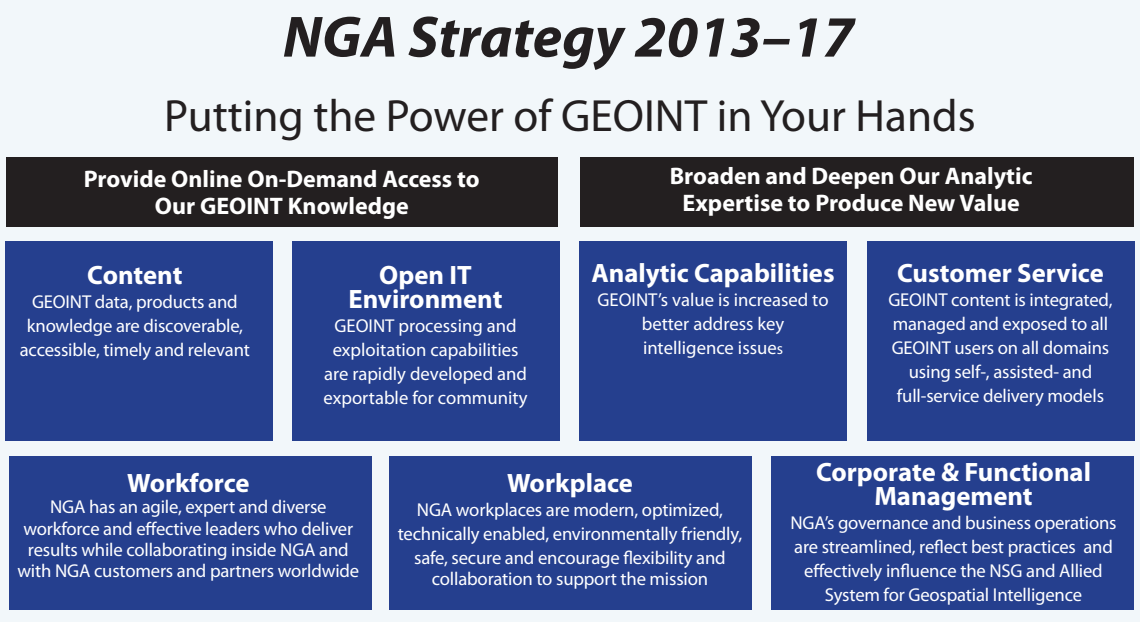
The strategy allows the agency agility in its response to the ever-changing challenges the GEOINT community faces while focusing on the Director of National Intelligence and Undersecretary of Defense for Intelligence priorities of counterterrorism, counter-proliferation, cyber, anti-access/anti-denial and global coverage.

The strategy further implements the NGA vision Long first outlined in October 2010 by, incorporating the goals of providing online, on-demand access to GEOINT knowledge, and broadening and deepening analytic expertise to produce new value to anticipate and respond to key intelligence questions of the future.

Seven strategic objectives will guide NGA in achieving its goals. They are content, customer service, open information technology environment, analytic capabilities, workforce, workplace and corporate and functional management. These objectives are interconnected and interdependent as each enhances the effort to achieve a common result.

"The strategy reinforces our belief in the strengths that each employee brings to NGA, and in the critical role of partnership and collaboration both inside and outside the agency," said Long.

These goals and objectives will help empower the NGA workforce to better deliver the next generation of GEOINT ensuring the discipline is a key contributor to U.S. integrated intelligence operations in support of multiple mission areas, including military and intelligence operations, intelligence analysis, homeland defense and humanitarian and disaster relief.



CRADAs Enhance NGA's Aeronautical Data Distribution

By Jan Lewis, InnoVision Industry Outreach Office

NGA photo by Marcella Taylor

A Borsight Electronic Flight Bag product displays on a hand-held device.

The National Geospatial-Intelligence Agency's InnoVision Cooperative Research and Development Agreements team, in partnership with the Source Operations and Management Directorate's Aeronautical Navigation Office (SF), recently activated five CRADA projects. Collectively called, "NGA Digital Aeronautical Data in the Flight Deck Environment," the CRADAs have the overall objective of satisfying the NGA need for digitally displaying aeronautical flight information publications (terminal procedures, charts, supplements etc.) on the flight deck.

"The CRADA partnerships will allow SF to focus on our mission of producing the best possible aeronautical products, while allowing commercial industry to do what they do best, develop software and hardware solutions," said Bruce Farnham, principal investigator for the CRADA efforts. "Having multiple CRADAs provides consumers of our products multiple choices for displaying critical flight data in the flight deck environments."

Aeronautical analysts and subject matter experts from five industry partners will work independently with NGA for the next five years. The NGA CRADA partners are: JOBEAN, Global NavSource, Borsight, ForeFlight and Hilton Software.

"These interactive partnerships could reduce NGA's annual hardcopy print budget by enabling our customers to utilize digital versions of our products, saving on significant printing and distribution costs," said Rodney Mosquito, InnoVision's CRADA lead for aeronautical CRADAs.

CRADAs are increasingly important since they require no funding from NGA, benefiting CRADA partners and NGA by sharing both expertise and non-monetary resources.

NGA Alumni Association Celebrates 1st Anniversary

The Association of Aerospace Charting Seniors, located in the West, and the National Geospatial Intelligence Alumni Association located in the East, merged last July to form the National Geospatial-Intelligence Alumni Association.

Merged at the suggestion of National Geospatial-Intelligence Agency Director Letitia A. Long, the combined association officially began functioning in January and has about 500 members in its two chapters, East and West.

A board of directors consisting of two members from each chapter governs the group. Initial East directors are Al Anderson (chair) and John Mendez, while West directors are Jim Boyd and Bob Edwards. Under the NGAA constitution, the chapters continue to operate much as they have, with the board providing a focal point for communications with and support of NGA and other organizations.

The chapters, formed in the 1970s, bring together former and current members and associates of NGA and its predecessor organizations for both social and NGA support functions. Members have provided interviews as part of the NGA Oral History Program, nominated deserving alumni to the NGA Hall of Fame and honored active employees for their significant contributions to the NGA mission and the honoree's community.

An NGAA-East member also has participated as part of NGA's Family Resource Group.

NGAA welcomes all current and former members of NGA and its predecessor agencies. More information on the association and its activities, with links to the chapters, is at www.ngaalumni.org. Current and former NGA employees may also join the Association of Mapping Seniors; their website is at www.mappers.org.

Lab Fosters Future GEOINT Experts

By Marianne V. Kramer, Geospatial Intelligence Advancement Testbed chief of staff, and John Prikkel, Dayton Geospatial Intelligence Advancement Testbed site lead, InnoVision Directorate

To work in the geospatial intelligence field in 2015, what subjects do you study in school? What kind of experience and background do you need to snag a great job? What advice do you give your son or daughter on where to focus his or her time and energy?

"The largest generation of young people since the '60s is beginning to come of age and enter the workforce," said Dr. Ann Carbonell, director of InnoVision's Information Integration Office. "These 'echo boomers' are the offspring and demographic echo of their parents, the baby boomers. They have grown up wired and connected both in their homes and schools. For NGA, tapping into this tech-savvy segment of the population is critical as the agency embraces technologies such as mobile app (application) development, cloud computing architecture, virtual reality, social media and 3-D visualization."

One hands-on opportunity in future technologies for these echo boomer students is located in Dayton, Ohio, at the Air Force Research Lab's Innovation and Collaboration Center Tec^Edge Discovery Lab.

Tec^Edge is a collaboration of the Air Force Research Laboratory and the not-for-profit Wright Brothers Institute. Research Director Dr. Rob Williams helped to build Tec^Edge and its research component, Discovery Lab, into an innovation center designed to offer students a technology experience and encourage them to become future technology leaders. The students range from high school juniors through doctoral candidates, but the focus is on younger students to whom technology is already an integral part of who they are and how they think. Students are competitively selected each spring and attend virtual orientation meetings with Williams so they are able to hit the ground running in June. In 2012 Williams' Tec^Edge will support about 100 students.

NGA photo by Marianne V. Kramer

Students in the 20012 Tec^Edge Discovery Lab program disassembled Innovation First Labs, Inc. HEXBUG®, motorized insects. Here student Megan Kramer welds rotors onto her HEXBUG to make it fly.

"[At the lab], students gain experience tackling challenging problems in areas such as robotics, virtual worlds, biomedical devices, nano-materials, smartphone applications and information visualization among others," said Williams.

"Students are typically organized into mentored student teams that tackle real-world research projects," said John Prikkel, NGA's Dayton Geospatial Intelligence Advancement Testbed (GIAT) site lead. "Mentors meet with students for perhaps four hours per week early in the program. This is reduced to about two hours a week during the summer, picking up again toward the end of the summer when final presentations are due. The summer program lasts 10 weeks and the student teams must provide two prototype projects by the end of the summer. From these students, Williams selects the most promising for year–round opportunities, thus maintaining a constant student presence at Tec^Edge."

While the Air Force covers funding for both the summer and year-round programs, Williams actively seeks additional mentors to work with students for both, he said. For example, the GIAT placed one contractor at Tec^Edge, fundamentally extending the Dayton GIAT into the TEC^Edge, working on mobile app development and supporting NGA's Readiness, Response and Recovery Integrated Work Group (IWG-R3) Strategic Initiative.

Working with two Wright State University students, Michael Duncan and James West, GIAT contractor Shane

NGA photo by Marianne V. Kramer

Michael Duncan, a student and team lead in the Tec^Edge Discovery Lab, interacts with a humanoid Aldebaran Robotics NAO robot. The students developed mobile device software to control the robot. Potential uses might be field reconnaissance or roadside bomb detection.

King leveraged students to help solve a map tiling issue for mobile devices that first responders can use to support disaster response apps in areas where connectivity is limited, said King. He briefed the capability at the second InnoVision Mobile Apps Summit in February and received significant interest and stimulated follow-up.

The TEC^Edge students improve their technical skills and their ability to work against real-world deadlines and responsibilities and work with mentors in the government for whom they may eventually end up working, said Williams. This experience is invaluable for both the students and NGA.

InnoVision may place a second contractor at Tec^Edge Discovery Lab, said Williams. He met recently with Ben Tuttle, the GIAT Mobile Apps Team lead, to discuss furthering the partnership and increasing mentoring activities. With the large number of unclassified mobile app requests already needed for the IWG-R3, Tec^Edge and the NGA partnership provide opportunities and experiences for students that could benefit the government in the near term and into the future.

Tec^Edge Discovery Lab started with a handful of students several years ago and has grown to 100 this summer. Williams would like to network his local discovery lab with other labs and virtually engage 1,000 students, he said. An expanded arrangement such as with NGA would let involvement and mentoring like this multiply in other geographic locations. Organizations interested in working with the lab should contact Williams at robert.williams@wpafb.af.mil. More information is available at the following link: http://wbi-icc.com/centers-services/discovery-lab.

Photo courtesy of the Air Force Research Laboratory and Wright Brothers Institute

The Summer at the Edge scholar intern program hosted its 3rd annual Open House in August. The event was the culmination of 10 weeks of intense research and exploration conducted by over 80 students. Teams comprised of high school to doctoral students presented over 20 posters outlining their work in areas including robotics, virtual world exploration and smartphone programming/exploitation.

Mentor-Protégé Program Builds Partnerships

By Margo Gasquet, Staff Officer, Small Business Programs Office

"The National Geospatial-Intelligence Agency awarded a record 18 mentor-protégé agreements in 2011, a testament to building partnerships and the unprecedented growth and success of the program since NGA began participating," said Small Business Programs Office (SBPO) Director Sandra Broadnax.

The Department of Defense established the Mentor-Protégé Program in 1990 to provide major DOD prime contractors incentives to those serving as mentors and developing technical and business capabilities in small, disadvantaged, women-owned, service-disabled, veteran-owned, and historically underutilized business zone small businesses, their protégés. The protégé's incentive is increased participation as subcontractors and suppliers under DOD contracts as well as long-term business relationships with major DOD contractors.

NGA seeks innovative and unique mentor-protégé agreements that focus on industry support of GEOINT, visualization, tasking, processing, exploitation and dissemination, persistent surveillance, timeline compression, horizontal integration, forward deployment, multi-intelligence and all forms of imagery in the electromagnetic spectrum.

The award process begins with a request for proposal for a stand-alone indefinite delivery indefinite quantity contract, which provides an indefinite amount, within stated limits, of supplies or services during a fixed period. Those interested describe their mentor-protégé approach in an executive summary and submit an overview of their proposed activities, cost estimates and anticipated benefits. In conjunction with the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, the NGA small business office analyzes the submission. If approved the office determines the government's objective based on the mentor's proposal, the Defense Contract Audit Agency conducts an audit/rate check to validate the mentor's accounting system and NGA negotiates labor, work hours, cost and milestones. Awards can range from one to three years with extensions possible.

NGA's Mentor-Protégé Program has produced many success stories highlighting the technology transfer component, in which a mentor helps enhance or modify a protégé's product or service so it can support NGA and/or other intelligence community missions. The technology transfer component helps build strong prime and subcontractor small businesses. In January the Army selected NGA protégé MicroTechnologies as one of four awardees for the Private Cloud Mobile IDIQ contract, while Air Combat Command awarded them a prime contract for the development and implementation of the Installation Geospatial Information and Services program for Central, Southern and African Commands.

MicroTech is a service-disabled veteran-owned small business. Along with cloud computing, they provide technology services, systems integration, product solutions and unified communications and collaboration. MicroTech and Northrop Grumman participate in a mentor-protégé agreement that began in 2010.

"The success of the mentor protégé program is a direct result of the NGA Small Business Office dedication to NGA's mission," said Matthew Markley, Operations and Training Division director for three-time mentor CTSC, LLC. CTSC mentored Data Management Group in 2007, Stargates, Inc., in 2009 and entered into a third agreement in 2011 with Global Consulting International (GCI). "Everyone benefits from their (NGA's) leadership and commitment to excellence," said Markley.

The Air Force recently selected GCI, a small, disadvantaged business, as a prime contractor on the $1.9 billion Design and Engineering Support Program contract. GCI's focus is on providing engineering services to improve system lifecycle cost, operational life, performance, sustainment, safety and environmental friendliness.

DOD recognizes mentors and protégés who achieve excellence in the execution of their agreements with the Mentor-Protégé Nunn Perry Award. The award acknowledges the protégé's growth and development

along with the mentor's performance in technical assistance. DOD selected two NGA mentor-protégé teams, IBM Corporation and Foxhole Technology Inc., and SAIC and Vector Planning and Services, Inc., as winners in 2011, and Computer Science Corporation and NVision Solutions, Inc., in 2010.

CSC paired with NVision, a small, disadvantaged business program participant and women-owned company, to provide guidance and direction under the program.

"We recognize the tremendous effort put forth by NVision over the years and the knowledge they bring to bear," said Bong Gumahad, vice president of CSC's national intelligence operations. "They continually exemplified the dedication and professionalism we seek in all protégé companies and we are excited about our future endeavors as a team."

NVision is a subcontractor on NGA's Global Geospatial Intelligence contract, providing geographic information services that support warfighter needs. Specifically, NVision provides the warfighter feature extraction for mapping systems (mapping intelligence) and two-dimensional and 3-D image extraction that helps warfighters maneuver in theater.

"Our work to support NGA's challenging mission has pushed us to be innovative with the technology we create and use as well as how we manage and run our business," said NVision President Socorro Harvey. "We look forward to a continued relationship with both NGA and our mentor CSC."

The key to the success stories is the technology transfer, said Broadnax. The commitment between the mentor and protégé to develop and/or enhance products or information to strengthen the intelligence community, to process GEOINT in a flash, and to protect national security is immeasurable but critical to the warfighter.

Identifying the technology transfer is a requirement in the executive agreement and transfers range from information assurance and cyber security to remote sensing and GIS solutions and support, just to name a few. Along with the mentor and protégé, DOD and NGA also benefit from technology transfers such as HP Enterprise Services providing a dedicated lab for their protégé Emagine IT in one of NGA's 2011 agreements. The lab provides proof of concepts, demonstrations, application/database testing and development to NGA for existing, new and emerging technologies resulting in efficiencies, cost savings and better informed decisions on GEOINT analysis of imagery and geospatial data and information. The protégé and mentor gain an increased understanding of NGA's business area architecture and NGA gains from two companies in a partnership providing expertise and knowledge and winners all around.

The NGA Small Business Programs Office continues to build partnerships by encouraging approved mentors to develop and enhance the capabilities of protégés. Potential mentors and protégés can meet up on NGA's website at https://www1.nga.mil/Partners/Pages/MentorProtege.aspx.

NVision has provided 3-D feature extraction services to NGA since 2006 using custom software and hardware they developed. The Mentor-Protégé program was a tremendous catalyst for NVision's growth and infrastructure development.

NVision photo by Joel Herr

CRADAs Enhance Competitiveness

By Jan Lewis, Project Scientist, and Jim Vrabel, Contractor, InnoVision Industry Outreach Office

NGA photo by Larry Franklin

Michael O'Brien, NGA's CRADA Program Director, Laura Jennings, Deputy Chief, Acquisition and Intellectual Property Law, Office of General Counsel, and Bertram Beaulieu, Director, InnoVision, celebrate NGA's milestone achievement of 25 active Cooperative Research and Development Agreements at an April 19 ceremony at NGA headquarters in Springfield, Va.

What is a Cooperative Research and Development Agreement? A CRADA is a formal agreement with an industry or academic partner to bring innovative solutions to National Geospatial-Intelligence Agency's most complex research and development problems. NGA and the partner contribute expertise, data and/or technology to the CRADA effort, and both partners benefit from the collaboration.

InnoVision's Industry Outreach Division manages the NGA CRADA program, as well as NGA's partnership with In-Q-Tel and the Small Business Innovation Research program. "The three programs offer diverse partnership opportunities for industry and academia to work with NGA," said Paul Nagele, deputy division chief.

"A significant difference between the programs is that CRADAs do not involve traditional contractual relationships; in fact, NGA is prohibited from contributing funds to a CRADA partner."

Why would a commercial enterprise, university or research lab agree to work with NGA without receiving funds? Partners can benefit from access to government-developed algorithms and scientific research and gain insights into NGA challenges through their side-by-side work with NGA employees. This interaction may enable collaborators to create a better geospatial production tool, sensor and/or database, which they can then make commercially available to their customers.

Congress passed legislation under the Federal Technology Transfer Act of 1986 (P.L. 99-502) that introduced CRADAs as a mechanism to increase federal laboratories' interaction with industry. The ultimate goal of the legislation was to enhance U.S. competitiveness by encouraging the transfer of technology between the U.S. government and the private sector.

NGA's CRADA projects range widely across NGA's mission areas, including everything from geospatial education to improving business processes to scientific research into emerging phenomenologies. Current research areas include: image exploitation, geospatial technologies, geospatial training, object-oriented technologies, multi-intelligence and/or multi-source processing and exploitation, advanced sensor research and development and enhancements to both electronic navigation technology and aeronautical data holdings.

CRADA projects involving Light Detection and Ranging (LIDAR) technology are an example of successful technology transfer and mutual cooperation between NGA and industry partners.

LIDAR, an optical remote sensing technology, is relatively new to NGA. Laser pulses bounce off objects to detect their properties and can measure distances to them, outline their shape and determine other object properties by illuminating a target with light.

NGA is working with CRADA partners Applied Imagery, Exelis Visual Information Solutions and Overwatch, leveraging their CRADAs to make several NGA-developed LIDAR tools available to the National System for Geospatial Intelligence, which includes intelligence community, joint

staff, military departments, services and combatant commands, to advance understanding of this technology.

NGA transferred government Tactical Decision Aid algorithms, which help analysts and users of geospatial tactical information, to these CRADA partners. The partners in turn agreed to incorporate the algorithms into their commercial-off-the-shelf analysis tools and provide operations and maintenance support for them. Transferred TDAs include helicopter landing zone algorithms designed to help identify acceptable helicopter landing locations and line-of-sight algorithms used for 3-D LIDAR analysis of a location's tactical environment.

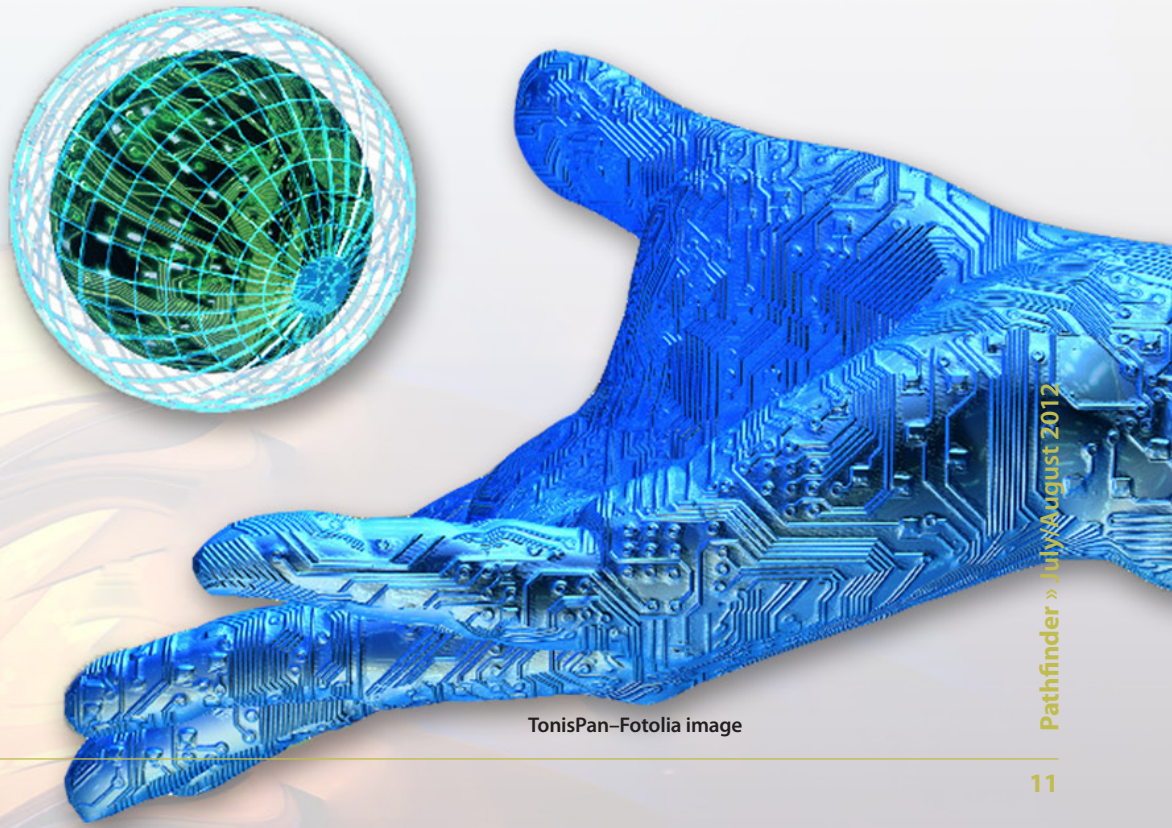
CRADA partnership agreements are increasingly important to NGA's research and development efforts because they allow exploration of cutting-edge technology that might not otherwise be possible in an era of tightening federal budgets. NGA's CRADA program reached the significant milestone of 25 active CRADAs in March, with several others in development.

"While the InnoVision CRADA team manages the CRADA program for NGA, personnel from many directorates are essential to program success, serving as principal investigators and subject matter experts," said Michael O'Brien, NGA CRADA program director.

Have a new CRADA idea? NGA is interested in establishing additional CRADAs with industry and academia that are consistent with the NGA mission and amenable to industry, academic and/or other participation and exchange. Contact the CRADA team at crada@nga.mil for more information or to suggest a CRADA.

NGA InnoVision graphic by Melissa Gray

C R A D A



TonisPan–Fotolia image

NGA Partners With DOE Nat'l Labs

By M. Karen Walker, Contractor, Office of Corporate Communications

Oak Ridge, Hanford, Los Alamos — in historical memory and popular imagination, Americans associate these places with the Manhattan Project, the Cold War and peaceful uses of atomic energy. What may be less well-known is that during the past six decades, these and other Department of Energy national laboratories have quietly and steadily built a research and development enterprise that seeks to tackle national-level challenges including: sustaining energy resources; managing climate change; reducing dangers to human health; promoting domestic and global economic growth; protecting America's deployed warfighters; combating terrorism and the proliferation of weapons of mass destruction; and mitigating conflict within and between nations.

The National Geospatial-Intelligence Agency has been a consistent contributor to and benefactor of the National Laboratories' successes. NGA — including its legacy organizations such as the Defense Mapping Agency and the National Photographic Interpretation Center — has a long history of working with DOE laboratories. Argonne, Lawrence Livermore, Los Alamos, Oak Ridge, Pacific Northwest and Sandia National Laboratories have all delivered new capabilities to the geospatial intelligence — or GEOINT — community. These capabilities include high performance computing, data visualization, signal processing and energy, transportation and population modeling.

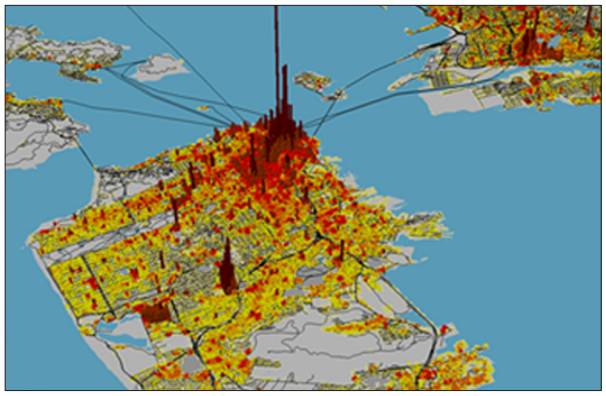
NGA's InnoVision Directorate leads the Agency's engagement with the national laboratories, advancing its mission to perform path-breaking scientific research while transitioning to innovative concepts and capabilities that solve the intelligence community's and warfighters' most complex and enduring problems. "The labs are an amazing national resource with unique facilities, computing power and multi-disciplinary scientific expertise focused on a host of pressing national intelligence questions," said InnoVision Director Bert Beaulieu.

The relationship between NGA and the Oak Ridge National Laboratory (ORNL) is an example of InnoVision's partnering approach. "We are nurturing a natural partnership that comes from shared values and shared vision," said Beaulieu.

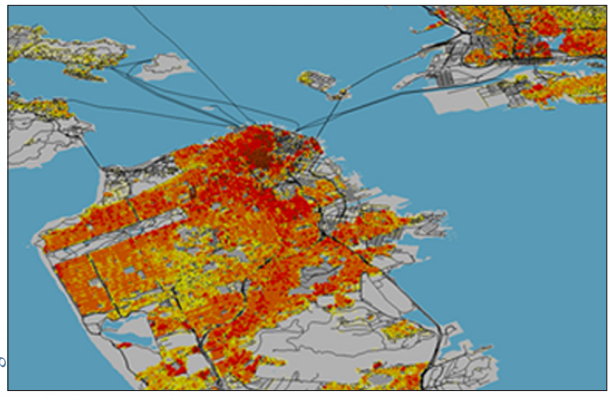
ORNL's John Doesburg, Director of International Security and Analysis Programs, echoed the point. The scientists working at NGA and ORNL "share a culture of life-long learning and service to the nation, focused on what's possible, not just what's doable" said Doesburg. "Having NGA as a partner allows us to push the frontiers of science and to realize our vision of conducting basic science research to solve grand challenges in global security."

ORNL is widely recognized for its commitment to research and development in geographic information science and technology. Dr. Budhu Bhaduri leads the Geographic Information Science and Technology Group, a GIS science and technology research and development group aligned with ORNL's computing and computational science directorate. "Where we sit within ORNL uniquely positions us to take advantage of emerging capabilities in high performance computing, computational science and data sciences and engineering," said Bhaduri.

In practical terms, Bhaduri and his team used this synergy to develop LandScan Global, LandScan USA and a settlement mapper tool, each of which allows analysts to rapidly capture and manipulate socio-cultural and socio-economic data about a populated area from high resolution imagery. According to Bhaduri, these geographic data integration and analysis projects generate the finest population distribution data available. This highly specific information is of great use not only to support current national security missions but also to creating models that forecast migrations and populations at risk from disasters, climate change, political unrest and other stressors. The focus is on how activities of people alter places, and vice versa. Toward that goal, LandScan Global and LandScan USA are meeting the challenge of developing "landscapes of people, day and night." Partnering with the national laboratories on research projects has yielded major returns on NGA's investment. For example, NGA's domestic deployers and mission partners such as the Federal Emergency Management Agency



Daytime



Nighttime

Courtesy Oak Ridge National Laboratory

These two graphics, produced with LandScan USA, a high-resolution geospatial and temporal modeling approach for population distribution and dynamics, compare and contrast the daytime and nighttime activity in San Francisco; the spires represent population density.

depend on the national laboratories' models of how critical infrastructure and population centers interconnect. These models show how a failure in one part of the energy grid might "chain out" to communities not directly impacted. This awareness not only speeds relief to those most vulnerable, but also improves disaster planning and guides the pre-positioning of disaster response resources, a point reinforced by Steve Alness, Acting Chief of Applications and Content Technology for the Integrated Work Group on Readiness, Response and Recovery. "ORNL's unique expertise in population, energy, transportation and climate modeling gives us a depth of understanding to effectively plan and carry out disaster relief efforts around the globe," Alness said.

NGA's focused work with the national laboratories exemplifies a partnering strategy to support and leverage centers of excellence on specific capabilities. Connecting centers of excellence to each other, and to members of the National System for Geospatial Intelligence (NSG) and Allied System for Geospatial Intelligence (ASG), advances InnoVision's cross-community functional management role. The NSG represents the nation's integrated GEOINT enterprise, encompassing technology, policy, capabilities, and producers and users of GEOINT in the U.S. government, industry, academia and non-governmental sectors. The ASG represents the geospatial intelligence relationships among the "five eyes" community of Commonwealth nations: Australia, Canada, New Zealand, the United Kingdom and the United States.

The GEOINT Research and Development Functional Management Executive, Becky Aiken, described this role using the analogy of a heat map. "We can see where there's a lot of work happening, and we can make that evident to NSG and ASG members," said Aiken. "We can also see where work is cooling. This could mean that a hoped-for break through didn't happen, so we need to move in a new direction, or it could mean that researchers need more resources to keep the fire going." Efficiencies arise from collective decisions on how to prioritize resources in new and novel approaches to global and human security, said Aiken.

The heat map analogy works because the national laboratories have become more interdependent. Doesburg underscored that the system is only as robust as the people within it, adding, "We've evolved from a system of national labs to a national laboratory system."

InnoVision builds relationships not only at the organizational level, but also among individual researchers and analysts. NGA researchers working inside national laboratories are gaining insights and creating tighter collaborations for state-of-the-art GEOINT. One of these is Dr. Brigitte Brunelle, a project scientist in InnoVision's Basic and Applied Research Office who is currently conducting counter-proliferation research at Los Alamos National Laboratory (LANL) as part of a Director of National Intelligence Exceptional Analyst Fellowship. "In addition to having access to state-of-the-art laboratory facilities, the opportunity to engage with LANL research scientists on a regular basis has enabled me to carry out this research in a scientifically rigorous and efficient manner," Brunelle said. The opportunity to build an extensive circle of cleared scientific colleagues, and to learn more about the DOE national laboratory system in general, will foster more robust and well-executed collaborations in the future, predicted Brunelle.

Over the long term, NGA's partnering strategy will continue to integrate NSG and ASG research with DOE's national laboratory activities, adding to a growing base of fundamental knowledge that is diverse, dynamic and data-driven. As summarized by Aiken, "strengthening this current research partnership with the national laboratories has become more important than ever as NGA and its NSG partners strive to efficiently focus increasingly precious R&D (research and development) resources on the nation's critical intelligence problems."

NEA Provides Virtual Capabilities

By Keith L. Barber, Director, National System for Geospatial Intelligence Expeditionary Architecture Integrated Program Office

High-Performance Computing Creates a Global Architecture

Warfighters and decision makers cannot wait days for data, so the National System for Geospatial-Intelligence (NSG) Expeditionary Architecture (NEA) Integrated Program Office (IPO) is providing new technology and architecture solutions to ensure timely access, discovery and retrieval of GEOINT now.

"We need the enabling technologies to make all this happen, from cloud computing and mobile GEOINT to application development and management," said National Geospatial-Intelligence Agency Director Letitia A. Long at a recent employee forum. "Achieving efficiencies and taking advantage of technology innovations are critical to our ability to realize our vision," she added.

NEA will employ commercial and open-source cloud computing technologies to expand upon benefits the commercial community is already seeing from virtualization and high-performance computing (HPC). A highly virtualized, scalable environment adapts to growing needs and can benefit the entire GEOINT user community. It brings existing data and services to a wider audience, enables the development of advanced analytical services, and greatly reduces the cost of developing and deploying new capabilities and maintaining current hardware and software.

GEOINT HPC and NEA

NEA's GEOINT HPC vision includes supporting the warfighter through a distributed set of physical and virtualized compute, storage, network and data infrastructure resources. Essentially, HPC implements parallel or distributed processing, which splits a task into chunks several different entities can work on simultaneously. While the processing, or compute resources are distributed across many physical locations they remain accessible from any part of the architecture. Nearly unlimited amounts of processing power can be available to work a task, which can be completed much more quickly than if a single entity processed it as a single task. The NEA IPO will design other resources, such as storage, network and data infrastructure, to work together to manage and execute the processing tasks using HPC.

HPC is highly applicable to GEOINT processing since its data sets are often far larger than with other, non-GEOINT text-based data. When coupled with other benefits of cloud architecture, such as resource scaling and dynamic allocation, HPC can greatly reduce timelines for delivery of GEOINT into the hands of the user while enhancing processing performance and enabling advanced analysis that was previously unattainable.

For example, a user may need light detection and ranging (LIDAR) data, which uses pulses of laser light to generate 3-D images, over a specific area. Today, that user could wait for extended periods of time for a source to acquire, process and provide the data. Many processing steps may be required before an analyst can use the data, such as segregating the data of interest and applying geographic coordinates. In a Hadoop cluster (or other parallel/distributed processing HPC configuration), the source can split the LIDAR processing amongst multiple servers that work simultaneously, significantly reducing the time the user must wait for delivery of the processed data. Distribution of parallel data and compute power like with Hadoop, combined with specific image processing and analytics accelerators delivered as part of the NSG GEOINT HPC environment, will enable this. Examples of these technologies include graphic processing units, which are specialized, efficient electronic circuits that can rapidly process images displayed on a user's workstation monitor, mobile phone screen or other display device, and field-programmable gate arrays (FPGAs). FPGAs are integrated circuits used in nearly any type of open-standard hardware configuration; users can re-program them on the fly to work with different applications.

The NEA cloud framework changes the set-up from stovepiped and limited access to globally accessible and usable. As new analyst needs emerge and the warfighter

mission evolves, the framework will facilitate the rapid development and deployment of additional capabilities in a services-based, virtualized environment with quicker access to data and resources across the cloud.

A key aspect of the framework is the automated scaling of compute resources to support virtualized environments that are distributed horizontally across the enterprise, better enabling capabilities such as advanced analytics. The value of parallel/distributed computing is further enhanced with automated scaling. Available compute processing will 'scale up' if there's a greater demand from the user and 'scale down' when the demand no longer exists. During these downtimes the resources may work lower priority standing tasks, such as non-time sensitive data processing. Users can share and use computing power anywhere in the cloud, which gives each user access to greater processing resources and greater performance than they would have with one computer at one desk. HPC automated scaling further decreases processing timelines for time-sensitive analysis that would otherwise be limited to the compute power of an analyst's physical workstation.

Enabling Remote Exploitation

New sensors continue to increase the volume and velocity of GEOINT data available to National System for Geospatial Intelligence partners. NEA aims to reduce the amount of data moving around just for processing purposes, with a goal of processing data in place whenever possible. HPC nodes will deliver a new virtualized (VPoP) model that supports remote connections. These remote sessions, combined with intelligence community, Department of

"Achieving efficiencies and taking advantage of technology innovations are critical to our ability to realize our vision," said NGA Director Letitia A. Long.

Petty Officer 1st Class Cory Christman prepares weather briefs for pilots at the Naval Aviation Forecast Center at Naval Station Norfolk.

Navy photo by Petty Officer 2nd Class William Weinert

Defense and other GEOINT service-based applications, provide remote processing and exploitation without moving the data.

Remote exploitation, combined with HPC processing, will be critical for advanced exploitation capabilities such as activity based intelligence (ABI). Effective ABI involves layering multiple sources of data and then applying mathematical solutions or automated algorithms to them to flag which activities might warrant further investigation by an analyst. ABI will be available as a service on remote servers so those with access can use their tools to analyze data at rest and download or disseminate only the finished ABI products they need. NGA will update and modernize these virtualized services as new versions become available, making them immediately available to the entire GEOINT community. ABI is poised to save thousands of hours of analysts' time while making discoveries that might otherwise go unknown. Some ABI capabilities are already available in theater.

The Bigger Picture: Moving to Global Enterprise

HPCHPC is just one of many key components to an on-demand, user-focused, cloud-based architecture. Though HPC can be allocated on-demand by a user, HPC does provide compute resources at many levels of the architecture. It provides compute power to run platforms (such as development platforms, virtual desktop operating systems, etc.) and software (especially fully featured, rich client desktop applications) as well as data (primarily for data ingest, processing and automated analysis). This approach offers a drop-in anywhere set of information technology capacities, termed NEA global nodes, with built-in infrastructure services that unify those nodes into the larger continental and outside the continental U.S. information technology enterprises.

Analysts can now process GEOINT datasets such as full-motion video, wide area motion imagery, LIDAR and hyperspectral imagery directly from ingested sensor platforms and use tools such as NSG Video Services, Google Visualization Services and the Full Spectrum Tool Kit served by the HPC platform to exploit them.

Interoperability is key to the successful implementation of cloud-based architecture. New standards and procedures must address how technology behaves rather than just describing it. A cloud-based environment is a vast ecosystem of components that must be interoperable, and the approaches to designing within this ecosystem differ from traditional methods. This shift in design patterns must keep and facilitate interoperability between mission partner systems while sustaining a coherent, mission-based global GEOINT service-model for the NSG.

Resource Management

The NEA cloud framework introduces a GEOINT-specific concept of cloud resource management called the Global Resource Manager (GRM). The GRM is not a set of systems administrators or data managers, but rather a set of services that manage data within the architecture. For example, the GRM will direct the parallel/distributed compute power, as it allocates all resources across the cloud, on-demand and in support of the mission. This provides robust, shared and reusable services enforced through open IT standards. Users across the IC and DOD can access a community of applications, services, data and derived products without affecting or altering them.

The GEOINT HPC platform provides scalable, elastic, distributed and responsive virtualized services to users. Users will have faster access to GEOINT, virtual access to the latest services and exploitation tools, and a framework that provides the infrastructure to support the best mission performance possible. This enables users to quickly share and act on GEOINT.

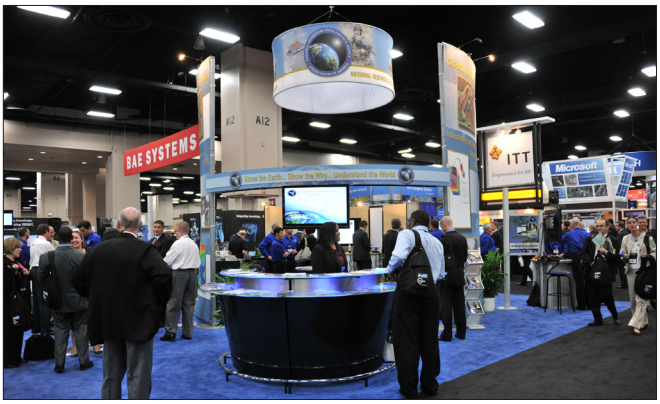
Looking Forward

The NEA cloud framework changes the set-up from stovepiped and limited access to globally accessible and usable. As new analyst needs emerge and the warfighter mission evolves, the framework will facilitate the rapid development and deployment of additional capabilities in a services-based, virtualized environment with quicker access to data and resources across the cloud.

NSG users and organizations will take advantage of access to content, as well as self-service GEOINT tools and applications to meet time-critical mission objectives. In addition, NGA will gain efficiencies for deployed environments (e.g. reduced overseas footprint and other cost savings). HPC is an initial step towards implementing this vision for NEA users — giving NGA's tactical users an additional needed edge.

Industry Interaction Drives Change

By Karen I. Palmer, Industry Interaction Program Manager



NGA photo by Rob Cox

The U.S. Geospatial Intelligence Foundation GEOINT Symposium provides an annual opportunity for NGA's Industry Interaction Program representatives to meet with industry partners. The NGA booth at last year's symposium, held Oct. 16-19 at the Henry B. Gonzales Convention Center in San Antonio, served as a focal point for those engagements. This year's symposium will be Oct. 8-11 at the Gaylord Palms Resort and Convention Center in Orlando, Fla.

NGA and Industry

Neither the National Geospatial-Intelligence Agency nor the intelligence community as a whole can perform its mission on its own. NGA's industry partners offer ground-breaking thought, pioneering research and in-depth technological expertise to NGA's business operations and production methods. They help NGA build the revolutionary capabilities the agency needs to remain the premier GEOINT provider.

NGA's mission partners include a wide array of decision makers and operational forces. Their interests include protecting national security, combating the threat of terrorism, implementing national policy, responding to natural disasters and countering illegal drug trafficking. To be successful, they require geospatial intelligence foundation data, information and services — tailored to meet highly specific needs and delivered quickly and in an easily understood format.

NGA has promoted teamwork between and among government and industry while keeping in mind that NGA has a fiduciary and contractual oversight responsibility to ensure contractors meet contract specifications.

Industry Interaction

"In 2003 James R. Clapper Jr., then director of the National Imagery and Mapping Agency (NGA's predecessor agency) and currently the Director of National Intelligence, implemented the Industry Interaction Program (IIP) based on his industry experience," said Tonya M. Crawford, director, contracting and NGA's current senior procurement executive. "Director Clapper worked with then-NGA Senior Procurement Executive Sharon Parish to provide companies equitable access to submit ideas and capability statements. IIP has built invaluable relationships between our industry partners and NGA, and plays a critical part in facilitating NGA's interaction with industry and in helping NGA with agile acquisition practices."

IIP serves as the central point of contact for industry to interact with NGA. It ties together, in one office, all industry-interaction activities not otherwise solicited through the normal procurement process. The program provides a forum for companies to submit ideas, capability statements, white papers and unsolicited proposals knowing they will receive an NGA response to each one. In addition, NGA coordinates all industry executive visits through this process.

In 2005 IIP established a database for information storage and recall for solutions and providers for new requirements. Currently, 2,646 vendors and over 18,800 documents that pertain to industry submissions and visits are in the database.

The IIP executive panel includes the director of the small business programs office as well as senior technical representatives from across NGA. They carefully review company submissions and provide a written status back to the company within a two-week period.

Between Feb. 1, 2004, and March 31, 2012, IIP received 913 submissions; some companies submitted more than one. The panel forwarded 67 percent of the submissions for further technical evaluation. Some companies have gone on to participate in cooperative research and development agreements (see related story on p. 10) and some have been awarded subcontracts in partnership with prime contractors. NGA has awarded 18 contracts using this process and has six additional potential contract actions for fiscal year 2012.

NGA encourages companies interested in supporting NGA's vision and mission to participate in the IIP process. For more information on IIP, visit www.nga.mil and click on "Partners" or contact Karen I. Palmer, Program Manager for Industry Interaction; Rochelle Edwards, Project Manager for Industry Interaction; or Crystal Branson, Special Assistant for Industry Interaction at 571-557-6748 or email industry@nga.mil.

Disaster Response Efforts Highlight Value of Relationships, Nontraditional Partners

By M. Karen Walker, Contractor, Office of Corporate Communications

Photo courtesy of the Naval Postgraduate School

NGA, National Defense University, U.S. Geological Survey, State Department and U.S. Agency for International Development representatives piloted technical interoperability and data flow between lead federal agencies and the Volunteer Technical Community in an international and domestic disaster response, part of the August 2011 Research and Experimentation for Local and International Emergency First Responders — RELIEF — experimentation event at Camp Roberts, Calif.

The nation's response to the January 2010 earthquake in Haiti demonstrated the life-saving power of governmental, private-sector and nongovernmental organizations working hand-in-hand during disaster response. Thanks to an emerging group of organizations loosely called Volunteer Technical Communities (VTCs) — like the International Network of Crisis Mappers, OpenStreetMap, the Global Earth Observation Catastrophe Assessment Network (GEOCAN), Google Map Maker, Ushahidi and CrisisCommons, among others — relief workers and international aid coordinators had access to a wealth of geospatial information to help them manage the response.

The VTCs' response to Haiti expanded efforts by the National Geospatial-Intelligence Agency's crisis action team to provide situational awareness and complemented NGA's holistic approach to disaster response. The VTCs produced geospatial information products immediately useful to relief workers, allowing NGA's team to focus on deeper and more specialized analyses for environmental and critical infrastructure assessments and forecasting population movements.

John Crowley, a researcher with the Harvard Humanitarian Initiative and National Defense University's Transformative Innovation for Development and Emergency Support program, helped marshal resources following the Haiti earthquake and credits the Haiti response with a "complete transformation in how we use geospatial information for crisis response." Contrasting the Haiti effort with the response to the 2004 Indian Ocean tsunami, Crowley conveyed the frustration of relief workers in Aceh, Indonesia, who had difficulty determining where to find internally displaced people (IDP) without imagery depicting their camp fires and temporary structures. In Haiti, however, imagery was widely available under attribution-only licensing from commercial imagery providers GeoEye and DigitalGlobe. The open license on imagery had a secondary effect: OpenStreetMap was able to build a map of Haiti's critical roads, infrastructure and emerging IDP camps within about 2 1/2 weeks, with 640 mappers contributing over 1.4 million edits, reported Crowley.

NGA's Katie Baucom, a geospatial intelligence analyst supporting NGA's Integrated Work Group for Readiness, Response and Recovery (IWG-R3), predicted that the Haiti response will be a long-lasting highlight in public-private cooperation. "The reservoir of geospatial information produced by and for local and international communities changed from unknown to extraordinarily detailed features in the blink of an eye," Baucom said. VTCs captured indigenous knowledge about places and people, including names for roads, landmarks and community gathering spots, Baucom added. This volunteer-led digitization effort made it easier for relief workers to cross-reference geospatial information with text messaging alerts and social media reporting to identify areas and people in need of aid, said Baucom.

The Haiti earthquake response offers a number of positive lessons for government officials seeking to build trust and teaming relationships with non traditional partners. Crowley emphasized four elements in particular: building momentum for a broad-based and strategic public-private partnership independent of a crisis response; solidifying collegial relationships before a crisis response; creating a neutral space in which to test the mechanisms for collaboration; and defining roles to provide consistency and a common frame of reference to guide future endeavors.

Building Momentum

The Defense Advanced Research Projects Agency sponsored one of the early catalysts for connecting global communications technologies, geospatial information and disaster response, a project called Strong Angel. Originally to train Marines for humanitarian operations like they do for combat, Strong Angel experiments in 2000, 2004 and 2006 created a neutral space between academia, government, United Nations' agencies, nongovernmental organizations and the private sector. These events used real-world scenarios and DARPA-like challenges to drive rapid innovation of information-sharing technologies with special focus on the interoperability of geospatial tools. "Strong Angel paved the way for a more concentrated effort to produce, collect and disseminate open geospatial data," said Crowley. The National Science Foundation and the National Defense University were key partners, and private sector team members have included representatives of Google, ESRI, Microsoft and Cisco Systems to name just a few, said Crowley.

Solidifying Relationships

In late 2009 the International Conference of Crisis Mappers convened a public-private dialogue under the auspices of Harvard and Tufts Universities to delve more deeply into geospatial information technologies. Crisis Mappers is a self-organized network of individuals from the humanitarian, development, human rights, policy, technology and academic communities. The overarching purpose, said Crowley, was to understand and harness the potential of crowd sourcing, text messaging, human geography, remote sensing and other tools to provide the best possible geospatial data for disaster planning and crisis response. "The face-to-face relationships, the exchanging of contacts, the collective awareness of capabilities — the Crisis Mappers' network was what made the Haiti response unique," Crowley asserted.

When the earthquake struck Haiti, VTCs like Crisis Mappers knew exactly how they could help. As a World Bank Global Facility for Disaster Reduction and Recovery report summarized, VTCs collaborated across specialties. Volunteer experts in remote sensing exchanged the latest aerial and satellite imagery and committed thousands of hours of labor to process more than 9 terabytes of raw imagery. Cartographers and Web technologists used the imagery to build an OpenStreetMap workflow that generated vector, or line data, sending the results to the MapAction team in the U.N.'s On-Site Operations Coordination Centre. In addition to these new maps, Ushahidi and other text messaging-based platforms placed the locations of more than 30,000 reports from the affected population into a Haitian text messaging shortcode. Volunteers at Stanford University worked with 1,200 members of the Haitian diaspora to translate these reports (usually received via text message or Twitter) into English, generally within five minutes of posting. Other VTCs built on this initial work. With the World Bank's guidance, volunteers with GEOCAN employed remote sensing tools to produce damage assessments that captured the spatial scale and magnitude of the disaster.

Creating a Neutral Space

The power of the crowd created an expectation for future disaster response efforts and prompted NGA analysts to find a way to interact with the VTCs. Christina Higgins, NGA's Office of Geospatial Management team lead, confirmed OGM's role was to bring the right people together, with perspectives ground in operations, policy, law and humanitarian assistance and disaster response, to develop a model for collaboration. The technology solution was easier to evaluate than the legal and policy implications, Higgins said. "OGM led us through a paradigm shift toward open, shareable and accessible geospatial data, so that we could enable but not get in the way of the crowd," added Baucom.

OGM launched this change process at the October 2010 CrisisMappers conference at Harvard. "The OGM team started asking questions — what do we need to know? How do we partner? What roadblocks do we need to get through?" Crowley recalled. Three objectives framed the answer to these questions. First, the process needed to preserve the U.S. Agency for International Development's role as lead federal agency for foreign disaster assistance. Second, the process needed to be designed around "demand-pull" requests for baseline geospatial data from the VTCs. And third, the process needed to be transparent. Given what's at stake during a disaster response, the VTCs, National System for Geospatial Intelligence (the community of GEOINT partners including Department of Defense, intelligence community, civil, industry, academia and service providers), NGA and lead federal agencies needed a high level of confidence in each other and in the rules of the road for exchanging and using open source and commercial imagery and geospatial data. It was a problem ready-made for the type of experiments Strong Angel conducted.

Using the Strong Angel model, Crowley encouraged the VTCs and NGA to collaborate during a series of quarterly field experiments at Camp Roberts, Calif., in 2011 known as RELIEF (Research and Experimentation for Local and International Emergency First Responders). According to OGM's Dave Reed, lead staff officer in OGM responsible for examining the VTC concept, "RELIEF provided the neutral space we needed to look at the broad range of legal, policy and operational issues associated with interaction between the VTCs and that growing group of USG (U.S. government) agencies who are NSG mission partners and involved in disaster response."

Defining Roles for Consistency, Common Reference

The Camp Roberts RELIEF experiments produced a conceptual work flow for geospatial information, with the Department of State's Humanitarian Information Unit (HIU) in the role of facilitator. The HIU — an interagency unit housed in the Bureau of Intelligence and Research's Office of the Geographer and Global Issues — is developing a procedure to manage and prioritize VTC requests for baseline data. Working closely with the department's imagery center and NGA support team, members of the NSG maintain situational awareness on where and how to access open geospatial data

including crowd-sourced geospatial information and participatory mapping products.

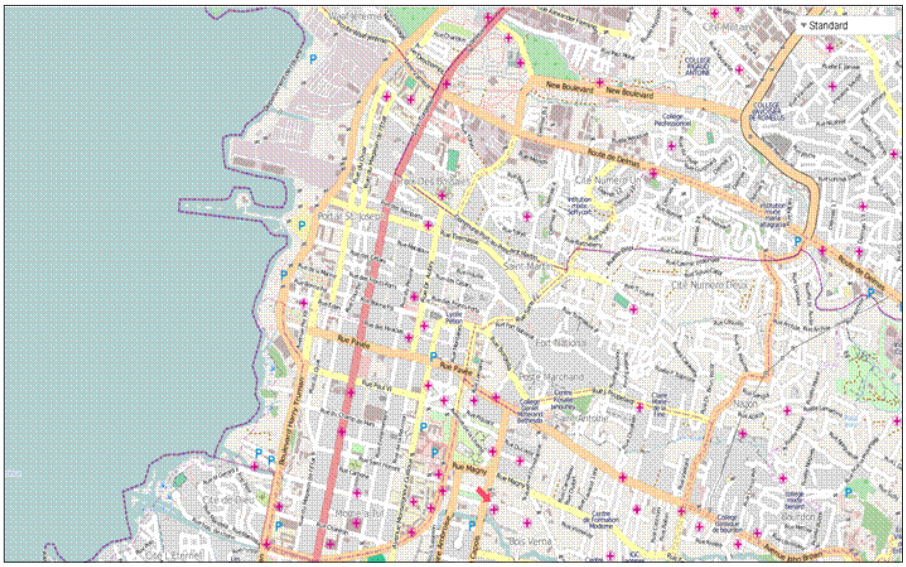
"The beauty of this collaboration," said Crowley, "is that the VTCs no longer have to rely on ad hoc personal networks to obtain imagery. The HIU is a 'go-to' group of geographers and analysts who provide an open interface with the U.S. government, and who are able to assess requests and release fresh imagery and vector data using a new and innovative workflow."

Benson Wilder, a humanitarian affairs analyst with the HIU, credits OGM and the Camp Roberts RELIEF experiments with "helping us develop a structure to fit the logic we've seen all along — the Volunteer Technical Communities have the ability to add detail that is meaningful to the disaster response community, and we should provide the best possible data as a basis for them to start from."

Sustaining Momentum

The long-term value of open geospatial data for disaster planning and response may be incalculable. As articulated by Wilder: "No clear lines exist between disaster response, recovery and long-term sustainable development — that is true for programs as well as the data used and created during their implementation. A development program might mitigate or prevent a disaster, and a well-executed disaster response can and should lead to more resilient communities." Open data remains the driving force for resiliency because "it enables a common baseline for decision making across organizations," explained Joshua Campbell, a geographic information system architect with the HIU. Returning to the VTCs' value added in producing geospatial information products infused with local knowledge of roads and infrastructure, Campbell commented that "this is how we get food to a certain spot, how we deliver vaccines more efficiently — open road and infrastructure data provides the foundation for a coordinated response by synchronizing planning and operations through the same lens."

Partnership building clearly demands a lot of patience. Baucom and her colleagues at the HIU look forward to stewarding the relationship with the VTCs in parallel with the stand-up of NGA's IWG-R3, which provides content, processing and application services to NGA's emergency preparedness, response and recovery mission partners. The constructs and relationships developed with the VTCs give the IWG-R3 a jump start toward mission success, with more rapid, dynamic and effective ways of accessing NGA's unclassified information. In turn, the increasing availability of high-quality open geospatial information means that during a crisis response, NGA analysts can dedicate more time to performing deeper and more predictive analyses for its mission partners.



This screen resolution graphic of Port Au Prince, Haiti, courtesy of OpenStreetMap, illustrates the detailed foundation data provided by Volunteer Technical Communities following the January 2010 earthquake, including Haiti's critical roads, infrastructure and emerging camps for those who were displaced from their homes.

Personal Influence Affects Charts, Maps, Surveys

Dr. Gary E. Weir, NGA Chief Historian

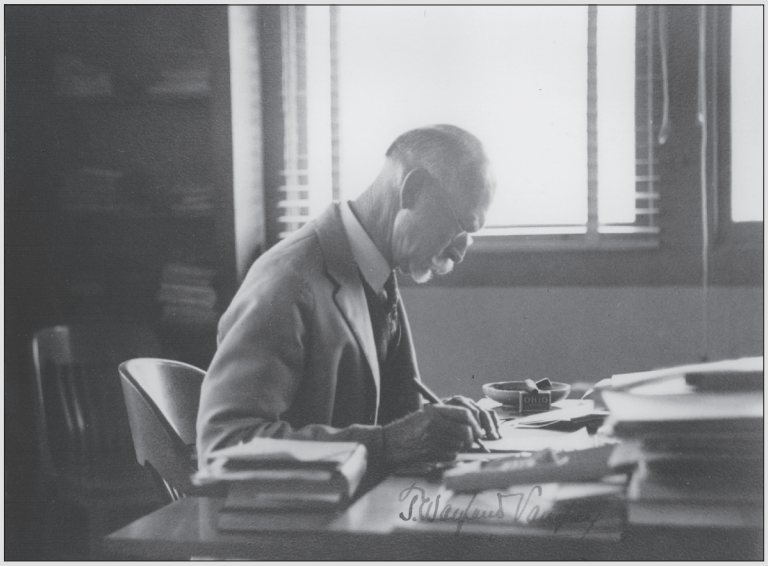


Photo courtesy of the Scripps Institution of Oceanography

In the process of planning new surveys and coordinating data collection, Hydrographer of the Navy Rear Adm. Walter R. Gherardi cultivated a relationship with the director of the Scripps Institution of Oceanography, Thomas Wayland Vaughan, photographed in his office in 1932.

The National Geospatial Intelligence Agency's productive relationships with universities and the scientific community extend well back into the history of our predecessor organizations. From the beginning these important connections took the form of very personal alliances and professional arrangements fashioned by individuals significant to our history. The U.S. Navy Hydrographic Office (Hydro) offers a case in point. The lack of funding, manpower and resources in a country burdened by the Great Depression forced naval and scientific leaders to look for collaborative solutions to acquire the data necessary to promote scientific inquiry, safe navigation and the national defense.

During the 1930s the Hydrographic Office did some of the most comprehensive surveys in its history and cooperated with universities and private research institutions as far as its budget and the political climate would permit. The Navy conducted work on temperature, salinity, currents, gravity, water chemistry and ocean bottom topography, as well as basic mapmaking surveys in cooperation with the Scripps Institution of Oceanography, the Woods Hole Oceanographic Institution (WHOI) and other interested groups.

Although the Pacific increasingly drew the attention of American grand strategists during the 1930s, the Navy applied the bulk of its limited hydrographic resources to the Caribbean and Gulf of Mexico region. From the strategic point of view, the Navy's concentration on home waters was not entirely misplaced. A complete understanding of the sea passages into the Gulf of Mexico, as well as an appreciation of the oceanographic character of the approaches to the Panama Canal, needed little justification. In a January 1928 letter to Chief of Naval Operations Adm. Charles F. Hughes, the Bureau of Navigation defended the need for new, more detailed surveys in the vicinity of the Canal Zone by citing the region's strategic importance in the event of war. By that time Hydro already had the results of the USS Niagara's three-month reconnaissance of the Gulf of Panama and the Pearl Islands. The ship's crew erected a series of triangulation towers to better determine the accuracy of the available charts and found them significantly flawed.

In the process of planning new surveys and coordinating data collection, Hydrographer of the Navy Rear Adm. Walter R. Gherard cultivated relationships with the directors of two premier oceanographic institutions to obtain assistance, instruments and advice. Thomas Wayland Vaughan of Scripps and Henry Bryant Bigelow of Woods Hole recognized, along with Gherardi, that the scarcity of funds, ships and personnel made them all mutually dependent.

In August 1932 Gherardi asked Bigelow for assistance in obtaining some instruments Hydro needed in its surveys. Bigelow replied in early September that he had no spare instruments to loan, but perhaps he could help in another way. Bigelow offered WHOI's assistance in training naval officers to use unfamiliar instrumentation. He wanted the admiral to assign one of his officers to WHOI's research vessel, Atlantis, scheduled to depart on Sept. 20 for the Gulf of Maine. If someone from the naval survey vessel USS Hannibal went on the voyage, "he would see all the operations and have a chance to thoroughly familiarize himself with the whole procedure," stated Bigelow.

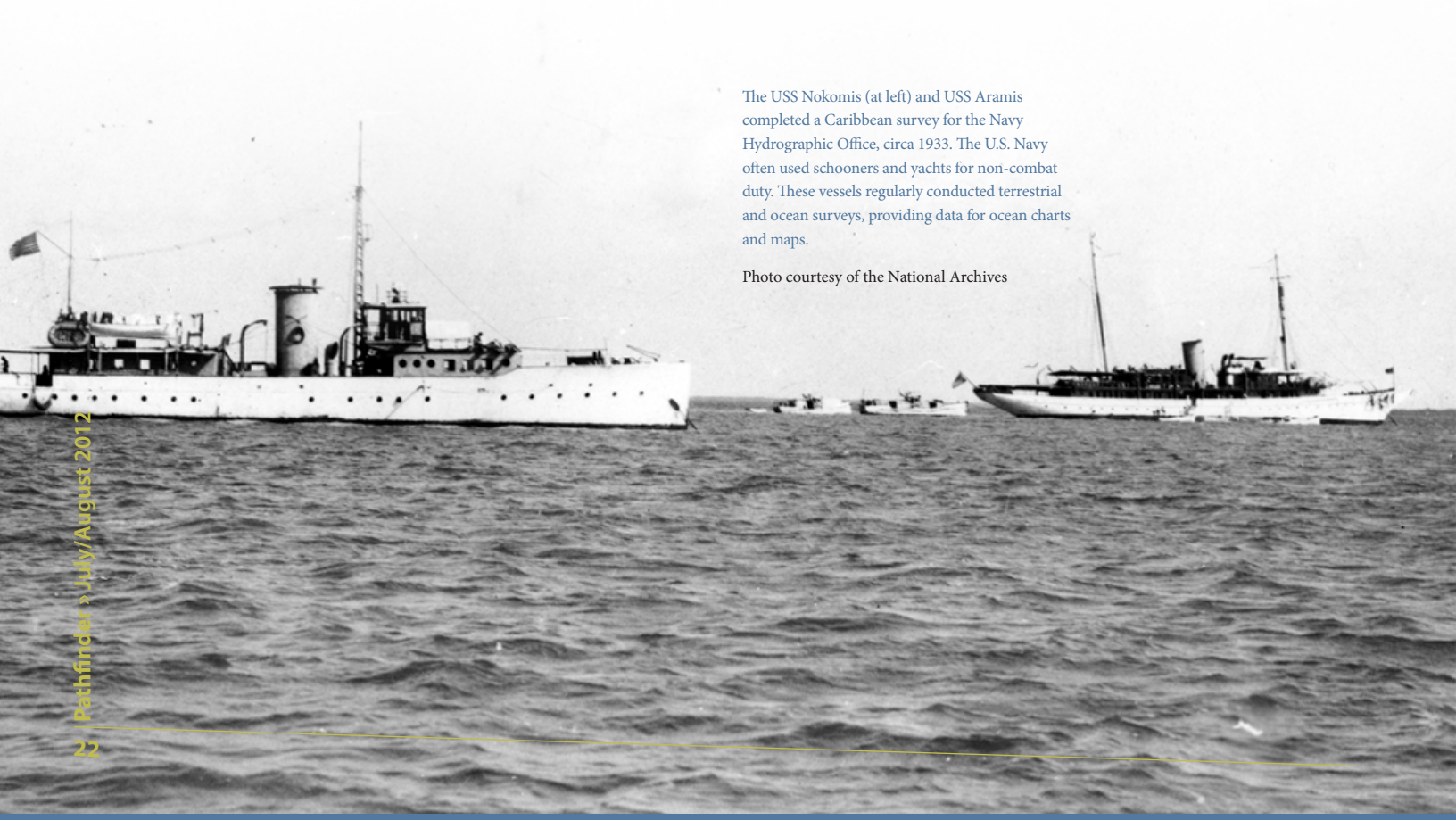
Gherardi wasted no time in accepting the offer. He wrote to Bigelow on Sept. 9 that he found the suggestion very gracious and constructive and would certainly select a member of the Hannibal crew to accompany Atlantis. By Sept. 14 Hydro ordered Cmdr. Charles C. Slayton, commanding officer of Hannibal, to join the WHOI expedition. Slayton's experiences with data collection methods and his participation in the activities of the cruise permitted Hydro to reap great benefit. As Gherardi commented to Bigelow in a letter penned Sept. 30, 1932, "There is nothing equal to the personal contact with those who have had continuing practical

experience in the use of special apparatus and getting a first-hand experience in its use." For Hydro, sowing the seeds of a long-term relationship made operational, scientific and fiscal sense.

Gherardi also cultivated a close professional connection with the Scripps Institution of Oceanography. He worked more closely with Vaughan than any other civilian scientific leader and both Hydro and Scripps profited immensely. While all oceanographic institutions, universities and seagoing businesses relied upon Hydro for essential navigational charts, only Scripps had the advantage of seeing the essential data for these charts before the information went to the publisher. By agreement with Gherardi, Scripps received the oceanographic survey data directly from naval vessels like Hannibal and Nokomis. Vaughan convinced the Navy to permit Scripps' scientists to perform the chemical and physical analyses necessary to render the information useful for chart composition. This gave Scripps personnel the first opportunity to use the information to augment their vision of the ocean and it gave Hydro a way of working up the data at minimal cost to the Navy.

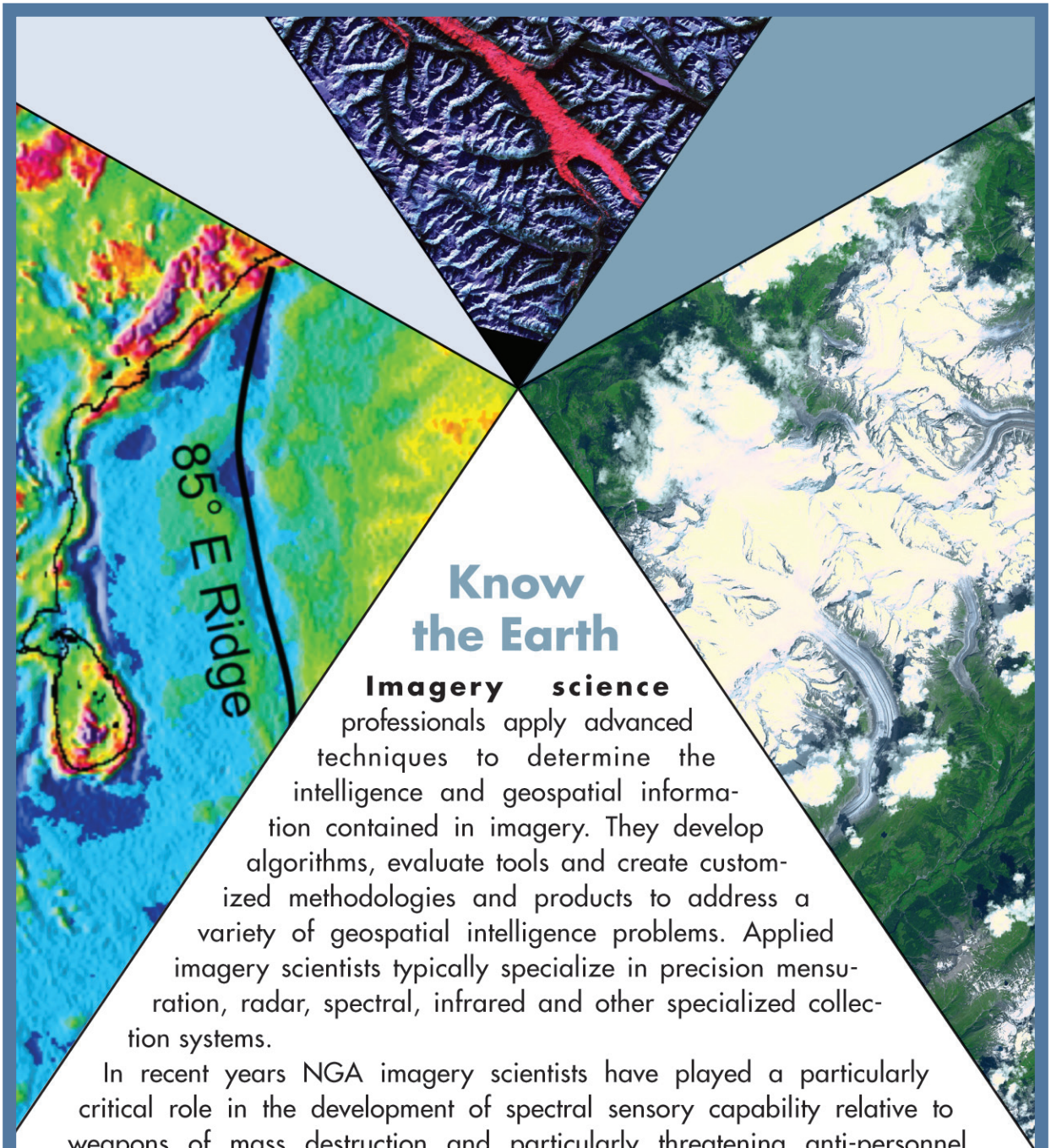
Vaughan realized early the possibilities of the alliance with the Navy and worked to strengthen and exploit it further. He asked Gherardi Oct. 1, 1932, if "it would be possible for one of our men to work on board one of your vessels while operating in the Gulf of Panama in order to carry out certain analyses." Along with the trip taken by Slayton on board Atlantis at Bigelow's invitation, this request by Vaughan set a significant precedent for exchange of personnel for research and training purposes. Hydro immediately applied for permission to take a civilian scientist from Scripps on board Hannibal in the Gulf of Panama. By late November Gherardi received final approval from the Bureau of Navigation and informed Scripps on Dec. 9, writing to the institution's acting director, Eric G. Moberg, while Vaughan travelled in Europe on business. Five days later Moberg informed Hydro that he intended to send the Canadian Richard H. Fleming to Hannibal. Fleming worked as a research assistant at Scripps while pursuing his doctorate in chemical oceanography at the University of California.

Collaboration between scientists and naval personnel on Navy ships, like that accomplished by Fleming on Hannibal, continued, as would the analytical services Scripps provided to the Hydrographic Office. With the Fleming voyage, Vaughan and Gherardi fortified significantly the Bigelow-Atlantis precedent for civilian-naval cooperation in field research. These relationships enabled Hydrographic Office personnel to provide the latest and best picture of the ocean to mariners worldwide, an endeavor still very much part of the NGA mission.



The USS Nokomis (at left) and USS Aramis completed a Caribbean survey for the Navy Hydrographic Office, circa 1933. The U.S. Navy often used schooners and yachts for non-combat duty. These vessels regularly conducted terrestrial and ocean surveys, providing data for ocean charts and maps.

Photo courtesy of the National Archives



Know the Earth

Imagery science professionals apply advanced techniques to determine the intelligence and geospatial information contained in imagery. They develop algorithms, evaluate tools and create customized methodologies and products to address a variety of geospatial intelligence problems. Applied imagery scientists typically specialize in precision mensuration, radar, spectral, infrared and other specialized collection systems.

In recent years NGA imagery scientists have played a particularly critical role in the development of spectral sensory capability relative to weapons of mass destruction and particularly threatening anti-personnel devices. In doing this they regularly ***show the way*** by keeping NGA on the absolute cutting edge of geospatial science—opening the possibility of new intelligence sources. They truly help the NGA workforce . . .

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