



NAVAL POSTGRADUATE SCHOOL

# IN REVIEW

MAGAZINE

OCTOBER 2013

## OPERATIONAL RELEVANCE

A LANDMARK NPS DISCOVERY IN ANTARCTICA IS THE LATEST IN A LONG TRADITION OF EDUCATIONAL AND SCIENTIFIC CONTRIBUTIONS TO THE NAVY'S OCEANOGRAPHER COMMUNITY.

## OUTSTANDING SCIENCE

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### INSIDE:

Former Student Combats Military Suicide with Smartphone App

Student Analysis Reveals Millions in Savings for USNS Comfort

Executive Education Program Leads Navy's Energy Culture Change



**Ronald A. Route**  
Vice Adm., U.S. Navy (Ret.)  
President, Naval Postgraduate School

*“Throughout countless meetings, vibrant discussions around lunch in the El Prado Room, or an impromptu classroom visit, the people of NPS are second to none in their commitment and enthusiasm for the success of this university.”*

**A** month has passed since I officially assumed the position of President of the Naval Postgraduate School, and although I was well-versed in the institution, there are a number of impressions that have struck a chord with me over these initial weeks.

First and foremost are the students — the reason this institution is here. During every interaction I have had with them, I am consistently impressed with their dedication, drive and professionalism, what one would expect from an officer of the U.S. Armed Forces. I heard from a number of colleagues well connected to NPS that I would be impressed with the approach our students take to their education, and they were right!

Our faculty and staff are equally appreciated for their continued dedication to the mission of NPS. Throughout countless meetings, vibrant discussions around lunch in the El Prado Room, or an impromptu classroom visit, the people of NPS are second to none in their commitment and enthusiasm for the success of this university. In the face of uncertainty, an empowering spirit of innovation permeates every corner of the NPS campus, and that spirit is fueled by the intellect and perseverance of our renowned faculty and professional staff.

While I have the good fortune of witnessing this excellence first-hand, one need to look no further than the pages of this edition of “In Review” for proof positive on all of the above. Some of the most compelling issues facing our Navy, DOD and national security as a whole are examined right here in Monterey by the officers, DOD civilians and internationals that will be charged with resolving them.

Secretary Mabus has made energy security a top service imperative, and NPS is continuing to do its part to help achieve his established goals. As students in the university’s dedicated energy degree programs near graduation, another energy contribution is hitting its stride. The Executive Energy Seminar is a weeklong immersive program to help senior leaders create a Navy culture where energy is integrated into the decision framework itself. The initial two classes have completed the program, with strong success, and we are looking forward to continuing our support to this effort.

The value of good intelligence has never been more critical, and students and faculty at NPS are examining promising systems to greatly improve the process of analysis, and the sharing of information. A new research effort, the Center for Multi-INT Studies, is looking at the advancement of algorithms that apply computer-driven analyses to the integration of multiple intelligence streams. Another effort at a more mature phase of development is the Beyond Line of Sight Command and Control project that turns Common Data Link, or CDL, radios into a bi-directional communications network. And yet another effort in full launch, GlobalECCO, provides an online portal where thousands of alumni in the Combating Terrorism Fellowship Program can stay on top of the latest tactics in combating one of the most prolific forms of warfare.

And finally, in our cover story, we detail a landmark expedition led by Dr. Tim Stanton of the Naval Postgraduate School’s Department of Oceanography. Steeped in tradition, NPS oceanography provides the foundation for the Navy’s Oceanographer community, with leadership at every level funneled through the university’s storied program. And its expert faculty like Stanton that make NPS oceanography what it is. Stanton is the kind of oceanographer that a Navy SEAL would be impressed with. He’s a field researcher, for sure, who treats an expedition to the Arctic like a jaunt to the corner store.

And while his discovery on Pine Island Glacier has tremendous implications on global issues like sea-level rise, I also find great satisfaction in knowing the same world-renown expert is in our classroom teaching Navy Officers the art of oceanography. Our students deserve the best, and as evidenced in this issue, indeed they are getting it.

*Ronald A. Route*



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## NAVAL POSTGRADUATE SCHOOL IN REVIEW MAGAZINE

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## On The Cover

While the Arctic may grab a lion’s share of the headlines, scientists are discovering that it’s the Antarctic continent that may play a large role in defining Earth’s future. A landmark discovery by an NPS-led expedition to Pine Island Bay is garnering worldwide attention, but it also casts a bright light upon the critical role of Navy’s oceanography community, and the Naval Postgraduate School’s contributions to it.

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## NPS Faculty Celebrate Tighe's Tenure, Welcome New President

While the federal government shutdown limited the grand formality and attendance of the change of office ceremony, retired Vice Adm. Ronald A. Route assumed the position as President of the Naval Postgraduate School, Oct. 4. The official change went on as originally scheduled, although was relocated to the NPS President's Office in Herrmann Hall with a few members of the military staff waiting to bid Rear Adm. Jan E. Tighe, Interim President, farewell.

"We have laughed, we have cried, we have sweated and we have rejoiced in the success of this institution and our students, faculty and staff," said Tighe. "Successes in this fiscal environment are hard fought, but you have persevered. NPS is better for it and I am proud of you."

Secretary of the Navy Ray Mabus described Tighe's brief but impactful tenure as president of the Navy's premier graduate university as, "nothing short of remarkable." Faculty and senior administration echoed the compliments, and joined Tighe, who was nominated for receipt of her second star during her NPS assignment, for a memorable group photo on the steps of Herrmann Hall following her final graduation ceremony in late September.

"Vice Adm. Route will bring an incredible amount of relevant expertise to NPS in areas that need it the most," noted Tighe, who has returned to the east coast to serve as Deputy Commander, U.S. Fleet Cyber Command and Deputy Commander, U.S. Tenth Fleet. "The NPS team has worked tirelessly



In honor of Rear Adm. Jan Tighe's final commencement ceremony, NPS faculty gathered for an old tradition, a post-graduation group photo on the steps of Herrmann Hall.

over the last eight months to lay a solid foundation which he will undoubtedly build upon and make us stronger."

As Route takes the helm, Mabus expressed confidence in the incoming president's leadership abilities and referenced his more than three decades of military service.

"Admiral Route is the right leader for the job," said Mabus. "His exemplary naval service of 36 years is invaluable to the position and I trust him to expertly guide this institution as they continue to provide the high-quality, relevant and unique advanced education and research opportunities that make our naval forces the best in the world."

"I am honored by this opportunity and grateful for the trust being placed in me by both the Secretary of the Navy and the Chief of Naval Operations," said Route, who brings more than 20 years of leadership experience at the senior executive and operational level, including responsibilities in graduate education, program requirements and resources, international affairs, research and development, and ethics.

### NPS Alumni Sweep Prestigious Stockdale Leadership Awards

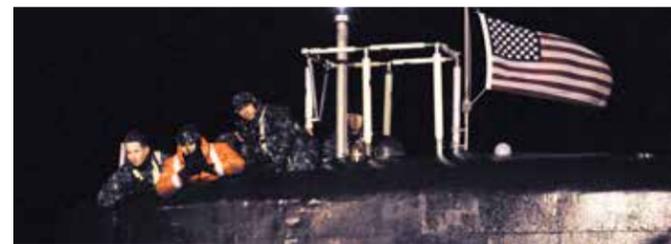
Naval Postgraduate School alumni, Navy Cmdrs. Richard N. Massie and Leif E. Mollo, have been selected to receive the Navy's coveted Stockdale Award for Inspirational Leadership, and will be honored during a Pentagon ceremony later this Fall.

Massie, the Pacific Fleet winner, is currently deployed aboard the *USS Maine* (SSBN 741-Gold) where he serves as commanding officer. He was recognized for his commitment to command excellence, and his efforts in support of the integration of women into the submarine force.

Writing from "somewhere beneath the Pacific," Massie described his views on leadership, and the priority he places on meeting with each of his Sailors individually, sharing three core principles

he needs of his crew.

"First, treat every person with dignity and respect ... We all need to pull together toward our common goals. Alienating an individual for some perceived difference is counter to these goals," said



Cmdr. Rich Massie, left, is one of two NPS alumni honored with the Stockdale Leadership Award.

Massie. "Second, everybody must act with integrity. Our business is too difficult and too dangerous to have anything less. We must be able to trust each other 100%.

"Finally, we all must be focused on the mission. [Everything we do] contributes to the larger mis-

sion and the security of the United States," he stressed.

"It's fantastic that he received this award. We faced a lot of challenges while I served under his command, but we accomplished some amazing things including a

meritorious unit commendation," said Lt. Ryan Hilger, a current student at NPS who served under Massie before beginning his studies.

Mollo, the Fleet Forces Command winner, is the former commander of the Navy's elite, Seal Teams Four and Eight.

"It is a great honor and also extremely humbling to receive this award. The example and standard of leadership that Admiral Stockdale set is one we can only hope to live up to," said Mollo.

"This may be an individual award, but in my case, I believe the real recognition and credit should go to the members of the commands that I was fortunate enough to lead," he continued. "Their dedication, courage, and perseverance were absolutely inspiring to me and it was an honor and privilege to be their commander."

Mollo made a point to reflect on his time at NPS, and the perspective that its one of a kind educational programs provided him as he deployed to some of the most world's most troubled regions.

"NPS' Defense Analysis/Special Operations-Low Intensity Conflict (SOLIC) curriculum expertly focused on education that proved to

be of great practical use during my subsequent tours," Mollo said. "I found myself constantly applying what I learned in a variety of environments, whether it was overseas working with foreign counterparts, in a leadership position at a NSW [Naval Special Warfare] command, or while serving on a joint staff."

### Monthly Gatherings Spotlight Student Research in Unmanned Systems

A monthly tradition for members of NPS' Consortium for Robotics and Unmanned Systems Education and Research (CRUSER) is a lunchtime gathering where students brief university faculty and fellow students on research topics in the unmanned systems and robotics domains. During the latest meeting in October, Air Force Maj. Matthew Allen discussed his effort on the defense of High Value Units (HVV) against "swarm" attacks.

Allen and a group of fellow students are utilizing a herding model to predict the "intent" of a swarming attacker by weighting the importance of an attacker reaching the HVV, and the importance of an attacker avoiding the defender. Students also used the model to evaluate HVV survivability using different defense strategies.

"Instead of just looking at HVV survivability, we looked at how many effective attackers would actually penetrate and reach an



Attendees at monthly CRUSER meetings get an update on current student research.

HVV. We also established new survivability perimeters," said Allen. "Multiple simulations were presented that varied survivability parameters, initial attacker posi-

tions, defender guidance laws, and hit rate functions."

The presentation was the result of a group project conducted in the Cooperative Control of Multiple Marine Autonomous Vehicles course.

### Workshop Begins Detailed Student Analyses on Navy's Most Challenging Issues

Students at the Naval Postgraduate School participated in a warfare innovation workshop in late September designed to challenge students to analyze a series of scenarios wherein U.S. forces are drawn into a



Student teams at NPS' Warfare Innovation Workshop.

conflict in the South China Sea.

The university's warfare innovation workshops explore advanced problems as directed by naval commands and researchers at NPS as these organizations strive to envision future conflicts, and the Navy's response to them, in support of U.S. national security.

"The warfare innovation workshop is actually a series of workshops that occur about once every six months, allowing our faculty and sponsors to leverage the operational experience of our students," said NPS Department of Operations Research Professor of Practice, retired Navy Capt. Jeff Kline.

During the most recent edition of the workshop, student groups were required to examine means to mitigate Anti-Access Area Denial tactics. Students explored small flotillas of manned and unmanned systems that can operate with the capabilities associated with larger fleets or air wings under a concept known as the Distributed Air

Wing and Surface Capabilities.

"We challenged our students to explore advanced concepts that will allow the U.S. and its allies to operate under the Anti-Access Area Denial (A2AD) umbrella on and over the sea, in an emission-controlled environment," said Kline.

"The concepts are a response to robust A2AD development efforts underway in countries like China and Iran who have developed asymmetric responses to counter our ability to operate freely throughout the world's oceans," he continued.

U.S. Navy Lts. John Goff and James Efirid found value in the strategic processes associated with

internship opportunities for their students ... They are an inspiring group of young future leaders, whose educational and life experiences have been enriched by their time spent at NPS," said then university Interim President Rear Adm. Jan E. Tighe, one of the symposium's key speakers.

"The Hartnell program is one of many feeder programs to our sum-



Former NPS President Rear Adm. Jan E. Tighe speaks with a summer intern at Hartnell College's annual STEM Internship Symposium.

mer STEM internship activities run out of the Cebrowski Institute," Tighe continued. "My hat's off to the faculty and staff members who gave so generously of their time to make a difference in the lives of these young future leaders."

In total, NPS hosted 93 STEM interns over the past summer comprised of high school, community college and university students selected through several intern partnerships and programs.

"Part of what we are doing here is recruiting the next generation of STEM professionals," said NPS Dean of Research Dr. Jeff Paduan. "Our Navy leadership recognizes the need for young people like these that are critical to the future success of the Navy."

"One hundred percent of the Hartnell students that interned at NPS have graduated with a bachelor's degree, are working in a STEM field, are working on doctoral and graduate work, or are on track to complete a degree ... We cannot take all the credit for that, but we are proud to have been a part of their success," said Alison Kerr, NPS STEM Internship Coordinator for the Hartnell College program.

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One such success story is that of former NPS intern Genaro Sanchez. Sanchez now works as an electrical engineer for Zodiac Aerospace in Santa Maria, Calif., but spent summers at NPS with the Space Systems Academic Group and the Hastily-Formed Networks Research Group while pursuing a degree in electrical engineering.

“I came to the U.S. when I was 14 and started high school in East Salinas ... I am the first one to attend college in my family,” said Sanchez. “I left a lot behind in Mexico ... It’s been a struggle, but it was worth it in the end.

“Working with the people at NPS and getting the experience that I gained there really helped me out ... I was exposed to technologies in a way that built trust in myself. I was good at what I did, and it motivated me to keep going,” Sanchez added.

**Human Systems Integration Program Graduates First DL Cohort**

NPS graduated its first cohort of students in the distance learning Master of Human Systems Integration (HSI) degree program during September’s commencement ceremony.

The HSI program is focused on humans as a significant priority in systems design and acquisition. Given the understanding that people are critical to system development, the degree provides students with the knowledge to optimize total system performance.

While resident HSI degree and certificate programs have been on campus for years, the new distance learning (DL) program provides federal government and defense personnel an opportunity to enhance their own careers. Offered through NPS’ Graduate School of Operational and Information Sciences, the HSI programs are overseen by retired Army Col. Dr. Larry Shattuck.

“The DL Master of Human Sys-



*Inaugural cohort of the distance learning human systems integration degree program.*

tems Integration program began in the fall of 2011,” said Shattuck. “It was created at the request of our resident master’s in HSI curriculum sponsor.”

This first cohort was comprised of students from multiple military branches ... a Navy officer, four Department of the Navy civilians and two Marine Corps civilians. In addition, Deborah Swain, this cohort’s distinguished graduate, is a contractor with DOD.

“We merge all the domains of human engineering to ensure that we’re designing for the human from every facet of the design, rather than trying to implement the human to hardware’s design,” she said. “In acquisition programs it ensures that you include the person up front.”

The program consists of several courses in systems engineering, acquisition, survivability and much more taken over the span of two years, and is limited to 30 students per year.

“It gave me an opportunity I wouldn’t have had otherwise,” added Kathy Ferguson, a DON civilian at the Washington Navy Yard. “There was no way I would have been able to come out here and get a degree. I’m very thankful for the distance learning opportunity.”

**Boeing Phantom Works Team Details Russia’s Arctic Ambitions**

NPS welcomed Boeing Phantom Works Senior Defense Analyst Michael Horn to Glasgow Hall for a discussion with students and faculty on Russia’s growing interest in the Arctic, Oct. 22.

Horn’s presentation detailed the increasing accessibility of Arctic resources and their value, with a focus on how and when Russia’s ambitions in the polar region may affect the interests of the U.S. and its allies.

“U.S. top interests in the Arctic are security, resources, commerce, protection of indigenous communities, and scientific research,” said Horn. “We are interested in finding out what Russian interests in the Arctic are, and looking into how those interests could impede our own.”

Horn discussed Russia’s current role in the Arctic, and conjectured upon possible Russian opportunities and interests 10 years from now and beyond. He cited the



*Senior Defense Analyst Michael Horn*

Northern Sea Route, for example, which when ice free reduces shipping transit time and fuel costs between the Atlantic Ocean and the Pacific Ocean.

“We think that Russia’s attempt to control the Northern Sea Route gives us a choice,” Horn noted. “We could live [with Russian control] because we can’t afford to meet every challenge, everywhere in the world. Or we could counter it ... We could say that the Northern Sea Route is so important that we have to match what Russia is spending there.”

**EMBA’s Latest Cohort on Campus for Orientation Week**

The latest cohort of 42 Executive Master of Business Administration (EMBA) students spent a week on campus getting to know each other, and their professors, in preparation for the two-year EMBA distance learning program. Even though the next time they see each will be via DL technology, the cohort will spend the next 24 months working together, and in smaller teams, on a variety of business and management coursework, projects and activities.

Naval Sea Systems Command (NAVSEA) Logistics Management Specialist Jessica Connelly, one of the students in the new cohort, noted how important this initial team building is for the program.



*Naval Sea Systems Command Logistics Management Specialist Jessica Connelly, left*

“It’s the team concept that I really like about this DL course. I’m inspired by the others that I’ve just met and I’m very excited to have the opportunity to earn an EMBA,” she said.

“NAVSEA has made a conscience decision to invest in Connelly’s career by funding her graduate education,” said EMBA Program Manager and Academic Associate Bill Hatch.

Connelly works for NAVSEA at the Washington Navy Yard location, and is attending the program via video teleconference classrooms. She and her fellow EMBA classmates began their programs of study on the first day of Fall Quarter instruction, Sept. 30. **IR**

**CIRPAS Adds New Aircraft, Radar System to Inventory**

Researchers at NPS’ Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) have been able to capitalize on the austere budgets of today’s Department of Defense with the addition of five newly-acquired aircraft to the facility’s hangar in Marina, Calif.

With organizations seeking to offload assets, research center leadership and staff put in the time and effort to work through the detailed acquisition and transfer processes, resulting in multiple UAVs, another Twin Otter and an advanced radar system added to its portfolio of research-supporting assets.

“The Twin Otter aircraft will be used to support post-doctoral atmospheric science and oceanography research,” said CIRPAS Director Bob Bluth. “It will also be used to monitor the Monterey Bay Marine Sanctuary’s eco-system.”

The new Twin Otter was used previously by the U.S. Army Golden Knights Parachute Demonstration Team, and will undergo a 3-to-5 year refitting process before it begins its new life as a research aircraft.



*CIRPAS New Twin Otter*

Also recently acquired was an S-band radar system previously used in Army counter artillery operations. The large, semi-truck radar system will also undergo extensive modifications to be used by CIRPAS researchers to study the formation of tornadoes throughout the Midwest’s infamous “Tornado Alley.”

“The S-band processing system is a good match with CIRPAS. It will be outfitted onto a flatbed

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**Debate Challenges Students to Consider the Ethics of Unmanned Systems**

NPS Department of Defense Analysis Assistant Professor Bradley J. Strawser moderated an informative debate between Visiting Associate Professor Heather M. Roff and freelance journalist Joshua Foust focused on the question, “Does the future of unmanned and autonomous weapons pose greater potential ethical dangers or potential ethical rewards?”



*Freelance journalist Joshua Foust, NPS Assistant Professor Bradley J. Strawser, and University of Denver’s Dr. Heather M. Roff*

Held on the NPS campus and open to all students, the lively exchange provided a detailed examination of key issues surrounding one of DOD’s newest emerging technologies and capabilities.

Foust is a prolific writer on issues relating to national security, with his work appearing in The Atlantic, The New York Times and Foreign Policy among many others. His recent article, “A Liberal Case for Drones,” argues a favorable view of unmanned systems, stating that under specific conditions, they are an ethical, and even preferable option to boots on the ground.

“Machines are quick, better at processing large amounts of data instantly,” said Foust. “Humans are deeply flawed moral actors in war ... Machines respond to criteria and input, they lack emotional choices,” and the negative affects of those emotions, he added.

Roff is a rising star within the University of Denver faculty, and has been critical of unmanned combat systems. Her work, “Killing in War: Responsibility, Liability and Lethal Autonomous Robots,” outlines her contrary views on the inability of autonomous machines to make complex moral judgments, a core discrepancy that makes lethal autonomous robots a poor combat option.

“We are focusing on the vices, but we should be looking at the virtues,” countered Roff. “What about when a soldier shows empathy or mercy? Taking the emotion out of combat is not necessarily a good thing. You can’t mimic human judgment.”

One of NPS’ resident philosophers, Strawser is a well-known authority on the ethics of unmanned systems. He came to the university following a

stint with Oxford University’s Institute for Ethics, Law and Armed Conflict. His recent book, “Killing by Remote Control: The Ethics of an Unmanned Military,” doesn’t argue one side or the other, but rather explores in great detail the potential ethical pitfalls and gains that unmanned systems pose.

Strawser served in the U.S. Air Force prior to joining the faculty at the Air Force Academy, and later with the Stockdale Center at the Naval Academy. A relatively new addition to the NPS defense analysis program, department leadership note he brings valued expertise to the students’ experiences.

“It’s crucial for our students to have an opportunity to explore the ethical implications of their decisions, especially as they practice their profession in an era of protracted warfare against shadowy opponents,” said NPS Department of Defense Analysis Chair Dr. John Arquilla. “Professor Strawser will challenge our students — Americans and internationals — to look at a range of issues objectively and carefully from an ethical perspective.”

The two-hour debate was attended by NPS students as part of a Warfare Innovation Workshop co-sponsored by the Navy Warfare Development Command’s Chair of Warfare Innovation and NPS’ Consortium for Robotics and Unmanned Systems Education and Research (CRUSER). A complete recording of the debate can be found online at NPS.edu/video.

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truck to perform mobile weather tracking,” explained Bluth. “When coupled with other radars, it can provide a three-dimensional picture of the formation of tornado-forming phenomena.”

## NPS Professor Helps USNA Interns Explore Tactical Communications

Naval Academy Midshipmen Daniel Fallon and Jonathan Driesslein spent a portion of their short summer vacation from Annapolis to volunteer as interns on the NPS campus. Working with Dr. Don Brutzman of NPS’ Modeling,

nesses in what we are attempting to do with our own project.”

A former naval officer himself, Brutzman served as a mentor for the Academy interns while examining a number of uses for QR code technology in tactical environments.

“One of the many ways QR codes can help in emission control is to relay the code through light as we did with ship-to-ship signaling,” Brutzman explained. “However, now the QR code represents hundreds of characters, and with the use of stronger LED lights, and flashing much more rapidly, messages can be relayed without radio emissions.”



Naval Academy Midshipmen Daniel Fallon, left, and Jonathan Driesslein

Virtual Environments and Simulation Institute, the duo examined the use of quick response (QR) codes for tactical communications in an emissions-controlled environment.

The two Mids worked on a software tool that translates text typed from the keyboard to a unique QR representation that is read by a camera scan at real-time speeds. Both Fallon and Driesslein were able to demonstrate their work with the tool at NPS’ Joint Interagency Field Experimentation (JIFX) exercise at Camp Roberts, Calif.

“Being exposed to the different technologies here gives us an idea on how we can collaborate with other projects, like the quad-rotor drone which also has its own camera,” said Fallon. “Not only do we meet the engineers and subject matter experts for these cutting-edge tools, it’s a chance for them to poke holes and find strengths and weak-

## Faculty Fill Operational Needs With Innovations in Unmanned Systems

Research Associate Professor Kevin Jones, along with Professor Isaac Kaminer and Research Associate Professor Vladimir Dobrokhodov, are pushing the limits of what is possible in the realm of unmanned aerial vehicle (UAV) engineering and development.

Several of their most intriguing concepts — such as the Tactical Long Endurance Unmanned Air System (TaLEUAS), and their Air Mobile Buoy Platform — seek to fill operational gaps by placing advanced, endurance-focused and renewable-energy powered aircraft into the sky.

The TaLEUAS tethered hex-rotor aircraft, for example, will be capable of extremely long-endurance operations, and can work in conjunction with sister aircraft to

perform missions with very little human command and control.

“I want it to be a ‘back-packable’ system that can stay up for days or months autonomously. Humans interact with it, but do not control the aircraft,” said Jones, a member of NPS’ Department of Mechanical and Aerospace Engineering.



Mechanical and Aerospace Engineering Research Associate Professor Kevin Jones

“The government has funded projects that are similar, but they were enormous, expensive and subject to weather ... Our concept already shows promise and could be built for \$30,000 or less.”

NPS student, Mexican Navy Lt. Nahum Camacho, has been working with the team to improve the “energy budget” that will help make their TaLEUAS performance goals a reality.

“We have a highly-efficient platform, it’s essentially a glider that harvests energy from the sun in two ways,” said Camacho. “During the day we rely on thermal soaring. We achieve this by using on-board sensors to locate thermals, and once found, we can fly like a large soaring bird without expending energy. The energy that we save is then routed to sensor packages and other instruments.

“We also use solar cells to gather energy. Other research projects have focused solely on either thermal soaring or solar energy, our combination of the two gives us the opportunity to create an aircraft capable of 24-hour flight,” continued Camacho.

Also of interest to Jones is the use of hex-rotors for sensing and surveillance. Working with his research partners from the National Security Agency and Lawrence Livermore National Laboratory, Jones is developing a hex-rotor that overcomes the power problem associated with rotary aircraft by offering a tethered alternative.

In addition to a steady stream of power, a tethered hex-rotor poses several advantages in DOD and beyond, Jones says.

“There is a lot of interest in the law enforcement and intelligence communities because a tethered hex-rotor gives near immediate eyes in the sky,” said Jones, adding that they are inexpensive, easy to operate, and can be deployed quickly.

“Tethered hex-rotors could also serve as easily deployable relay or mobile cell phone towers in the wake of a natural disaster,” he added, emphasizing the possible humanitarian assistance and disaster relief (HADR) applications of the concept.

But perhaps the team’s most intriguing UAV concept is their Air Mobile Buoy System, an innovative platform that utilizes a seawater and solar powered multi-rotor to enhance communications capabilities.

“The key idea is to build a low cost and agile autonomous multi-rotor capable of lifting a significant payload of computational, acoustic detection and communications equipment powered by high-performance solar panels,” said Jones. “Long distance communication in rough seas requires significant elevation and stabilization of communication antennas.”

Jones says his floating multi-rotor offers both stability and elevation by launching its antenna-equipped airframe skyward for up to 10 minutes where it can send or receive transmissions before returning to its initial position or deploying to a more advantageous location. Additionally, the buoy system could be used to move sensors to optimal intelligence gathering positions without human intervention.

## Naval War College Review Honors NPS Faculty with Best Paper Awards

Retired Navy Capt. and NPS Professors of Practice, Wayne P. Hughes and Jeffrey Kline, took first and second place in the prestigious Hugh G. Nott Prize competition for their contributions to the Naval War College Review this past year.

Hughes was awarded first place for his paper entitled, “Naval Operations: A Close Look at the Operational Level of War at Sea.” Kline was awarded second place, alongside co-author Hughes, for his paper entitled, “Between Peace and the Air-Sea Battle: A War at Sea Strategy.”

“People who write in this journal are from all over the country and from all kinds of institutions ... Their common interest is some type of maritime operations or warfare,” said Kline. “There’s a uniqueness to Wayne Hughes winning first and second prize in a very respected international journal — probably unprecedented,” he added.

Kline and Hughes’ co-authored article focused on the strained relationship with China, and how to go about containing and deterring any major conflict.

“I think you can say that within the last few years, China has been bullying her neighbors,” said Hughes. “The Japanese, Indonesians, Vietnamese and Philippines are being threatened. China is illegally claiming ownership of the oceans, and it is that action on their part that we want to be able to halt.”

Kline added, “Wayne and I were exploring an additional addendum to the air-sea battle, and a different

approach to potentially influence, engage or deter China through what is called the war at sea strategy. We wanted to provide contributions to contain the conflict at sea by providing flexible term options.”

The duo presented and developed a strategy based on analysis, wargaming, concept generation and risk assessment paired with an “ends, ways and means” strategy, noted Kline.

“We emphasized that this is something that should precede strikes in the air-sea battle strategy which is why the title is, ‘Between Peace and the Air-Sea Battle: A War at Sea Strategy.’ These would come first as a way to influence China short of the possibility of the war expanding and getting out of control ... becoming World War III,” said Hughes.

The Naval War College Review was established in 1948 and is a forum intended to address public policy matters in the interest of the maritime services.

## Professor Ronald Fricker Receives 2013 Hamming Award

Operations Research Professor Ronald D. Fricker, Jr. was officially presented the 2013 Richard Hamming Annual Faculty Award for Achievement in Teaching by Vice Adm. Richard W. Hunt, Director,



Operations Research Professor Ronald D. Fricker, Jr., right, and Vice Adm. Richard W. Hunt, left.

Navy Staff at NPS’ Summer Graduation Ceremony, Sept. 27. Fricker excelled in all three criteria for the Hamming Award: outstanding teaching, excellence in thesis supervision, and strength of contribution to NPS students beyond

the classroom.

“It’s a big honor,” said Fricker. “Even more so with the students we have here, they are spectacular in everything they do, both here and in the field.”

The Hamming award is named for NPS Professor Emeritus Dr. Richard W. Hamming, and highlights a faculty member who demonstrates outstanding teaching skills. Hamming dedicated his life to teaching and research, specifically in the mathematics, computer science and telecommunications fields of study. Each year, NPS students nominate faculty members for the award named in his honor.

## International Financial Managers Tackle Budget Execution Course

Twenty-two course participants from nine countries attended the latest edition of NPS’ Defense Resources Management Institute (DRMI) short course on Budget Preparation, Execution and Accountability (BPEA) in September.

DRMI Lecturer Mark Hladky is one of several instructors participating in the two-week course, providing principles and concepts for preparing and executing defense budgets.

“Within a general planning, programming, budgeting and execution system framework, [the BPEA] illustrates how planning and programming support national defense objectives and priorities,” said Hladky, who also serves as the course coordinator. “The course focuses on how this kind of system allocates resources in the budget under changing circumstances.”

Students work through several case studies designed to capture the process of translating top-level guidance and integrating it at lower organizational levels to create a defensible budget, implement funds control, and establish performance management and accountability in the resource allocation process

Participating students traveled



NPS graduate Army Maj. Daniel Hall, NPS Senior Lecturer Dr. Larry Shattuck, and Wright State University Professor Kevin Bennett, pictured from left to right

from Argentina, Colombia, Lebanon, Liberia, Malaysia, Norway, Pakistan, Saudi Arabia and the United States, and are made up of seasoned financial management officials in their respective ministries of defense. Ten of the students are returning to NPS, having attended DRMI courses in the past.

## Ops Research Student, Professor Honored With Best Paper Award

Journal of Cognitive Engineering and Decision Making (JCEDM) Editor-in-Chief Amy Pritchett presented the journal’s Best Article award to recent NPS graduate Army Maj. Daniel Hall, NPS Senior Lecturer Dr. Larry Shattuck, and Wright State University Professor Dr. Kevin Bennett at the Human Factors and Ergonomics Society’s annual meeting, Oct. 1.

The article, entitled “Evaluation of an Ecological Interface Design for Military Command and Control,” focused on the team’s efforts to create an interface to support decision making and problem solving during ground-based tactical operations.

“We were trying to develop an innovative display for commanders to help them make decisions better and faster,” said Shattuck.

Shattuck and Bennett spent 10 years working on the project, with Hall joining the effort while pursuing his master’s degree at NPS. The trio was the first to be awarded JCEDM’s inaugural Best Article award for their contributions to the prestigious professional journal. ■



Sailors aboard the guided-missile cruiser *USS San Jacinto* (CG 56) pray for suicide victims during a suicide prevention and awareness event called “Walk out of Darkness.” Former NPS student U.S. Navy Lt. Darryl Diptee developed an app to help combat military suicide by providing a means for personal expression in a private, confidential virtual space with a counselor.

## NPS Class Inspires Officer to Combat Military Suicide With Smartphone App

By MC3 Shawn J. Stewart

**THE U.S. MILITARY** suffered more casualties from suicide than from combat last year. A staggering 349 service members took their own lives in 2012 according to a Pentagon report on active-duty suicides. These numbers, when compared to 229 troops killed in combat over the same period from the Washington Post’s tally, compelled U.S. Navy Lt. Darryl Diptee to seek out the underlying causes of military suicides and, ultimately, to develop a solution of his own to assist in combating the problem.

While attending the “Coping with Wicked Problems” course at the Naval Postgraduate School, Diptee was challenged by his professor, Dr. Nancy Roberts, to find and identify a wicked problem, or a catastrophic issue seemingly impossible to solve, and create a solution.

“Darryl identified military suicides as an issue on which he wanted to focus for the wicked problems course,” she said. “His interest in the topic grew as the course progressed and continued to the point where he actually came up with a solution that he is now prototyping,” said Roberts.

Diptee lists Roberts’ enthusiasm, energy and passion along with a concerning Time magazine cover feature, as inspiration for his efforts.

“I saw the Time magazine cover story that stated, ‘One per Day’ — referencing the military suicide rate. I was deeply troubled by the statistics of the article, which went on to state that [at the time] the suicide rate for vet-

erans was one per 80 minutes,” said Diptee. “The article, my own military experience with fragmented mental health care, and Dr. Roberts’ ‘Coping with Wicked Problems’ course proved to be very influential when I created the Chronic Emotional Atrophy (CEA) theory.”

The CEA theory offers an explanation as to why people in the U.S. military could become suicidal. As Diptee describes it, CEA occurs when a person’s brain rapidly loses the ability to process emotions due to prolonged exposure to an emotionally-sterile environment.

“My CEA theory states that suicidal symptoms [in the military] are environmentally induced due to the machine-like, stone-faced bravado that occurs in military culture ... leaving little room for any honest expression of personal feelings or emotions,” said Diptee.

Macho-man syndrome negatively stigmatizes the expression of emotion and rewards emotional-numbness, he added.

“Expressing emotion and feelings is jokingly seen as a characteristic of the weak in the military,” he continued. “Further enforcing the bottling up of emotions, which can have detrimental effects leading to CEA.”

As Diptee continued his research into the root causes of service member suicides, he began noticing a correlation between their underlying symptoms, and those of patients who experience frontal lobe damage.

“I created the CEA theory during the research process after discovering numerous symptomatic similarities between medical patients who suffered frontal lobe brain damage [due to surgery, accidents etc.] and suicidal military members with physically intact brains,” said Diptee.

According to an article published in the *Journal of Consulting and Clinical Psychology*, a patient who has experienced frontal lobe trauma may know the appropriate response to a situation, but present an inappropriate response to that same situation in action. Emotions that are felt may not be expressed in the face or voice. As an example, someone who is feeling happy would not smile, and his or her voice would be absent of the thought emotion. The person may also exhibit excessive, unwarranted displays of emotion.

“CEA is thought to slowly strip away the most delicate human qualities, including the ability to experience deeply embedded and secondary emotion,” said Diptee. “This is a service member with a frontal lobe that basically doesn’t work right, essentially emotionally numb.”

High-profile cases have lent credence to the research in question. Professional football player Junior Seau, who committed suicide two years ago, suffered from chronic brain damage due to multiple head injuries over his 20-year career, including the scaring of Seau’s frontal lobe. In addition, a correlation can be inferred between the machismo atmosphere exhibited in professional sports, to what one would encounter in military culture.

In following interviews, Seau’s ex-wife says that during the last years of his life, he suffered from random mood swings, depression, forgetfulness, insomnia and detachment. All are consistent symptoms of frontal lobe damage, and are in line with Diptee’s CEA theory.

The discovery led the former NPS student to ask a simple fundamental question, why do military personnel with physically-intact brains exhibit many of the same symptoms as medical patients with frontal lobe brain damage? And more importantly, are there correlations in how they can be treated?

Diptee quickly found the answer in a straightforward therapeutic approach. And he quickly set out to provide a resource to help fight the effects of CEA for deployed troops, creating the Emotional Vitality Assistant (EVA) model using a special application design process developed by Stanford University.

“EVA extends the physical mental health therapy space to the virtual space,” said Diptee. “It is a smartphone application that was designed to combat CEA by promoting continual personal expression in a private, confidential, virtual space with a counselor.

“It is believed that if service members continually and honestly express their deepest emotions in a safe non-threatening arena with a counselor, that the symptoms that lead to suicidal thoughts will not occur,” he added.

Diptee’s EVA application is grounded in a concept of therapy known as Frontal Lobe Stimulation (FLS).

“FLS strengthens emotional and mental health by helping a service member exercise emotional functioning of the [frontal lobe region of the] brain,” said Diptee. Exercising emotional function can be anything from writing or vocally expressing personal feelings, creating art or human bonding, he said.

“EVA will help fight the effects of CEA for deployed troops,” Diptee added, “because it is socially acceptable, technically feasible and eco-

“It is believed that if service members continually and honestly express their deepest emotions in a safe non-threatening arena with a counselor, that the symptoms that lead to suicidal thoughts will not occur”

Former NPS student Lt. Darryl Diptee

nominally viable.”

Since its creation, Diptee’s application and the supporting research has garnered a lot of attention, giving him the ear of military leaders and the private sector.

“I was invited to present EVA at the Naval Development Warfare Command’s IdeaFest in Hampton Roads, Va.,” said Diptee. “EVA received many positive responses and showed potential for use with the Navy Expeditionary Combat Command’s Embedded Health Care Provider (eHCP) program.”

Diptee has also received recognition from the offices of Senators Tim Kaine and John McCain, expressing interest in the EVA concept and requesting more information.

“The Navy Times requested an interview on my research and the EVA concept, focusing on innovation in the Navy and the people behind those innovations,” he said. “The EVA concept was recently shared with some flag staff, and it is currently under review.”

And it couldn’t be a better time for Diptee’s research. In light of Suicide Prevention Month, Secretary of Defense Chuck Hagel released a message to the forces emphasizing the Department of Defense’s ongoing support of research into the epidemic.

“The Department of Defense has invested more than \$100 million into research on the diagnosis and treatment of depression, bipolar disorder and substance abuse, as well as interventions for relationship, financial and legal issues — all of which can be associated with suicide,” said Hagel in the statement.

The challenge of military suicides is wicked indeed, and having found his solution to a wicked problem, the timing couldn’t have been better than the present for Diptee’s research.

“I believe that my research can help arm our military with the knowledge and tools to keep themselves mentally healthy and emotionally stable,” said Diptee. **IR**



Following an NPS course in how to approach seemingly insurmountable problems, Lt. Darryl Diptee, left, was inspired to create the Emotional Vitality Assistant, a smartphone application that provides service members with immediate access to mental health resources. The app is garnering increasing attention within the Navy, including a recent demonstration to Master Chief Petty Officer of the Navy Michael D. Stevens, right.

# OPERATIONAL RELEVANCE OUTSTANDING SCIENCE

BY KENNETH A. STEWART AND DALE M. KUSKA

THE NAVAL POSTGRADUATE SCHOOL HAS A LONG, STORIED TRADITION OF EXCELLENCE IN EDUCATIONAL AND SCIENTIFIC CONTRIBUTIONS TO THE NAVY OCEANOGRAPHER COMMUNITY ... A BREAKTHROUGH DISCOVERY ON THE REMOTE PINE ISLAND GLACIER OF ANTARCTICA IS ONLY THE LATEST.

More than a century ago, when the Navy established its School of Marine Engineering in Annapolis — precursor to the Naval Postgraduate School — sea service leadership knew that mastering the craft of navigation, of championing the power of the sea, was of immense importance.

Today's Navy faces different challenges when it comes to the mighty ocean, but they are still fundamentally grounded in a deep understanding of this powerful force. And while Navy Oceanography is a small community, its impact across the warfighting spectra is indeed quite large. From anti-submarine warfare to air operations, from the deep sea to the riverine environment, the requirement for accurate, timely and critical oceanographic data based on the latest advancements in technology, techniques and sound science are paramount to decision and operational superiority.

"The various branches of N2N6E collectively work to ensure enhanced knowledge of the physical environment through a wide array of sensing capabilities and data fusion," said Rear Adm. Jonathan White, Oceanographer and Navigator of the Navy. "This knowledge helps support safe and effective operations forward and provides warfighting advantage through decision superiority. I like to say that it gives us home field advantage ... at the away games."

Navy Oceanography is a global effort, and was certainly a critical component to the vision

retired Adm. Gary Roughead, former Chief of Naval Operations, had for decision superiority when he created the Information Dominance Corps. He emphasized the role of oceanography in this radical realignment to master the information spectrum, even if oceanography personnel did encompass less than five percent of its total force.

Similarly, oceanography at the Naval Postgraduate School is not a large department — with 24 total students earning master's degrees in meteorology/oceanography and physical oceanography in 2013 — but its impact on the community is striking. If a career Oceanography officer of the U.S. Navy progresses to O-5, that officer most likely will have attended the Naval Postgraduate School, for it is built into the career path. In fact, only one quota per year can be selected for an alternate educational path, to be fulfilled at the Massachusetts Institute of Technology. And the only doctorates available to the Oceanographer community are at NPS. Retired Rear Adm. David Titley was one of the fortunate officers selected for both master and doctorate studies at NPS, and

would go on to excel in his 32-year Navy career including his own tenure at the helm of Navy Oceanography.

"The way I look at it, training teaches you for the present, but education teaches you how to think about the future," said Titley. "And it's not only thinking about the future, but thinking about problems that ... you didn't even know were going to be of interest to the Navy."

That couldn't have been more apparent to Titley than the day when former CNO Roughead selected him to establish and advance the Navy's Task Force Climate Change.

"Probably the place where I most used my Ph.D. in the Navy was in the Arctic when Adm. Roughead asked me to stand up and lead the Task Force Climate Change. It was really taking a look at a lot of different information, trying to put it together in a way that would make sense for senior decision makers," explained Titley. "And we really

looked at everything from science to policy to operations. And the fact that I had a Ph.D., and that it had come from the Naval Postgraduate School, really helped me in learning how to think through that problem."

With this level of responsibility within the oceanography

officer community, finding Naval Postgraduate School alumni within the leadership structure isn't difficult. In addition to White, just about every command within the N2N6E structure has an NPS graduate at the helm. And these alumni keep a close watch on the program developing their junior-to-mid level

officers.

This past year, Rear Adm. Brian Brown, Commander, Naval Meteorology and Oceanography Command, joined White for a periodic curriculum review of the university's meteorology and oceanography academic programs. In fact, these two senior leadership positions are required to ensure operational relevance and academic quality are both maintained through periodic reviews.

"The output of the curriculum review is important to the overall health of our officer community, and it's also critical for the overall readiness of the Navy," said Brown. "How we educate our officers through the topics we cover, the breadth and diversity amongst the skills between oceanography and meteorology, is absolutely important for decision

making out in the fleet.

"For the Navy and operational oceanography, the curriculum here at NPS provides the most focused education. We have other opportunities at civilian institutions, but they won't cover what the Navy needs better than the Naval Postgraduate School."

## REMOTE ANTARCTIC RESEARCH DETAILS ICE MELT BELOW MASSIVE GLACIER

AN INTERNATIONAL TEAM OF SCIENTISTS AND GLACIOLOGISTS ARE REAPING THE DATA-RICH REWARDS OF AN EXHAUSTIVE EXPEDITION TO THE WESTERN ANTARCTIC ICE SHELF'S (WAIS) PINE ISLAND GLACIER, WHERE LANDMARK MEASUREMENTS OF OCEAN/ICE INTERACTIONS ARE BEGINNING TO CLARIFY WHAT EXPERTS HAVE LONG CALLED "THE BIGGEST SOURCE OF UNCERTAINTY IN GLOBAL SEA LEVEL PROJECTIONS."

Naval Postgraduate School Department of Oceanography Research Professor Tim Stanton and University of Alaska Department of Physics Professor Martin Truffer led the team to the remote edge of the Pine Island Glacier's massive shelf. And the results of their expedition are giving scientists a rare look beneath the ice at one of the most critical research sites on the planet — a site whose fate could affect the lives of millions.

Stanton and Truffer have been working for years with colleagues from Pennsylvania State University, NASA, the British Antarctic Survey, and New York University in an effort, funded primarily by the National Science Foundation, to detail exactly what is happening beneath the Pine Island Glacier.

The accelerated flow of glacial ice from Antarctica's WAIS into the Amundsen Sea has

# OCEANOGRAPHY RESEARCH AT NPS

The NPS Oceanography department's education mission is to provide a sound understanding of the science of physical oceanography and to develop the technical expertise to provide and use oceanographic and acoustic data and models in support of all aspects of sea operations and undersea warfare. Areas of expertise include:



The increasingly critical **polar regions** are being explored in numerous field programs in the Arctic and Antarctic involving ice camps, ice breakers and the development of numerical models to simulate the motion of sea ice and ocean currents at high spatial resolution.



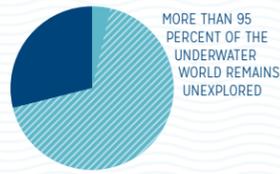
The **littoral/coastal** oceanography group has specific expertise in the area of coastal ocean circulation that derives from unique instrumentation and modeling capabilities.



**Nearshore** oceanography research is focused on field measurements of waves, surf zone currents, bottom morphology and sediment properties. The research is highly relevant to the Navy problems of special force operations, amphibious landings, and mine-counter measures.

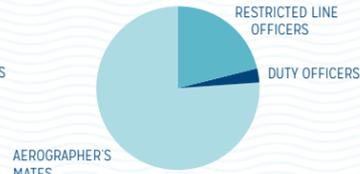


**Acoustical** oceanography research includes the quantification of physics, coherence, variability and predictability of sound propagation in littoral regions and the development and applications of acoustical remote sensing techniques to monitor the ocean's physical properties and marine mammal activities.



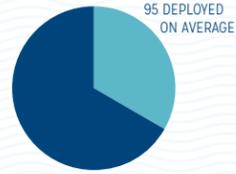
72%

Percentage of Earth covered by water



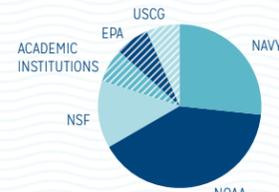
1650

Approximate number of Navy personnel in the oceanography community



285

Navy battle force ships across global oceans



45

Current vessels in the federal oceanographic research and survey fleets

## NPS' OCEANOGRAPHY ALUMNI LEGACY

Knowing the environmental conditions where U.S. servicemen and women are deployed is critical to mission success. Everything from forecasted weather to location-specific ocean currents to surface-ice buildup are provided by Navy ocean scientists to ensure accurate and relevant information is supplied to U.S. and allied forces across the globe in real-time. Almost all oceanography and meteorology naval officers come through NPS for graduate education and a chance to conduct important scientific research. Here are the commands and current leadership that make up naval oceanographers in 2013.

### NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND

COMMANDER: **Rear Adm. Brian B. Brown**

NPS DEGREE: MS with distinction in Meteorology and Physical Oceanography, 1997

MISSION: Command and management of the Naval Oceanography Program, utilizing meteorology and oceanography, GI&S, and precise time and astrometry, to leverage the environment to enable successful strategic, tactical and operational battle space utilization across the continuum of campaigning and at all levels of war – strategic, operational and tactical.

### NAVAL OCEANOGRAPHY OFFICE (NAVOCEANO)

COMMANDING OFFICER: **Capt. Paul Oosterling**

NPS DEGREE: MS Meteorology and Oceanography, 1995  
MISSION: Optimize America's sea power by applying relevant oceanographic knowledge in support of United States National Security.

### FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER

COMMANDING OFFICER: **Capt. John Okon**

NPS DEGREE: MS Meteorology and Oceanography, 1993  
MISSION: Produce and deliver weather, ocean and climate information for fleet safety, warfighting effectiveness, and national defense.

### NAVAL OCEANOGRAPHY OPERATIONS COMMAND

COMMANDING OFFICER: **Capt. Tony Miller**

NPS DEGREES: MS Meteorology and Oceanography, 2001; Ph.D. Physical Oceanography, 2006  
MISSION: Provide strategic, operational and tactical oceanographic, riverine and atmospheric decision superiority to U.S. and coalition forces.

### FLEET SURVEY TEAM

COMMANDING OFFICER: **Cmdr. Ronald R. Shaw Jr.**

NPS DEGREE: MS Meteorology and Oceanography, 2000  
MISSION: A rapid-response military team with capabilities to conduct quick-turnaround hydrographic surveys anywhere in the world.

### NAVAL ICE CENTER

COMMANDING OFFICER: **Cmdr. John W. Simms**

NPS DEGREE: MS Meteorology, 2000  
MISSION: Provide the highest quality, timely, accurate, and relevant snow and ice products and services to meet the strategic, operational, and tactical requirements of U.S. national interests across a global area of responsibility.

### Provide Real-Time and Forecast Conditions to Warfighters:

- Anti-Submarine Warfare
- Aviation Operations
- Expeditionary Warfare
- Fleet Operations (Strike and Expeditionary)
- Geophysics
- Intelligence, Surveillance and Reconnaissance
- Maritime Forecasting and Operations
- Meteorology
- Mine Warfare
- Navigation
- Precise Time and Astrometry
- Special Warfare
- Undersea Warfare

## IN DEEP

One of the primary goals of the Naval Oceanography Office is to provide accurate environmental information to warfighters around the globe at any given time. NPS prepares officers with advanced scientific and oceanographic knowledge to take back to the fleet. Below are recent meteorology and physical oceanography theses conducted by NPS graduates in academic year 2013 (Oct. 2012-Sept. 2013) and sponsored faculty research projects.



*Small Flux Buoy for Characterizing Marine Surface Layers*  
**Lt. Carlos A. Zúñiga, Chilean Navy**

*Wave and Current Observations in a Tidal Inlet Using GPS Drifter Buoys*  
**Lt. Cmdr. Stephen A. McIntyre, USN**

### TECHNICAL REPORT

*Comparison of SWATH and monohull vessel motion for regional class research vessels*  
CO-AUTHOR: Curtis A. Collins  
PREPARED FOR: Office of Naval Research



*Dynamical Influence and Operational Impacts of an Extreme Mediterranean Cold Surge*  
**Lt. Cmdr. Adam Shinabarger, USN**



*Three-Dimensional Structure of Thermohaline Staircases in the Tropical North Atlantic and Their Effect on Acoustic Propagation*  
**Lt. Amy C. Bulters, Royal Australian Navy**



*Assessment of Hybrid Coordinate Model Velocity Fields During Agulhas Return Current 2012 Cruise*  
**Lt. Cmdr. Jonathan A. Savage, USN**  
*NPS Outstanding Thesis*



*Tidal Wave Reflectance, Evolution and Distortion in Elkhorn Slough, Ca*  
**Lt. Cmdr. Casey J. Gon, USN**

*Characterization of the Vertical Structure of Tidal Currents in the Golden Gate (San Francisco) Inlet*  
**Cmdr. Muhammad Khalid, Pakistan Navy**

### DEPARTMENT RESEARCH

*Evaluation of Joint Semi-Automated Forces Electromagnetic Propagation Prediction Methods for Navy Continuous Training Environment/Fleet Synthetic Training. Results and Recommendations*  
CO-AUTHORS: Arlene A. Guest, Peter S. Guest  
SPONSORS: Naval Warfare Development Command



*The Effects of a Remote Atoll and Lagoon on the Marine Boundary Layer*  
**Lt. Cmdr. Eric L. Daley, USN**



*Channelized Ice Melting in the Ocean Boundary Layer Beneath Pine Island Glacier, Antarctica*  
PRINCIPAL INVESTIGATORS: Timothy Stanton, Bill Shaw



*Wave Current Interactions and Wave-Blocking Predictions Using Non-Hydrostatic Wave Model*  
**Lt. Kaitlyn E. Longley, USN**

*Salinity, Temperature, and Optical Characterization of a Tidally Choked Estuary Connected To Two Contrasting Intra-Coastal Waterways*  
**Lt. Cmdr. Jeanette Sheets, USN**

*Mesoscale Simulations of Coastal Circulations Evaluated Using Measurements from a Dense Meso Network*  
**Capt. Daniel B. Muggelberg, USAF**



*Temporal and Spatial Variability of Black Sea Hydrodynamics and Chlorophyll: A Concentration with Connection to Wind Forcing*  
**Lt. j.g. Emre Gulher, Turkish Navy**

### DEPARTMENT RESEARCH

*Littoral Oceanography for Mine Warfare*  
PRINCIPAL INVESTIGATOR: Peter C. Chu  
SPONSORS: NAVOCEANO

*Analysis of Bioluminescence and Optical Variability in the Arabian Gulf and Gulf of Oman For Naval Operations*  
**Lt. Thai Q. Phung, USN**



*The Effects of Shoaling Internal Tides on Benthic Exchange Events and Near-Boundary Mixing Along the Continental Shelf*  
**Ens. Darren L. Pastrana, USN**

*Numerical Modeling of the Vertical Heat Transport Through the Diffusive Layer of the Arctic Ocean*  
**Lt. Cmdr. Angela S. Lefler, USN**

*An Evaluation of Sea Ice Deformation and Its Spatial Characteristics from the Regional Arctic System Model*  
**Lt. Thomas J. Mills, USN**



*Modeling the Effects of Transbasin Nonlinear Internal Waves Through the South China Sea Basin*  
**Lt. Joseph J. Ceschini, USN**

### PUBLISHED RESEARCH

*Barotropic Tide in the Northeast South China Sea*  
CO-AUTHOR: Ching-Sang Chiu  
PUBLICATION: IEEE Journal of Oceanic Engineering

*Intelligence Fused Oceanography for Anti Submarine Warfare using Unmanned Underwater Vehicles*  
**Lt. Cmdr. Paul Kutia, USN**

been a concern of scientists since the late '80s. But as warm sea water flows along the ocean floor toward the grounding line, where the massive glacier and land meet, the resulting boundary layer current heads back out to sea along the underbelly of the glacier, carving a series of melt channels along the way.

In late 2012, after years of planning, missed opportunities, and uncooperative weather, the team was able to deploy one-of-a-kind sensors and profilers designed and built by Stanton through the 450-meter ice shelf. The resulting data sets are revealing, for the first time, exactly how much ice is melting beneath the massive glacier, one that is estimated to contribute an astounding seven percent to overall global sea level rise.

"Fresh water forms every time [the sea] injects heat into the shelf," explained Stanton. "The warm water starts to melt the ice at the grounding line and creates a plume called a boundary layer current. We measured the effects of that current for the first time.

"There were basically three scientific activities performed at the Pine Island Glacier sites ... Our instrumentation packages underneath the ice shelf, dual seismic and radar mapping by Penn State, and the British Antarctic Survey group's radar survey," said Stanton.

Together, these activities reveal a detailed picture of glacial ice melt beneath the shelf, stripping away the glacier's bottom at a rate of approximately six centimeters per day, Stanton said.

The Pine Island Glacier truly is one of the most remote locations on the planet, and conducting research at the end of the world was no easy feat. Stanton's field site was located 1,800 kilometers from McMurdo Research Station, a small but surprisingly well-appointed facility that provides welcomed support to various research efforts on the southern continent. Once you depart McMurdo, however, sub-zero temperatures, snowstorms, and ice as far as the eye can see, pose enormous logistical challenges, but even they might be overshadowed by the research site's remote location.

"Working out of McMurdo to do research on Pine Island is like sitting in Seattle and trying to do field work in Minnesota

with nothing in between," said Truffer. "It was an incredible physical challenge trying to get out there, we had done nothing before on this scale."

There were also years of setbacks prior to the successful deployment of the team's equipment, which Truffer reluctantly describes as a "season of learning."

But in December 2012, all the pieces fell into place. The team's equipment reached McMurdo by vessel, and was then flown by a ski-equipped C-130 Hercules to a staging area, then transported via Twin Otter aircraft to the ice shelf—a trip of more than 1,100 miles. Once on the shelf, the equipment was packaged aboard snowmobiles and trekked to pre-selected drill sites.

Logistical headaches aside, Stanton and Truffer note that detailed data of the ocean/ice interactions beneath the Pine Island Glacier specifically have been on glaciologists' wish lists for decades. Dr. Terry Hughes with the University of Maine underscored the importance of the Pine Island Glacier in 1982 when he referred to it as "the weak underbelly of the West Antarctic Ice Sheet."

Truffer became involved in the Pine Island Glacier project after previous observations of warm water glacial melting in the Arctic and his past ice-drilling expertise.

"The science excites me ... Ten years ago

we looked at this issue of glacier melting from oceans at several places. We looked at a glacier in Alaska where there was very warm, 45-degree water in front of a glacier and determined that this is a big part of how ice is lost. We then went to Greenland, where we saw 15 kilometers of glacier front lost in three years due to warm water flowing underneath," said Truffer.

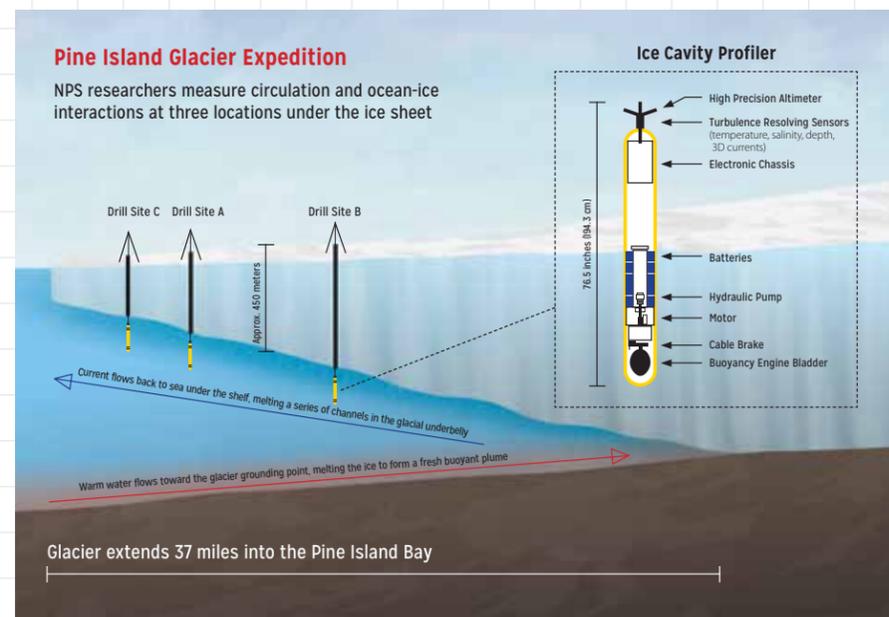
While previous research detailed the processes that were believed to be occurring beneath the Pine Island Glacier, Stanton and his team needed precise measurements. He selected what he believed would be three ideal sites to measure basal glacial melting, where boundary layer currents had carved channels beneath the ice shelf.

"We wanted to be able to measure the currents and turbulent exchange within one of these channels and then use radar measurements across the structure to compare melt rates," said Stanton.

"There is no one measurement that gives us all the answers," he continued. "What we have brought to the table are detailed measurements of melt rates that will allow simple physical models of the melting processes to be plugged into computer models of the coupled ocean/glacier system. These improved models are critical to our ability to predict future changes in the ice shelf, and glacier melt rates of the potentially unstable Western Antarctic Ice Sheet in response to changing ocean forces," continued Stanton.

Stanton's measurements were made

### THE ACCELERATED FLOW OF GLACIAL ICE FROM ANTARCTICA'S WAIS INTO THE AMUNDSEN SEA HAS BEEN A CONCERN OF SCIENTISTS SINCE THE LATE '80S.



From left: Base camp on the remote Pine Island Glacier. NPS Research Professor of Oceanography Tim Stanton, middle, helps fellow researchers test the hot-water drill that will be used to create a tunnel through the ice. The research team lowers an ocean profiler, one of several pieces of equipment specially designed and built at NPS, into the ice shelf.

possible by the successful development and deployment of his Ocean Flux Profiler and Fixed-Depth Ocean Flux Package sensors.

"We developed a specialized suite of ocean instrumentation that could sample turbulence and lateral transport rates in the ocean cavity, and autonomously offer two-way communication of data and sampling commands over yearlong sampling periods," said Stanton.

But to get those results, Truffer had to bore through nearly 500 meters of solid ice to create a pathway by which the instruments could be placed beneath the glacial shelf, and they had to do it quickly before the holes froze back up.

"We used a 'so-called' hot water drill. We started out by melting about 1,000 gallons of snow, and then heated the water and started pumping it into our hole in the ice," said Truffer. "Utilizing this process, we were able to drill boreholes at three sites. When we started out we did not believe we would be able to do more than two sites in a single season."

Once the instruments were deployed, and the boreholes froze over, the sensors were anchored to the bottom of the shelf.

"The idea that we were able to drill through 500 meters of ice and then deploy our sensors through the hole that we had made was remarkable," said Shaw.

The sensors measured details such as salinity, ocean water turbulence and ice thickness data, which were transmitted back to NPS for analyses.

"We were essentially measuring the salt flux and the little turbulent eddies that occur within the current ... We could integrate these findings over time, by adding up the

salt flux and the basal retreat. Using these two methods allowed us to get at the melt rate," said Stanton.

"It was very challenging building instruments that gather this data, and were small enough to go down the boreholes. This was the most challenging field program I have ever done, but we are very pleased with the results," he added.

Shaw compares the eddies beneath the ice to an inverted river flowing along the underside of the ice shelf. "It's a lot like a river system, but instead of eroding its surroundings, it melts them," he said.

"The objective is to know how fast [the ice] is melting now, but also to understand how much heat is coming in. Without these measurements, we would be unable to determine precisely how [warm seawater] is affecting actual melt rates," added Stanton.

"We now know how much heat is getting under the ice shelf and how much it is melting glacial ice. As it melts, it is lifting up the ice shelf, allowing water to go in even further, resulting in the grounding line lifting up," said Stanton. "As you lift it up, you reduce the drag on the ice shelf allowing the ice to flow more quickly down from the ice sheet.

"Pine Island Glacier is a principal outlet of WAIS that has rapidly thinned, retreated, and accelerated. The spatial pattern of thinning suggests that the glacier drawdown is the direct result of increased basal melting of the ice shelf that has reduced its buttressing effect," Stanton explained.

The buttressing, or friction, of the ice shelf's lateral contact with land or slow-moving ice keeps the seaward movement of glacial systems in check, ultimately creating an overall equilibrium where glacial ice fills in the rear as the front of the glacier slowly melts into the ocean and occasionally breaks off into large icebergs.

The measured glacial melt rate at the site, and through the channel on Pine Island, at approximately six centimeters per day, reveals a critical need to understand channeled melting underneath these massive

glaciers, as they are major contributors to global sea-level rise now, and are expected to be so into the future.

And there is a more ominous potential outcome as well. As the grounding line continues to retreat into an ever-deepening basin, more ice is exposed to melting by the

warm ocean water, and the ice flux towards the sea will increase as well. This has major societal implications as this part of the ice sheet by itself holds enough water to raise global sea level by more than one meter.

While the potential of losing the entire Pine Island Glacier is remote, it may not be nearly as remote as the research site itself, where the team is already developing plans to return and continue their research. As scientists continue to detail the precise melting rates below Pine Island Glacier and similar sites, advanced understanding of these massive systems, and their overall impact on sea levels, become increasingly clear. **IR**



A recent student analysis at the Naval Postgraduate School into lighting life-cycle costs detailed up to \$6 million in savings over three years for the Military Sealift Command's hospital ship USNS Comfort, currently underway to the Philippines to assist with disaster relief and medical aid after Typhoon Haiyan tore through the country in November 2013.

## NPS Student Analysis Reveals Multi-Million Dollar Savings for USNS Comfort

By Kenneth A. Stewart

A RECENT ANALYSIS of lighting life cycle costs aboard the *USNS Comfort*, conducted by students at the Naval Postgraduate School, revealed a solution that could save taxpayers up to \$6 million in as few as three years.

The *Comfort* is a 1,000-bed Military Sealift Command (MSC) hospital ship, originally built in 1977 as a commercial oil tanker and converted by the Navy in 1986.

"We have everything a 1,000-bed hospital would have, but additionally, we have a galley and the quarters that support a working staff of 2,200 people," said *USNS Comfort* Chief Engineer Joseph Watts. "The *Comfort* is basically a giant, floating building."

In the never-ending effort to save money and improve efficiency, Watts requested a life cycle lighting analysis of the *Comfort* to reduce electrical, maintenance and disposal costs associated with shipboard lighting.

"We generate our own electricity at sea and plug into a public meter while in port," said Watts. "The bills are quite impressive, and I was interested in reducing the cost and man hours necessary to keep the lights on."

An NPS student team took on the challenge, exploring the feasibility of replacing traditional fluorescent lighting aboard the *Comfort* with new LED fixtures and bulbs. And this is no ordinary job ... the *Comfort* uses approximately 14,000 24-inch bulbs and another 14,000 48-inch bulbs.

"If you wanted to change a few light bulbs in your own home, you wouldn't have to take out a second mortgage," said operations research senior lecturer, retired Navy Capt. Steve Pilnick. "But what if the scope of the problem involved government purchases of tens of thousands of bulbs plus

government employee maintenance staffing spread out over many years?"

The student team examined every aspect of a change at this magnitude, looking at life expectancies, costs, environmental impact and energy efficiency. In addition, providing consistent lighting in the presence of radio frequency interference and harmonic distortion produced by X-ray and scan machines aboard the ship was a critical consideration.

In the end, the student team provided a detailed analysis on all factors related to the potential switch, including millions in cost savings over just a few years.

"The Navy benefits from this study ... It provides the detailed cost-versus-benefit analysis necessary to meet mission requirements with tight budgets," said Pilnick. "Military Sealift Command leadership was able to make an informed decision due to the work of government employees that understood the problem and were able to communicate a solution."

The student-led lighting cost analysis was part of a distance learning capstone project completed in conjunction with NPS' distance learning Master of Systems Analysis curriculum. The program is designed primarily to provide graduate level education to mid-grade naval officers whose career paths do not afford them the opportunity to conduct resident graduate studies at NPS.

"We focus our curriculum on practitioners, and we build into our curriculum projects that are meaningful to our students," said Pilnick. "Ninety-five percent of our students work on projects that come out of, or are sponsored by, organizations for which they are currently working." **IR**

## Energy Executive Education Helps Navy Leaders Implement Cultural Change

By Kenneth A. Stewart

A UNIQUE AND DIVERSE mix of Navy officers, senior enlisted and DOD civilians converged upon the Naval Postgraduate School, Sept. 23-27, to take part in an intensive week-long executive education course that seeks to change the Navy's culture of energy consumption.

NPS' Energy Academic Group (EAG) and its Cebrowski Institute created the course to teach senior leaders how to foster change in direct support of Secretary of the Navy Ray Mabus' energy security goals, one of which is the implementation of sweeping cultural change throughout the services, making energy a key component of every decision.

"Presence is what we are all about. When there was an earthquake in Haiti, a tsunami in Sendai or a fighter was needed in Afghanistan, we were there," said Mabus in a recorded message to the attendees.

"Without the energy to feed our platforms, we might not be there when it matters," he continued. "We need forward thinkers during this transformation forward ... We need your leadership and innovative thinking to meet this challenge."

"It's a cultural change that is happening on the deck plates," Mabus said. "Being locked into things because that's the way they have always been done is not a rationale, it's an excuse."

The forum provides attendees with an engaging array of course work, lectures and experience tours, exposing them to some of the nation's best minds in the areas of conservation, alternative energy and efficient engineering.

But while these topics are consistently referenced throughout the week, NPS organizers insist the program is not about environmental advocacy.

"Our focus is on the warfighter," said Sue Higgins, Deputy Director of the Cebrowski Institute. "A \$1 increase in the price of oil equates to a \$30 million cost to the Navy ... that money has to come from somewhere, and it generally comes from education and training," she continued, referencing the subsequent erosion in military readiness.

Even more critical than cost, however, is the danger heaped upon service members tasked with bringing a steady supply of fossil fuels to both man and machine on the front lines. And it isn't much better out on the seas, says one of the forum's key presenters, who stressed the futility of being forced to leave an area of operations to gas up.

"Why am I so passionate about this energy business?" asked Deputy Chief of Naval Operations for Fleet Readiness (N4), Vice Adm. Phil Cullom. "Because I remember that time, off the coast of Kosovo, when every couple of days we'd have to leave the Adriatic to go out to the Mediterranean to refuel ... We would be off-stage for 12-16 hours, and were useless."

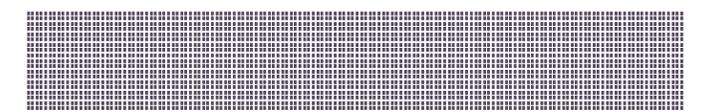
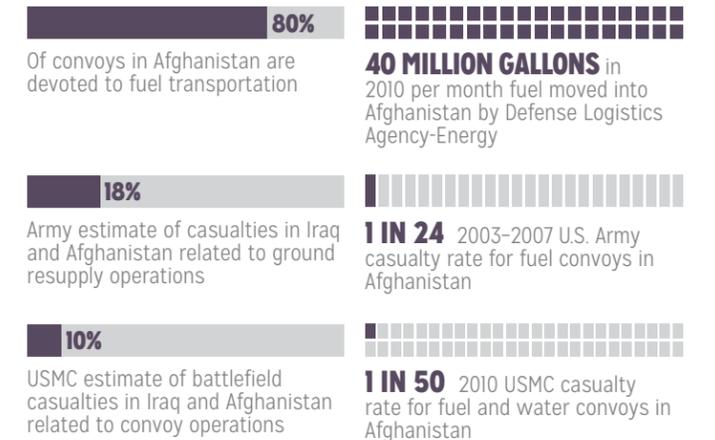
Cullom is one of the Navy's leading energy thinkers and has been working to change the Navy's culture of energy usage for more than a decade.

Joining Cullom in presenting to the class included some of the energy realm's top thinkers, such as retired Rear Adm. Len Hering whose work with the California Center for Stable Energy is leading innovative solutions in water use and transportation. Also present was Rocky Mountain Institute Chief Scientist Dr. Amory Lovins, a widely recognized, energy-efficiency guru who was named one of Time magazine's 100 most influential people in 2009.

With the daunting challenge of creating service-wide cultural change,

ultimately, time will be the greatest enemy of Mabus' energy efficiency goals. But with efforts like the Energy Executive Education Seminar continuing, NPS is showing today's sea service leadership how to rethink forward power projection. **IR**

### ENERGY SECURITY IS NATIONAL SECURITY



Vice Adm. Phil Cullom, Deputy Chief of Naval Operations for Fleet Readiness (N4), has spent more than a decade working to change the Navy's culture of energy usage. Cullom, along with several leading experts in energy efficiency and innovation, taught a weeklong course in how to ignite cultural change in energy utilization across the Navy and Marine Corps.



Scenes from the Aug. 2013 Joint Interagency Field Experimentation at Camp Roberts, Calif. From left, NPS Associate Professor Timothy Chung with a unicorn UAV. A gas-powered Rascal UAV in flight. A trio of multi-rotor UAVs. The birds-eye view monitoring station. NPS' fleet of unicorn UAVs for swarm research. A researcher launching a Stalker UAV using a sling-shot method.

## NPS Leads Collaborative Effort to Inspire Innovation Across Government and Beyond

By Kenneth A. Stewart

**THE NAVAL POSTGRADUATE SCHOOL'S** Joint Interagency Field Experimentation (JIFX) program brought together more than 400 researchers, scientists, first responders and military personnel, Aug. 5–8, to conduct a flurry of experiments and evaluations at the California National Guard's Camp Roberts facility in southern Monterey county, Calif.

Experimental technologies — with names like “The Squid” and “The Crowd and the Machine” — operate side-by-side with techy “wrist watch” gadgets that not only tell time, they also link-up with robotic sensors and provide users with advanced situational awareness (SA). Add a barrage of energy-efficiency technologies, innovative structural design products, and unmanned aerial devices of diverse shapes and sizes, and you have an environment where the solutions to some of the nation's most pressing security challenges can be perfected.

“Everyone out here is someone the government believes may be able to help solve a problem,” said Field Experimentation Director, Associate Professor Ray Buettner with the NPS Department of Information Sciences — Buettner has led the quarterly event for the past several years. “I don't know of any other place in the government that brings together these kinds of people, and offers this many opportunities for interaction.”

JIFX organizers describe the event as a collaborative learning environment, a partnership between the military, government, civilian entities and academia where innovative thinkers across several bureaucratic boundaries come together to solve problems.

“JIFX helps us to see what is already out there, in lieu of embarking upon an expensive government acquisition project,” said John Verrico with the Department of Homeland Security (DHS) Science and Technology Directorate.

JIFX participants and their associated experiments are organized under the umbrellas of intelligence, surveillance and reconnaissance (ISR); command and control (C2); humanitarian assistance and disaster relief (HA/DR); electronic warfare; and, deployable infrastructures.

In addition to the usual joint service personnel dotted throughout, officials from DHS' Federal Emergency Management Agency (FEMA)

have become active participants in JIFX. Representing first responders across the spectrum, FEMA officials explore everything from mobile network mapping technology to rapidly deployable housing and C2 structures. Much of FEMA's interest was piqued by new technologies centered on HA/DR operations and solutions.

“HA/DR is very active out here ... What they are learning is good for [the military as well], especially in light of the current budgetary restraints,” said Buettner. “It's not all about things that fly and shoot, it's also about finding non-kinetic solutions to non-kinetic problems.”

FEMA Chief Innovation Advisor Desiree Matel-Anderson has been working with NPS researchers, JIFX organizers and her DHS colleagues to encourage new ideas within the organization — something she hopes will lead to workable HA/DR and homeland security solutions.

“We are building up a culture of innovation with community input ... maximizing the great ideas that are festering in the organization,” said Matel-Anderson. “By working with JIFX, we are able to test some of those great Ideas.

“Disaster recovery teams are in the field right now working with people ... We want to work with a ‘whole of community’ response to aiding disaster survivors,” she continued. And that ‘whole of community’ approach can be greatly enhanced by capitalizing on modern social networking technologies and the habits of its users.

“It's part of an open government concept where we share information that we receive with the community and seek their assistance,” said FEMA Business Management Division Director Carlos Davila. “We are concerned with how we can rapidly identify survivors, find out what they need and ensure that their needs are met.”

One of the advantages to the JIFX approach is the ability to reveal solutions from individual technologies that were not initially designed to address those problems.

In one example of technological crossover, FEMA Corps volunteers recently used hand-held mobile devices to conduct survivor registration during HA/DR operations in Moore, Okla. In the process, they were also

able to map cell phone connectivity, creating a “heat map” that could be used by HA/DR personnel to reach survivors.

Another featured JIFX initiative with potential HA/DR applications, and many others, is an attempt by military engineers to replace the old Barracks Huts, or B-Huts, with new modular structures that can be quickly assembled and used for either shelter or work space.

The U.S. Army Engineer Research Development Center (ERDC) and the Department of Homeland Security developed the new Structural Insulated Panel, or SIP Hut. According to ERDC, it can be built in just five squad hours, using two skilled leaders with unskilled labor, and can provide substantially reduced energy demand, reduced construction time, reduced construction footprints, and improved quality of life.

“We have a solution to a problem,” said U.S. Army Lt. Col. Steven D. Hart. “The SIP Hut, because of its rapid constructability and low energy footprint, is well suited for disaster relief applications and other emergency housing needs,” Hart added.

In addition to emerging technologies, a long time mainstay at quarterly JIFX events with direct military applications, and equal opportunity for crossover into DHS and civilian issues, is unmanned systems. Research into all areas of unmanned platforms has been an important part of the JIFX experimentation program since its inception.

NPS systems engineering Associate Professor Dr. Timothy Chung has been working with a squadron of Unicorn unmanned aerial vehicles (UAV) over the past few events, with a goal of a single operator controlling a “swarm” of up to 50 aircraft.

“Swarming is the notion of having multiple agents that work in a coordinated manner to achieve some sort of objective,” explained Chung. “With

the expanding presence of unmanned systems, we need to start thinking about scenarios where we or an adversary might start using large groups of these unmanned systems in a combined way ... Even if enemy drones are not sophisticated, they might be able to overwhelm U.S. air defenses.”

Another system that received considerable attention at the recent event was InstantEye, a quad-rotor UAV that can fly both vertically and horizontally at speeds of up to 30 mph.

“If you need eyes above, this will give them to you very quickly, within 30 seconds, and with 30 minutes of flight time,” said Thomas Vaneck with Physical Sciences Inc., developer of the vehicle.

In spite of the broad diversity of the technologies being evaluated at JIFX, there is one commonality ... the majority of them were first developed to meet national defense needs. But like

many defense technologies throughout history, they have the potential to provide tremendous benefit to homeland security and civilian applications as well.

One such blossoming area of study earmarked for future JIFX events, especially relevant in Monterey County's fertile Salinas Valley and the state's wine country, are public health and agricultural applications for UAVs. Sensors are being developed that can detect pathogens or crop-destroying pests, as well as sensors that monitor the temperature, moisture and other data necessary for optimal growth.

As the quarterly JIFX program continues providing a forum for the rapid development and deployment of defense-related solutions and technologies, the answers to countless other challenges — from humanitarian assistance and disaster relief operations to advanced efficient agriculture — can be perfected along the way. **IR**

*“Everyone out here is someone the government believes may be able to help solve a problem. I don't know of any other place in the government that brings together these kinds of people, and offers this many opportunities for interaction.”*

Associate Professor Dr. Ray Buettner  
NPS Field Experimentation Director

# NPS Establishes Central Information Exchange Portal for Combating Terrorism

By Amanda D. Stein

EACH DAY, AROUND the world, the Combating Terrorism Fellowship Program (CTFP) provides U.S. and international officers with innovative training and education in combating terrorism. Tens of thousands of security personnel from more than 140 nations have participated in CTFP classes and seminars offered by nearly a dozen institutions. But how can the program continue to keep graduates consistently at the top of their game?

A Naval Postgraduate School team of faculty and researchers took on this challenge, and the result of their efforts is now accessible to CTFP alumni around the world. GlobalECCO, or Global Education and Collaboration Community Online, has now launched in full offering a wealth of counterterrorism-focused resources, documents, games and forums.

NPS Department of Defense Analysis Associate Professor Michael Freeman serves as project lead on the effort, and says that while terrorism has become a more visible tactic of warfare over the past decade or two, it is far from new and will likely only increase.

“Terrorism has certainly risen to the forefront of modern warfare, but it is a form of warfare that has been with us for thousands of years,” explained Freeman. “Terrorist ideologies change, but their tactics and

strategies are, in fact, generally consistent over time. As wars between states have become and continue to be less common, our attention will increasingly shift to conflicts within states or between states and extremist organizations.

*“Terrorist ideologies change, but their tactics and strategies are, in fact, generally consistent over time.”*

Associate Professor Dr. Michael Freeman  
NPS Department of Defense Analysis

“Britain, Egypt, India, Algeria, Pakistan, Israel, the Philippines, Colombia and many, many others have been fighting terrorism for decades and even centuries in some cases.

What we are trying to do

with CTFP and GlobalECCO is share the experiences and lessons that others have learned,” continued Freeman. “We also hope to enable greater on-the-ground collaboration between countries fighting terrorism by building a community of CTFP alumni, many of whom have been and will be deployed to confront terrorist threats that are regional and sometimes global in nature.”

While most CTFP students take part in short certificate programs, a select few enroll in full graduate degree programs like those offered by the NPS Department of Defense Analysis, where they study alongside officers from around the world. And while CTFP’s programs are offered through a number of different institutions around the U.S., it was NPS’ participating faculty that realized the need for greater connection amongst the program’s alumni population.

“Many of the students, even here at NPS, don’t realize that they are sponsored by, and a part of, the larger CTFP effort,” said Freeman. “What we are trying to do is build a community. And it’s not just a community of students here, but a larger community of CTFP alumni from several institutions that includes NPS.”

The GlobalECCO website offers multiple avenues for continuing engagement, collaboration and education. The journal, Combating Terrorism Exchange or CTX, helps CTFP alumni stay abreast of developments and ideas in their field of expertise. CTX is a peer-reviewed journal that features articles and columns by experienced international counterterrorism practitioners from across the CTFP community and beyond.

Another way members of GlobalECCO are also encouraged to engage with their peers is through the site’s strategic game center with titles like Infochess, Guerilla Checkers and Asymmetric Warfare. Here, members can take on the role of the state or the insurgent in a number of original, two-player strategic games, most of which have been designed on the NPS campus.

But whether it’s a game, a journal article, or a conversation thread with colleagues, the bottom line to GlobalECCO is information exchange.

“The core of what we are really doing is providing some unique content, and a supporting online venue, that we think will encourage CTFP alumni to collaborate, communicate and to continue to learn,” explained Freeman.

The portal, at <https://globecco.org>, is open to all alumni of CTFP programs. Full access can also be granted to U.S. government personnel requesting it via a link on the website. ■



Naval Postgraduate School Department of Defense Analysis Professor Michael Freeman is pictured in his office accessing the GlobalECCO portal. The site, found at <https://globecco.org>, provides access to a wealth of scholarly materials, strategic games and more to the global Combating Terrorism Fellowship Program alumni community.



NPS Department of Applied Mathematics Professor Dr. Frank Giraldo, right, and his Nonhydrostatic Unified Model of the Atmosphere or NUMA is inching closer to possible multi-agency adoption. Over the past several months, Giraldo and Assistant Professor Lucas Wilcox, left, have been reworking NUMA to capitalize on advancements in graphic processing unit technologies, resulting in National Oceanographic Partnership Program sponsorship.

## Faculty-Developed Weather Prediction Model One Step Closer to Multi-Agency Adoption

By Kenneth A. Stewart

NAVAL POSTGRADUATE SCHOOL Professor of Applied Mathematics Dr. Frank Giraldo has been working for several years on a complex weather prediction tool, the Nonhydrostatic Unified Model of the Atmosphere or NUMA, which he and his team members hope will be adopted as the nation’s preeminent, multi-agency weather prediction model.

“Our work is targeted at providing weather prediction for the Navy and all of the various agencies who are looking to adopt a single model,” said Giraldo.

Although the work has been ongoing for some time, and is years away from full multi-agency implementation, NUMA has generated considerable interest and momentum both in the U.S. and abroad in recent months. In what could be a significant opportunity for further development, the Korean Institute of Atmospheric Prediction Systems (KIAPS) is looking to use NUMA as a prototype for the Korea Meteorological Administration (KMA).

“KIAPS is a nine-year, project-based institution and our mission is to develop Korea’s next generation operational numerical weather prediction (NWP) model,” said Dr. Tae-Jin Oh group leader of the KIAPS’ Dynamical Core Team. “Our product will eventually be used operationally.”

“They are a great organization with tons of fresh researchers hungry for research that can help us to get NUMA where it needs to be,” added Giraldo, who traveled to Korea in September to conduct further research and strengthen the NPS-KIAPS partnership.

In an additional vote of confidence, NUMA also recently received National Oceanographic Partnership Program sponsorship. The grant, awarded in response to a proposal by Giraldo and Assistant Professor Lucas Wilcox, will focus on harnessing the computational power of graphic

processing unit (GPU) technology within the NUMA model.

GPUs are processors that were originally designed for graphics, but Wilcox has demonstrated that they can be exploited to conduct complex mathematical equations as well.

“Only a small portion of modern CPUs are used for the floating-point computations found in NUMA, the rest of the chip is dedicated to running serial programs, such as Microsoft Word fast,” said Wilcox. “The GPU is a different technology, it is designed to crunch numbers in parallel fast... We want to develop a version of the NUMA codes that can run on GPUs and then push those codes upstream into the main version of NUMA.”

All of this computational power is necessary due to the complexity of what Giraldo is trying to replicate. He has to account for huge areas of atmosphere and replicate their conditions using mathematical formulas. As he increases fidelity and looks at ever-smaller swatches of atmosphere, the code becomes more complex and has to account for an increasing number of variables.

“Think of it like Google maps. If you zoom out you can’t see your house, but if you add more resolution you will be able to see your home... As you increase the resolution something has to give, you either have to increase your memory or time allotted for the equation, so we split the problem over multiple systems to increase resolution and speed,” explained Wilcox.

If successful, recent work with NUMA and GPU technology may lead to developments beyond the scale of weather prediction.

“We are also looking at how we can apply these same numerical techniques to model earthquakes,” continued Wilcox. “We intend to publish our work open-source so that other researchers can apply it to other models.” ■



The Joint Battlespace Awareness ISR Integration Capability (JBAIIC) team discusses lessons-learned during a daily after action review. JBAIIC was recently utilized at Naval Air Weapons Station China Lake to validate advances in the Naval Postgraduate School's Beyond Line of Sight Command and Control research program.

## NPS Researchers Lead Beyond Line of Sight Command and Control Research Effort

By Kenneth A. Stewart

**THE NAVAL POSTGRADUATE SCHOOL'S** Distributed Information Systems Experimentation (DISE) research group embarked upon an ambitious series of experiments in mobile Internet architectures designed to create a self-healing, self-forming network that facilitates defense command and control (C2) as well as intelligence, surveillance and reconnaissance (ISR) dissemination.

The project, dubbed Beyond Line of Sight Command and Control (BLOS C2), was developed in direct response to a Combatant Command requirement for a resilient, reliable mobile network with Type I encryption and anti-jamming capabilities that can survive in satellite-denied environments.

"The BLOS C2 architecture was designed to satisfy a Centcom capability gap in support of NAVCENT [U.S. Naval Forces Central Command] force protection threats, as well as a multi-service Centcom contingency plan," said BLOS C2 Principal Investigator and architect, retired U.S. Navy Capt. Bill Roeting.

For the last eight years, Roeting has worked to establish a high-band-

width networking capability to generate a common tactical picture as well as bi-directional C2 for special operations forces, joint tactical air controllers and other ground forces.

"This is the last mile in completing Vice Adm. Cebrowski's vision for a network-centric battlefield," said Roeting. "The BLOS C2 architecture will get the U.S. military one step closer."

*This is the last mile in completing Vice Adm. Cebrowski's vision for a network-centric battlefield. The BLOS C2 architecture will get the U.S. military one step closer."*

Retired Navy Capt. Bill Roeting  
Principal Investigator  
NPS Distributed Information Systems Experimentation

Roeting's solution to the beyond line of sight command and control problem utilizes Common Data Link (CDL) radios already in the Department of Defense inventory.

"CDL radios have the ability to be used as a platform to send data to other CDL radios. Each radio becomes a node in the BLOS C2 network," said NPS Department of Information Sciences Research Associate Professor Shelly Gallup.

But in order for the CDL radios to behave as desired, a software modification had to be made to make the CDL radios bi-directional and fully network capable.

CDL radios are generally limited to one-way, point-to-point data

links, but DISE researchers demonstrated that CDL radios can be used to provide a high bandwidth, bi-directional network by creating a hub and spoke network architecture suitable to supporting full motion video, Voice over Internet Protocol (VoIP), chat and enhanced still imagery.

"There were a lot of skeptics that said it could not be done, but we did it," said retired Navy Capt. Jack Jensen, an analyst with DISE. "We got the equipment into manned and unmanned platforms and it worked."

In order to extend the CDL driven network, DISE researchers took advantage of the Air Force Life Cycle Material Command's Tactical Pod (TACPod) — a communications and networking gateway designed for unmanned air systems.

"We are using MQ-9 Reapers ... with a tactical pod which acts as a kind of airborne relay for imagery and video, and allows for distributed users to pass information back and forth," said Gallup.

DISE researchers are also using U2 and Harrier aircraft as well as vehicle and command-center mounted delivery platforms, and intend to use an Air Force Advanced Targeting Pod (ATP) in future applications.

The experiments have to date proven that a variety of delivery systems were capable of relaying and converting data and imagery between aircraft, ships and Mission Operations Centers (MOC), potentially enhancing access to critical mission information, imagery and data.

"What we are trying to do is allow the Mission Operations Center (MOC) to see anything that is going on in their theatre," said Gallup.

The BLOS C2 program is indicative of the DISE approach, focusing on the enhancement of new or existing technologies to increase capability while decreasing cost, and most importantly, meeting mission requirements. Perhaps most important however, and similar to nearly all research efforts at NPS, students are active participants throughout the effort.

Gallup says continuing experimentation will examine varying setups, as well as limits of the network architecture, all in an effort to maximize mission effectiveness while saving time and money.

"We are testing different configurations of the systems and range limits for transmitting images, procedures and hardware. We are also looking at the engineering design parameters to see if they meet the requirements prepared in [our sponsors] requirement documents," said Gallup.

"We are looking at gaps in capability within the Department of Defense and seeing what is already in the inventory that can be used to close that gap," said Jensen. "DISE performs a very interesting service for the DOD and the Navy ... The taxpayers get good value out of what we do."

"Actual numbers have not been quantified," added Jensen, "but when you look at the cost of developing and acquiring new equipment, our approach to BLOS C2 will potentially save many millions of dollars and 5-10 years of research." ■

## New Research Center Seeks to Revolutionize Intelligence Analysis

A new research center at NPS has been created to focus research into the emerging field of intelligence integration, often referred to as multi-INT or multiple intelligence. The evolving field takes an interdisciplinary approach to the integration of data from disparate sources and associated systems to improve the results gleaned from current and future intelligence systems.

"We want to revolutionize the intelligence cycle," said Center for Multi-INT Studies (CMIS) Director Dr. Jim Scrofani. "The multi-INT approach seeks to develop the theoretical foundations, models and algorithms that make timely, robust and optimal situational awareness and decision making possible."

CMIS was born out of a growing realization that the collection of data has outpaced the ability to make sense of it — traditional reliance upon existing intelligence processing methods is no longer adequate.

"All Department of Defense and intelligence organizations use data sets from disparate sources to extract information about targets ... In their unprocessed forms, these data convey only partial information," said Scrofani. "Translating this information into knowledge requires an understanding of macro and micro relationships between the data, and converting that knowledge into effective, actionable intelligence."

"CMIS seeks to transform the methodologies for integrating and synthesizing data from disparate data sources in order to provide military users with operationally-relevant information in a timely manner," added CMIS Co-Director Dr. David Garren.

Center leadership hopes to accomplish this by, amongst other things, using advanced algorithms to automate time-consuming intelligence operations that tend to bog down analysts and take time away from cognitive analyses, tasks that human beings accomplish best.

"We need to allow humans to critically think and focus on the cognitive work, while leveraging the power of automation, where machines excel," said Scrofani. "By using algorithms that can tip and cue sensors, we can rapidly confirm or deny hypotheses, pointing analysts to the most probable answer as opposed to having them search the entire solution space for answers."

Lt. Ashley McAbee, an electrical and computer engineering student, is working with CMIS to develop maritime domain and track analytics that extract historical maritime transit patterns utilizing a database of Automatic Identification System (AIS) reports.

"Additionally, we are looking at this same open source AIS data to perform higher-level fusion. We want to go beyond standard track analysis, where we predict vessel trajectories. We want to detect target behavior and intention," explained McAbee.

A recent NPS graduate, Lt. Kris Tester, also worked with CMIS to develop some of the algorithms that may help make this sort of analysis possible.

"Kris developed advanced algorithms that can help us see collusion among vessels of interest, or subtle behaviors like shadowing or trailing. We want to extend this research, and use machines to analyze these large volumes of data to detect patterns that are often elusive to human detection," said Scrofani.

While the potential maritime benefits of the CMIS approach are promising, similar techniques can be applied to the analysis of vehicle or troop movements on the ground.

"You could also look at the movement of enemy ground forces, the movement of troops and vehicles, and tell when things are happening in coordination, in a manner that may indicate hostile intent," said Scrofani.

As the new center continues to develop, Scrofani hopes CMIS can provide an influx of both leadership and researchers into the multi-INT community. Ultimately, he envisions a center that will, "serve as the national focal point for advancing multi-INT and intelligence integration research, education, and foster the development of a multi-INT community."

# NPS Alumnus Returns to Campus to Keynote Summer Graduation

By MC2 Chablis J. Torrence

**VICE ADM. RICHARD W. Hunt**, Director of the Navy Staff and a Naval Postgraduate School telecommunications systems management alumnus, returned to his alma mater to celebrate the 400 new fellow graduates earning 412 degrees during the 2013 Summer Quarter Graduation Ceremony held in King Auditorium, Sept. 27.

Presiding over a graduation ceremony for the final time was Interim President Rear Adm. Jan E. Tighe, also an NPS alumnus, who after welcoming the graduates and their families applauded the work of faculty and staff in executing the school's mission.

"Before I introduce our guest speaker, there are a few groups of people I would like to recognize," said Tighe. "First and foremost, I would like to acknowledge our faculty and staff that made this graduation possible. Your passion and commitment to this institution and to our students is profound and very appreciated."

Tighe also recognized the assembled graduates' families and friends for their own roles in the achievements of the class.

"You share in today's success by being a part of our students' lives, and

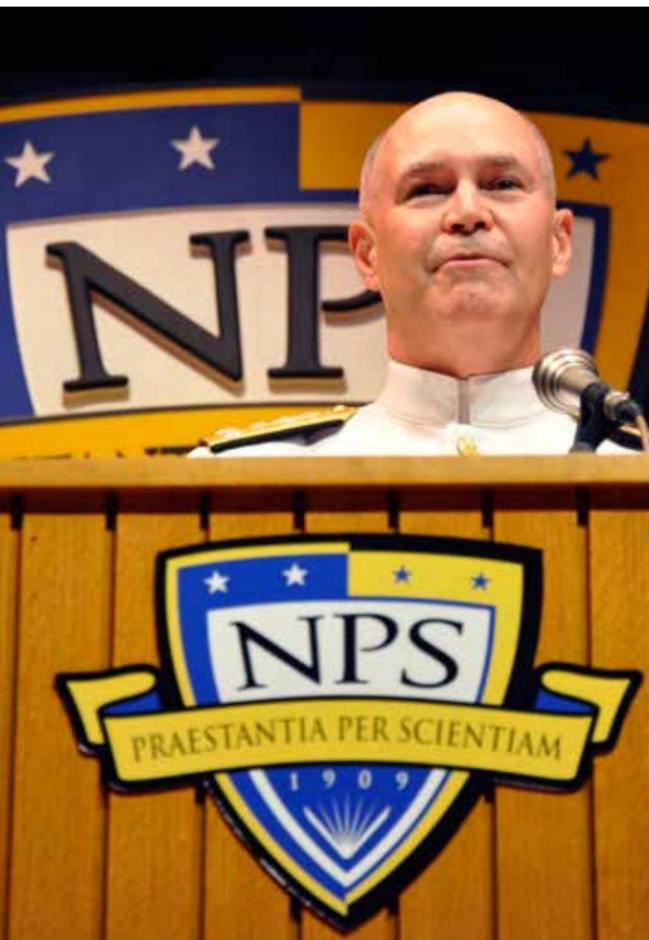
supporting them to achieve their educational goals," she noted. "Your role is often overlooked or understated, but today would not be possible without your sacrifice, love and support."

With the tragic events of the Washington Navy Yard (WNY) shooting less than two weeks removed from the ceremony, Tighe also made a point to recognize the Navy families impacted by the devastating crime. The Summer class had its own direct connection to the tragedy, with personnel from the Naval Sea Systems Command at WNY graduating through one of the university's distance learning programs.

As Hunt took the podium, he offered his own recognition of a job well done.

"I would first like to acknowledge Rear Adm. Tighe for the terrific job that she has done as interim president over the last year," said Hunt.

"I'd also like to thank the support and professionalism of the entire NPS staff and faculty during this period," Hunt said. "You have insured that the Naval Postgraduate School has continued to excel as one of our nation's leading higher education institutions." **IR**



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# Godspeed, Scott Carpenter

On Thursday, Oct. 10, Mercury 7 astronaut and NPS alumnus retired Navy Cmdr. M. Scott Carpenter passed away in his home in Vail, Colo.

Carpenter is best known as one of the original seven astronauts selected for the Mercury Program, and would later cement his legacy in American history in May 1962 when he circled the Earth three times aboard the *Aurora 7* — a name he coined for the craft after nature's stunning displays of color.

"It was a cherished experience," said Carpenter in a past interview. "I got the chance to see the inner workings of the grand order of things ... And it proves that men can do about anything they want to if they work hard enough at it."

Carpenter maintained that while the experience of traveling into space was extraordinarily gratifying, he garnered equal satisfaction from the challenge and camaraderie in simply accomplishing the feat. Space Systems Academic Group Chair Dr. Rudy Panholzer agrees.

"Scott Carpenter embodies the perseverance and determination of America's early manned space flight program," he said. "I believe the unending resolve to send Americans into orbit during this era is nearly as remarkable as the achievement itself."

And while Carpenter left an undying legacy on American history, he also began a lasting one right here on the NPS campus. Carpenter was a graduate of the university's General Line School in 1959, and the first alumnus selected to be a NASA astronaut.

More than 40 NPS graduates would follow in his footsteps, astronauts that span every space program from the early Mercury days through the final flight of the space shuttle, and beyond.

And while much has changed in the education and research programs offered at the university, students and faculty alike can still embody the principles upon which Carpenter stood firm.



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