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NAVAL POSTGRADUATE SCHOOL

IN REVIEW MAGAZINE

JANUARY 2012

INSIDE:

Daniel T. Oliver
Vice Adm., United States Navy (Ret.)
President, Naval Postgraduate School

Given that we are graduating four classes of master and doctoral degree students — some 1,000 plus graduates — every year, a very unique environment is created on this campus. It's an environment that boils with the excitement of innovation, where professional students and their faculty advisors are, on a daily basis, standing at the precipice of discovering something new.

PRESIDENT'S MESSAGE

The Naval Postgraduate School has spent a concerted effort over several years to firmly establish its role as a research university of the highest caliber. Clearly, to educate students at the graduate level requires a sophisticated and robust research effort, and ours has evolved through the tireless efforts of our faculty, students and staff into just that.

Like those at many peer universities, our faculty have great passion for their respective areas of study, adding to society's body of scholarly knowledge through advanced research into their various fields of expertise. They also find true reward in watching their students evolve into thought leaders as they find their own distinctive research areas during their graduate studies, and all for the higher calling of improving national security. And given that we are graduating four classes of master and doctoral degree students — some 1,000 plus graduates — every year, a very unique environment is created on this campus. It's an environment that boils with the excitement of innovation, where professional students and their faculty advisors are, on a daily basis, standing at the precipice of discovering something new.

In just one quarter, three short months, another round of students will make that treasured walk that all of our alumni know well — through Spruance Plaza and Spanagel Hall and into King Auditorium for the culmination of their studies here at the Naval Postgraduate School. And a majority of them will have completed that thesis, that addition of scholarly knowledge to the betterment of society, of national security, and of preparedness against all threats.

In this edition of "In Review" we take a look in-depth at the impact of the research accomplished at our university through the lens of just one quarter — this past Summer quarter of the 2011. It's one of our larger quarters in terms of graduating students and exemplifies the sheer level of research that lives and breathes every day at our institution. We have outlined in careful detail the essential data of this work on the cover and centerspread of this issue — all 170 of the student theses submitted and approved for the award of a degree in that ceremony in late September of 2011.

Our analyses put into one picture how these projects relate to each other, where the officers and civilians who completed this work came from, what discipline they are studying and so much more. And if you take the time to dive into the image, you will see the names of the individuals who spent many tireless nights toiling with this often challenging effort.

I am compelled to note, however, there is one very important aspect to this image that is not clearly apparent — and that is the value this research adds to accomplishing our mission of improving national security. We have researchers travelling to the bottom of the world to better understand the interactions of Antarctic ice shelves with the ocean processes below them. We have students putting hard dollar figures to the life cycle costs of disposable batteries, hoping to reduce the expense, both in dollars and to the environment, of what it takes to power a Marine Corps battalion. And we have active research into all aspects of unmanned systems — from the acquisition of two ocean-faring unmanned surface vehicles, to detailed research into defensive applications of swarming unmanned air vehicles.

As the United States moves into a new era of defense strategy, our national security priorities evolve and shift, and we continue to endure the challenges of ever-tightening budgets, I am thankful our university has placed such a concerted effort on the value of research. When our students leave NPS, they leave here with not just a degree, but empowered to be better leaders as they continue to serve the United States and their respective nations. And they have accomplished something else as well … they have added to our society's collective of knowledge, creating new discoveries while improving national security. Indeed, there are few experiences in the professional realm that I would hold in as high regard.

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FEATURES

DEPARTMENTS

ON THE COVER
When 377 students completed their studies at NPS and walked the stage in King Auditorium in late September to receive their degrees, the culmination of months of diligent work and study came to a triumphant close. And for 170 of them, that close came at the addition to the collective of scholarly knowledge, a student thesis. In this issue of "In Review," we put on paper what one quarter of student research looks like. It's an impressive display of academic output, especially considering the Naval Postgraduate School produces four graduating classes every year.

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Transportation Security Administration Chief Visits NPS, CHDS

Transportation Security Administration Chief John Pistole was on the Naval Postgraduate School campus for a series of meetings and briefings with members of the Center for Homeland Defense and Security (CHDS) and NPS leadership. He also was among the guests of honor at the school's fall graduation ceremony, presenting diplomas to a cohort of CHDS graduates that included several TSA employees.

Transportation Security Administration Chief John Pistole was on the NPS campus for a series of meetings and briefings with members of the Center for Homeland Defense and Security and NPS leadership.

With the responsibility of overseeing a 60,000-strong workforce and the security operations of more than 450 federalized airports throughout the U.S., Pistole praised NPS' efforts, noting that education was key to making TSA a more dynamic and capable organization.

"One of the key enablers for the TSA becoming a high-performing organization is how we train and give additional educational opportunities to our workforce," said Pistole. "NPS gives us the opportunity to give our workers additional training to equip them to become future leaders."

NPS, and its CHDS, offered Pistole a unique training environment where students would have access to real-world scenarios and the guidance of field experts with information and training that no other institution could provide.

"The center was established to provide graduate level education to senior homeland security officials," said CHDS Director Glen Woodbury. "Since the TSA's own creation, the organization has sent its current and emerging leaders to CHDS programs, and provided invaluable expertise to national strategy and policy for homeland security."

Alumnus Returns to Campus for USW Curriculum Review

NPS Meteorology/Oceanography alumnus and Director, Undersea Warfare Division (N87), Rear Adm. Barry L. Bruner, returned to campus in November for a series of student briefings and faculty discussions, part of the Undersea Warfare curriculum review.

During the presentation, Bruner spoke about his time at NPS and the improvements in the university's programs that he has seen over the years. "It is great to be here at NPS," he noted. "The two years that I spent here were two of the best years of my life, and it's great to see how this institution continues to get better."

Bruner answered questions about future changes in the curriculum, as well as the changing requirements for the Navy. He also emphasized the importance and value of the time students spend at NPS. "The lessons that are learned here at the Naval Postgraduate School put the officers in great step for the future," said Bruner. "It's not just the specific degree and the knowledge associated with the degree, it's really bigger than that, it teaches them how to think and how to approach problems and its going to provide a phenomenal return on investment for the Navy and for the county both."

Director, Undersea Warfare Division Rear Adm. Barry L. Bruner

University Assists Nepal in Defense Institutional Reform

A senior Nepalese defense delegation, led by the Nepalese Secretary of Defense, paid a visit to the Naval Postgraduate School's Center for Civil Military Relations (CCMR) for a week of collaborative work within the Defense Institution Reform Initiative (DIRI). The visit was part of the ongoing process of restructuring the Nepalese Ministry of Defense with support of the U.S. government through the DIRI program.

Nepalese defense delegation at NPS in December

Established in 1994, NPS' CCMR is the Department of Defense locale for expertise in strategic, operational and academic dimensions of civil-military relations. It was established with the mission to meet the needs of emerging democracies, providing advanced education to both foreign and U.S. civilian and military parties.

DIRI is an Office of the Secretary of Defense initiative developed to provide support for strategic capacity building in the defense ministries of U.S. partner nations.

Students Help Monterey Fire with … Algorithms

Operations Research students, Marine Corps Capt. David Coté and Maj. Tom Dono, used data provided by Monterey Fire's administration in order to model the most effective use of apparatus, manpower and response scenarios

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NPS Explores Joint Research, Education Programs with India's Peer Defense Institutions

A new and promising partnership between NPS and India's peer defense institutions has emerged in response to U.S. leaders calling for collaboration between the two countries. Last year, President Barack Obama recognized India as a growing global force, and a U.S. ally in meeting the challenges of the future.

"In Asia and around the world, India is not simply emerging; India has already emerged," said Obama in a speech to the Indian Parliament at the Parliament House in New Delhi, Nov. 2010. "And it is my firm belief that the relationship between the United States and India — bound by our shared interests and values — will be one of the defining partnerships of the 21st century. This is the partnership I have come here to build. This is the vision that our nations can realize together."

Former Chief of Naval Operations, Adm. Gary Roughead, echoed the sentiments of the President, noting that the waterways surrounding India are a crossroads for global commerce, communication and transportation. Maintaining a secure maritime domain in the region is a focus of both U.S. and Indian military leadership.

"We have many mutual interests as nations — from democracy to free trade to maritime security — and it is in the interests of American and Indian citizens that we come together to see that these interests are protected," he noted during a visit to India in Apr. 2010.

A delegation from the India Integrated Defence Staff tours a research lab during a campus visit. A new and promising partnership between NPS and India's peer defense institutions has emerged in response to U.S. leaders calling for collaboration between the two countries.

As an institution focused on defense-relevant education, research and advanced technologies, NPS saw an opportunity to advance the partnerships between the two nations — to use its faculty expertise in nearly every aspect of national security operations to help develop a partnership in education and research with India's Defense Research and Development Organization (DRDO), the nation's single research institution supporting all branches of their Armed Forces.

"We currently only have two Indian students studying at NPS. India is a nation that has a population of 1.2 billion people. They are the largest democracy in the world," explained Dr. Chuck Kimzey, Director of NPS' National Security Institute. "So geopolitically, I think that building a relationship, and NPS contributing to that relationship, is important."

In early 2011, NPS President Dan Oliver traveled to India to sign a Letter of Accord with the DRDO Director General Dr. V. K. Saraswat, outlining the plan to pursue joint efforts in research and education.

"We saw an opportunity to connect with India's defense institutions not only because we have similar concerns — national security, counter-terrorism, economic stability — but because an academic partnership allows for the sharing of intellectual resources of benefit to both organizations," said Oliver. "We already have Indian students enrolled in our resident programs at NPS, and while we certainly have the capacity to increase this number, we also felt we had a successful existing relationship upon which we could build and expand."

The conversation has continued since Oliver returned from India, bringing DRDO and Defense Institute for Advanced Technology (DIAT) leaders to NPS this past September of 2011 to give leadership a chance to outline specific areas for collaboration and on the future goals of the partnership. DIAT is India's equivalent to NPS, a graduate-level degree granting educational institution, and is part of the DRDO.

"Since our initial visit to India, the Letter of Accord, and now with the recent proposal with DIAT, I have been very pleased to see the progress we have made in this effort," said Oliver. "We have a solid plan in place to fully utilize subject matter experts from both institutions, delivering to both our students and theirs, a comprehensive and global perspective on defense studies. And I believe an important note is that this is a partnership that still remains in its early stages."

Executive Vice President and Provost Dr. Leonard Ferrari, co-chair of the Executive Committee and a strong supporter of the collaboration, echoed that sentiment.

"Our latest visit with the Indian delegation was a great success. We were able to outline a solid plan for the future of this partnership, with very specific educational and research objectives in mind," said Ferrari. "As defense-based research institutions, I believe both sides see tremendous value in developing these kinds of international collaborations, capitalizing on the unique strengths of our respective institutions' students and faculty. This partnership is still young, but we have already seen some very rewarding results and I am confident that the value of this effort will only continue to build with time."

Three Monterey Fire Department firefighters are pictured following a final project briefing by Marine Corps students Capt. David Coté, right and Maj. Tom Dono, second from left.

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for the city's protection against structural fires.

As the final project for their fall 2011 Networks and Flows course, OA4202, Coté and Dono modeled and analyzed the fire department's network on the Monterey Peninsula using a minimum-cost/maximum-flow algorithm. Through a series of experiments that simulated interdicting fire stations and simultaneous fires, the results of the study both validated and re-enforced the current distribution of fire-fighting assets as regulated by Monterey Fire.

"This is a great tool that we were [able to apply] to validate a system that the fire-fighting guys use to keep citizens safe," said Coté. "This project also served to build relationships with the community. We used our tools as analysis — the computer algorithms we learn in class — to help other people make better decisions and in this case protect others."

Dono was equally impressed with the fire department's eagerness to share information. "I just think that working with the Monterey Fire Department was an extraordinary experience. Their insight into our project was instrumental, and they are an outstanding group of professionals. I cannot thank them enough for all their help," he noted.

Hands-on Activities Engage Young Women in STEM Fields

Through the Expanding Your Horizons (EYH) Conference in November, NPS hosted more than 100 young girls from around the Monterey Peninsula to introduce and encourage them to explore careers in the Science, Technology, Engineering and Mathematics (STEM) fields.

A workshop leader at the Expanding Your Horizons Conference helps participants with their experiment during a session titled "The Hidden Code in Strawberries," which taught the girls to extract DNA from fruit using everyday household products.

NPS Chief of Staff, Air Force Col. Zoë Hale, presented opening remarks to the girls, talking about her own career in the service, and how she came to be in her current role at NPS. Hale was one of many career women on hand at the event to encourage the participants, from grades 5–10, to start thinking about potential future careers. "I was very pleased to have been part of the EYH Conference, helping to encourage and support these young ladies … After all, they might one day be studying or working in labs right here at NPS," she said.

"EYH provides chances for young women to meet female role models and learn firsthand about how they chose careers, civilian or military, in one of the many different STEM fields they represent and are now actively engaged in," explained Dr. Dave Nickles, NPS Director of Research Communications and Outreach, and the conference organizer. "It is one thing to read about women scientists and engineers in their text books, but quite another to engage with the real person. EYH provided these girls a chance to become aware of and then motivated to pursue courses of study that can lead to paths they may never have previously considered."

Transformative Education Forum Brings Educators Together from Diverse Backgrounds

Sponsored by the Office of the Under Secretary of Defense for Policy and the Office of Naval Research Global, select Naval Postgraduate School leaders, faculty and researchers participated in the Transformative Education Forum (TEF) in Monterey, bringing together educators from all over the world to discuss the concepts of education in today's global climate.

"This conference, and the entire Global Challenges Forum effort, was recently established as a non-profit foundation in Geneva with the support of Mr. Talal Abu Gazaleh, of Amman, Jordan," said NPS Executive Vice President and Provost Dr. Leonard Ferrari. "Our hope is to hold these international dialogues in different locations around the world, to focus on specific, but important, global security issues. We intend to apply that dialogue and attendee experience to the security challenges of the 21st century in order to find sets of scalable and transferrable solutions."

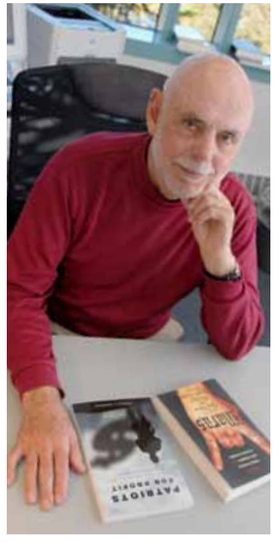
Attendees collectively expressed value in the dialogue that the forum provided. Dr. Moses Satralkar of the Indus Training and Research Institute in Bangalore, India said, "The Transformative Education Forum has had a deep impact on me personally, since I relate to your vision which I know can change the future of many individuals and even nations. Your passion and commitment to the cause is inspiring. This is an excellent initiative to promote social welfare through reforms in education; please be assured of my active involvement and support of the TEF in future."

NSA Professor Releases Two Books on Diverse Subjects

National Security Affairs Distinguished Professor Dr. Tom Bruneau's extensive research and collaborative efforts resulted in two works that tackle distinctly unique topics of national defense and civil-military relations.

Bruneau recently authored "Patriots for Profit: Contractors and the Military in U.S. National Security" and "Maras: Gang Violence and Security in Central America," delving into two very different topics.

In "Patriots for Profit," Bruneau takes an in-depth look at the issues concerning the replacement of military forces, in recent conflicts, with civilian contractors and the effects and repercussions of such strategies. Bruneau raises the point that, while the military is a representation of the U.S. government and controlled by elected representatives of the American people, contractors work under little public control and limited legal authority.



NPS National Security Affairs Distinguished Professor Dr. Tom Bruneau

In coauthoring "Maras," Bruneau collaborated with Lucia Dammert of the Global Consortium on Security Transformation and Elizabeth Skinner of NATO's Allied Command Transformation in collecting a series of essays and studies from multiple experts in the study of the history, organization and propagation of the Mara Salvatrucha and the 18th Street gangs that originated in Los Angeles and have been growing in prominence and influence in the United States and North and Central America, and are becoming increasingly more dangerous.

Faculty/Student Team Wins MILCOM's Best Paper Award

NPS Computer Science Professor Geoffrey Xie, recent graduate Lt. Scott Huchton, and Assistant Professor Robert Beverly were awarded the 2011 Fred W. Ellersick Military Communications (MILCOM) Award for the Best Paper in the Unclassified Technical Program, presented at the MILCOM Conference in November. Their paper, titled "Building and Evaluating a k-Resilient Mobile Distributed File System Resistant to Device Compromise," looked at securing sensitive mobile networks that may be appealing targets for adversaries.

With the growing popularity of smartphones and mobile devices, the question of security is always a cause for concern. In response to those challenges, the paper explores a prototype storage system called the Mobile Distributed File System, designed to compliment existing authentication, privacy and integrity techniques. The paper was an extension of Huchton's thesis, and a topic that will continue to be a focus for the defense community.

"Information, particularly information at rest, is a difficult problem for the Navy, DoD, or any

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Professor Clay Moltz Explores "Asia's Space Race"

National Security Affairs Associate Professor J. Clay Moltz explores Asia's space programs and the dangers of a growing militarization of the space race in his most recent book, "Asia's Space Race: National Motivations, Regional Rivalries, and International Risks."

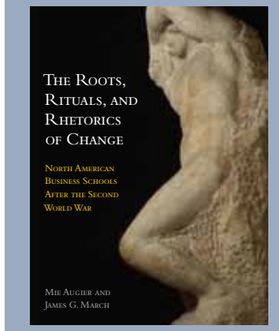
Moltz, former deputy director of the Monterey Institute's Center for Nonproliferation Studies, became active in space security discussions in 2006 and 2007 as co-coordinator of two conferences on the topic, one in France and the other in Japan. He was surprised by the stark differences between European space programs' collaborative approach and Asia's more secretive and competitive policies. He noticed that the topic of space security was one that Asia shied away from talking about, raising a red flag for Moltz.

"Everybody in Europe was speaking about the same types of problems, the same types of approaches, and about how to collaborate," explained Moltz. "In Asia, the different national representatives did not even seem to be describing the same reality. They had a great deal of mistrust. They were not very transparent about what they were willing to say about their own space programs. And they also did not have any real region-wide emphasis in their space policies. It was all national.

"It was very clear that these countries were simply not comfortable working together in space," he continued. "Deep-seated historical geopolitical rivalries were a key factor driving their space programs. And if anything, the situation seemed likely to get worse before it was going to get better."

Moltz lectures frequently on this and related topics in his "Space and National Security" course. He is also a frequent lecturer in various classes under the Space Systems Academic Group, where he holds a joint appointment. "Our students need to understand the international dimension of space activity and where the major Asian space programs are headed," he explained.

Quick Hits



Global Public Policy Academic Group Research Associate Professor **Mie Augier** recently released, "The Roots, Rituals, and Rhetorics of Change: North American Business Schools after the Second World War," co-authored with James G. March. The book outlines the landmark changes in business schools as they transitioned into sophisticated, academic and analytical programs. Stanford University's David Labaree noted, "This is a great story that has never been told with such clarity, empirical support, and conceptual breadth. The book draws on the particular strengths and perspectives of each of the authors. Augier is a stunningly accomplished intellectual historian of business school culture. Meanwhile, March is the preeminent organizational theorist, who shares a story only he is fit to tell."

The Defense Resources Management Institute (DRMI) conducted its first mobile course ever in Yerevan, Armenia, Oct. 3–14. The DRMI team included team leader **Dr. Bob McNab**, **Dr. Ryan Sullivan** and Lecturer **Luis Morales**. The course included a variety of topics ranging from program budgeting, multi-year costing, and evidence-based decision making. Twenty-two participants, including members of the Armenia Ministry of Defense, Ministry of Policy, Ministry of Territorial Administration, National Security Council, and General Staff, attended the course.

Dr. Sivaguru S. Sritharan

The university recently established the Center for Decision, Risk, Controls and Signals Intelligence (DRCSI) as part of an effort by the university and DoD to promote advanced mathematical research to meet and overcome the technological challenges of the future. Led by Research Professor of the Office of the Dean of Research, **Dr. Sivaguru S. Sritharan**, the research center has a long-term vision of building a group of faculty with the most relevant expertise in strategic systems and signals intelligence that can come together to address long-term, high-risk research in these technical areas. Student research support will also be a critical component of the new center's mission.

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branch of the military to deal with," said Huchton. "There are a number of ways to approach solving the security issues or the resiliency issues, but they are either very expensive or are not computationally practical in a mobile environment with limited power. I believe we've just scratched the surface with a demonstration of feasibility in the thesis and a presentation of practical metrics and limitations in the MILCOM paper. I think the fact that we won the Ellersick Award for best unclassified paper is a testament to the hard work that went into writing it," he continued. "I'm honored to share the award with people I so highly respect."

Conrad Chair Honored During Navy Budget Chief's Visit to Campus

Rear Adm. Joseph Mulloy, the Chief of Naval Operation's Director of Fiscal Management, presented a briefing on the current Navy budget strategy in Ingersoll Hall, Nov. 29. In his position, N82 on the CNO staff, one of Mulloy's responsibilities includes serving as the the curriculum sponsor for the Financial Management curriculum in Graduate School of Business and Public Policy (GSBPP), and will return in April of this year for a program review. Financial Management is currently the largest curriculum at the business school for in-resident students, with 63 currently enrollments.

Chief of Naval Operation's Director of Fiscal Management, Rear Adm. Joseph Mulloy

During his visit, Mulloy also presented Senior Lecturer John Mutty with the Department of the Navy Superior Civilian Service Award and medal on behalf of acting Assistant Secretary of the Navy, Financial Management and Comptroller, Charles E. Cook, III. While Mutty is being relieved after a successful eight-year-run overseeing the Conrad Chair, and 16 years as a member in the Conrad Scholarship Committee, he will continue to teach in the business school.

Mulloy also connected with faculty and students on his trip, attending meetings with NPS President Dan Oliver, Undersea Warfare Chair retired Rear Adm. Jerry Ellis, Vice Provost for Academic Affairs Dr. Doug Moses, Vice President for Finance and Administration Colleen Nickles, and GSBPP Dean Dr. Bill Gates.

Operations Research Senior Lecturer Jeff Kline, right.

Operations Research Senior Lecturer Wins Distinguished INFORMS Award

The Institute for Operations Research and the Management Sciences (INFORMS) recently awarded NPS Operations Research Senior Lecturer Jeff Kline the 2011 INFORMS Prize for the Teaching of the Operations Research and Management Science (OR/MS) Practice.

The prestigious award recognizes Kline's commitment to OR/MS and his many contributions to students in the field. A retired Navy captain, Kline has taught OR at NPS, offering a campaign analysis course for junior-level graduate students, as well as a capstone sequence for distance-learning students. He also teaches an elective series to mid-level officers at the Naval War College in Newport, R.I.

Kline is also active in the Center for Executive Education's Transition Support Program, creating customized analysis short courses for flag officers transitioning into positions of increased responsibility. One of his most active roles is serving as the Program Director for the Consortium for Robotics and Unmanned Systems Education and Research (CRUSER), a group chartered by Under Secretary of the Navy Robert Work.

Kline explained what an honor it was to join OR colleague, Dr. Rick Rosenthal, the 2000 recipient of the INFORMS award, as the second NPS faculty member to receive the honor.

"I am honored to receive the Institute for Operations Research and Management Science Teaching of Practice Award," noted Kline. "We are the only college to receive this award twice and to follow in Dr. Rosenthal's footsteps is a professional privilege. I thank the NPS OR department for giving me the opportunity to provide instruction to our junior and senior officers on how to use analysis to better national decision making."

Former CJCS Adviser Capt. Wayne Porter Joins NPS Faculty

The NPS community recently welcomed alumnus Capt. Wayne Porter as the new Chair of Systemic Strategy and Complexity under the Global Public Policy Academic Group. Porter most recently served as the special strategic assistant to Chairman of the Joint Chiefs of Staff Adm. Mike Mullen, and co-wrote "A National Strategic Narrative," which creates a contextual narrative to help guide future U.S. policy.

Porter has long contemplated complexity theory and social cognitive and behavioral aspects of a strategic environment, and felt that NPS was the perfect place to explore those topics collaboratively in a setting where they could have a tangible and lasting impact on research and education.

With the support of Mullen, who took Porter's idea to Secretary of Defense Leon Panetta, the NPS Chair of Systemic Strategy and Complexity position was established. Having only recently settled into his new office here on campus, Porter has already hit the ground running, connecting with professors across departments to explore areas for systemic strategy and complexity to be incorporated into lectures and courses.

"This new position was designed basically to expose to an interdisciplinary student audience the value of applying systems and complexity theory to operational and strategic design," explained Porter.

He personally understands the value that this kind of theory can bring to NPS students, having received dual masters degrees in Computer Science and Joint Command, Control, Communications, Computers, and Intelligence. Porter hopes to work on his Ph.D. during his time here, and test out systems and complexity theories in potential thesis research.

"I wanted to be a 'guinea pig' to demonstrate the value of systemic strategy, because I'm convinced we need to take a much broader approach to the complex environment in which we operate. Not only that, I genuinely believe in the quality of the faculty here, the intrinsic value of the school, and the unparalleled excellence of the student body," said Porter. "You have this dedicated group of really smart students with real-world experience. I can't think of many other places anywhere in the world where you would have the same quality of students with that rich experiential background capable of pursuing — in an interdisciplinary environment — problem sets of global significance."

Capt. Wayne Porter, the new Chair of Systemic Strategy and Complexity under the Global Public Policy Academic Group.

NPS Research Professor of Oceanography Tim Stanton, middle, helps fellow researchers test the hot-water drill that will be used to create a tunnel for the ocean profiler. The researchers have made several trips to Antarctica to test the equipment in preparation for their current research trip, which will run from the end of Nov. through the end of Jan. *(Photo provided by NASA)*

At the Bottom of the World

NPS faculty, researchers utilize custom research tools for six-week Antarctic expedition.

By Amanda D. Stein

A TEAM OF NPS oceanographers is braving weeks of frigid temperatures and gusty winds in Antarctica for the research opportunity of a lifetime.

NPS Research Professor of Oceanography Tim Stanton, Research Assistant Professor of Oceanography Bill Shaw, and Oceanographer Jim Stockel are on a two-month-long expedition to the remote Pine Island Glacier (PIG) ice sheet in Antarctica, where rapidly-moving ice sheets have researchers anxious to explore warm water currents beneath ice shelves that extend out into the ocean from the continental edge.

The 10-man research team, comprised of researchers from three other universities and NASA, has several important pieces of equipment in tow, including three specially-designed research tools developed and built by Stanton and his team at NPS.

In the ocean cavity below the glacier, the research group is deploying these instruments to measure the ocean circulation that is bringing slightly warm water across the continental shelf to the base of the ice shelf. The interaction of the ocean with the ice shelf is melting the glacier, from below, at a rapid rate. The PIG ice shelf is an area of particular concern, selected because it is among the most rapidly melting ice masses in the world, moving seaward at a rate of 4km a year.

"The Pine Island Glacier ice sheet is fed by a massive glacial system up on the continent. It flows down and extends out in the ocean by about 50 km," explained Stanton. "The glaciologists who have studied these systems for the last 25 years have noticed that the ice is moving two to four times more rapidly than it was in the past. And the glaciology numerical models suggest that the buttressing effect of the glacial tongue is being reduced rapidly and they hypothesize that that reduction of the extent of ice shelves is accelerating the ice flow down to the ocean."

Stanton and the NPS team took several years, and multiple Antarctic trips, to perfect the custom tools that will transmit data back to computers on the NPS campus. NASA's Robert Bindschadler, an emeritus glaciologist at NASA's Goddard Space Flight Center and lead scientist for the PIG research trip, noted the value that Stanton and his NPS colleagues bring to the team.

"In short, our project would be going nowhere without the superb technical skills of Tim Stanton and his team," Bindschadler noted. "The sub-ice shelf environment into which we are hoping Tim's novel and unique instrumentation is to be deployed will allow oceanographers and glaciologists to make a huge leap forward in the understanding of the critical interactions of water and ice along the underside of a major Antarctic ice shelf."

Stanton has made several trips to the Antarctic throughout his career, each time working to improve his equipment design and data collection methods. The NPS gear has been designed to fit down through the narrow, deep holes the group will be melting through the ice sheet specifically for this research project. The equipment includes three main components: an Ocean Flux Profiler, a Fixed-Depth Ocean Flux package, and a surface infrastructure system.

> *"The whole objective is to try to take measurements and observations in this extraordinarily remote system that will allow us to better model that system and contribute to computer models that help predict what might happen in the future."*
>
> Tim Stanton
> Research Professor of Oceanography

The team will use a hot-water system to drill the two 20cm diameter holes into the 500m thick ice shelf, where they will then lower the ocean flux profiler. Once it reaches the underside of the glacier, the profiler will be left in place to measure temperature, salinity and vector currents of the water flowing within the ocean cavity. The equipment has been developed over four years, and stood up in numerous tests both at NPS — a vertical tube fixed on the side of Spangle Hall serves as a test tunnel for the profilers — and in small-scale Antarctic experiments. The data gathered will ultimately give researchers a better understanding of the warm-water currents that carve channels and underneath the ice shelf and cause it to rapidly melt.

"The research will shed light on ocean processes acting over a wide range of time scales in a critical setting — below a melting glacier ice shelf," explained Shaw. "Better understanding of ocean circulation and turbulence below Antarctic glaciers will be used to improve large-scale climate models."

"If a system like this starts to collapse, we could see massive sea level rise on decadal of century time-scales," added Stanton. "So the question becomes at what time-scale might this happen and what are the physical processes that lead to that … The whole objective is to try to take measurements and observations in this extraordinarily remote system that will allow us to better model that system and contribute to computer models that help predict what might happen in the future."

The surface infrastructure system supports the profiler and fixed depth instruments while also reading meteorological changes at the site. The surface infrastructure also contains the power source for the communication components of the system — with a wind generator, solar panels, and a bank of lithium batteries. The surface infrastructure allows researchers at NPS to transmit the full data set back from the Antarctic, while also allowing sampling strategies to be changed each day over the expected 2–3 year life of the instrument system.

Stanton noted that, as with any extreme research trip, there is incredible potential for errors. Weather conditions and the remote location mean that once they are stationed in their tents on the PIG, they are thousands of miles away from civilization. Any broken equipment or unexpected problems must be handled as well as possible by the 10-man team.

"It's very remote. There's no corner store, nowhere to go buy a resister or something," Stanton explained. "We have to rely on things working. One good thing about designing everything is that you know how to fix it. But there are some things you just can't fix. It doesn't take much to kill the whole system."

But in spite of the harsh conditions and unknown variables, the team is happy to finally get the chance to see their equipment in action, and looks forward to the potential understanding that researchers can get from the data gathered. The team expects that several NPS students will be active in analyzing the data, possibly using it in theses, once it starts transmitting back to Monterey.

"It has been an interesting experience being involved in this project," said Stockel. "We have put a tremendous amount of time and energy into preparing for this opportunity and now we have our chance to try to pull it off." IR

Follow the Pine Island Glacier Research Team

At press time, the research team had finally secured transport to the remote Pine Island Glacier. To get the latest updates, blogs from the team, photos and more from Antarctica, visit the Pine Island Glacier research website.

A team of researchers and NPS faculty practice lowering an ocean profiler into the ice shelf during a previous trip to Antarctica. The profiler is one of several pieces of equipment specially designed and built at NPS specifically for the current research trip. *(Photo provided by NASA)*

Marine Corps Capt. Darrell H. Brown holds a rechargeable battery similar to the units he studied for his master's thesis. Brown analyzed the full life cycle cost savings of using rechargeable batteries over disposables, estimating striking potential cost reductions in his analyses.

Marine Corps Student Analyzes Life Cycle Cost Savings of Rechargeable Batteries Over Disposables

By MC1 Rob Rubio

ABOUT A YEAR ago, a Marine Corps Captain walked into the office of Naval Postgraduate School Operations Research Professor Daniel Nussbaum claiming he had a great idea for his thesis. Capt. Darrell H. Brown would go on to describe a 2006 deployment with his battalion landing team to the Horn of Africa, and the operational constraint he felt of packing so many batteries, especially with new optics, tactical lights, cameras and various other electronics. His solution? Replace disposable batteries with rechargeable ones.

"Here we are with all of this gear that needs batteries and we are on a ship with very little embarkation space," remarked Brown. "Why couldn't we have a large charger where all of these batteries are stacked in racks on a stanchion and we plug it in?"

Brown set out to analyze the idea in great detail through his thesis for his master's degree in management through NPS' Graduate School of Business and Public Policy (GSBPP). It wasn't a wholly new idea … In fact, a handful of previous GSBPP students had already begun studying the fully-burdened costs of batteries through their own theses. Brown wanted to continue this work, and to place a specific quantifiable cost savings on a potential change.

Brown, Nussbaum and co-advisor Professor Keenan Yoho began examining the specific battery requirements for a typical Marine Corps infantry battalion — what are the operational assets they use, how do they use them, and what are the batteries needed to support this. The team then analyzed the full costs of purchasing, delivering, using and disposing of rechargeable batteries vs. non-rechargeable through the full life cycle. In the end, when all of the numbers and costs are quantified, Brown had made quite a case to acquire rechargeable batteries along with chargers to go with them.

Nussbaum notes, "You are getting 20 to 100 batteries for the cost of one. The question is can you keep enough on hand and recharging so that there is always power available … [This] is a concern for the infantry battalion.

"[Brown] was able to do the numbers, the modeling and write it down, and now it has to be brought up the Marine Corps chain to see if it can be implemented as policy," Nussbaum added.

Brown's work also discovered that the more batteries you need, and the longer a battalion is in the field, the more money could be saved — in other words, the more the battalion needed to use batteries, the faster that battalion would reach its battery cost break-even point.

When compared to non-rechargeable batteries, with the number of times that a rechargeable battery can be reused, Brown noted the recurring life cycle cost savings of purchasing, transportation and disposal costs is staggering. He highlighted the BB-2590 battery as an example, a rechargeable replacement for the BB-5590 standard batteries used at a very high level in tactical radio communications equipment.

> *"You are getting 20 to 100 batteries for the cost of one. The question is can you keep enough on hand and recharging so that there is always power available … [Capt. Brown] was able to do the numbers, the modeling and write it down, and now it has to be brought up the Marine Corps chain to see if it can be implemented as policy."*
>
> Dr. Daniel Nussbaum
> Professor, Operations Research

The 2590 battery is engineered to be re-used between 224 to 1,000 times, he noted. "But I spoke with the contractor who is running long-term life cycle studies of these batteries, constantly cycling them in various pieces of equipment, and these batteries have been used upwards of 1,200 or more times," he added.

When a single battery can save the life cycle cost of 1,200 disposable batteries from purchase, transportation and disposal, the investment in rechargeable batteries is recovered very quickly. A standard disposable unit cost runs approximately $78 each, with these rechargeable batteries at just over $300 a piece along with $1,800 for a charger.

Brown's analysis estimated that with these costs — and a battalion using about $14,000 in disposable batteries per day — increased investment costs in rechargeable units are recouped in about 19 days. Any service using tactical radios can benefit every step along the resupply chain all the way to theater, without having to throw away depleted batteries and call back for new ones.

The impact on supply convoys, Brown added, is of note. It is well known that one of the significant sources of casualties in theater occurs in resupply convoys. Reports suggest that approximately one in eight convoys is attacked, and batteries alone can easily add on another vehicle to a supply convoy requiring 2–4 additional personnel. You can remove that entire vehicle and additional personnel, Brown said.

He also highlighted disposal costs, with non-hazardous solid waste (NHSW) disposal at an estimated $1.28/lb. compared to hazardous solid waste at $4.00/lb. With the reduction in hazardous waste dispoal required by using rechargables, additional cost savings were realized. And this doesn't include the benefit of simply keeping these disposable batteries out of the environment.

Brown bounced operational implementation scenarios off of subject matter experts and he was told that it might certainly work. And based upon his model, using rechargeable batteries can save an amount in the neighborhood of $15,000 per day, per infantry battalion, each using 182 batteries per day in operational scenarios.

In his thesis, Brown also addresses what can be used to recharge the batteries. Vehicle chargers can be mounted into vehicles — and portable, fold-out solar panels weighing in at 1–3 pounds, can also be used. They are just as effective, rain or shine, and are using a renewable energy source to recharge the batteries.

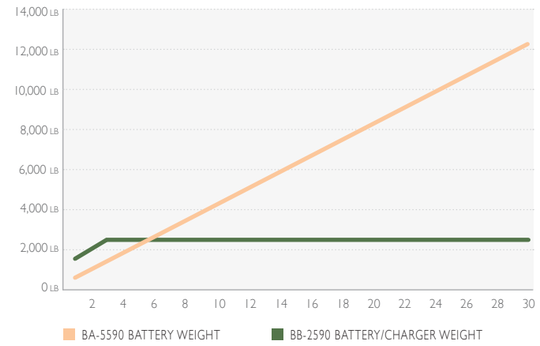
Brown stressed that everyone uses batteries — military, DoD, as well as the general population — but when it is not seen as a significant cost driver in a budget, it tends to fall below the radar. For any DoD entity who does use a lot of batteries, he noted, they should think about using rechargeable, as there is a tremendous push to reduce our cost of energy.

As far as next steps for the research on campus, co-advisor Nussbaum said, "Energy is hot, and batteries are just a piece of it. The next piece needs to be institutionalizing these ideas and results as policy within the services … I am looking for thesis topics to follow on."

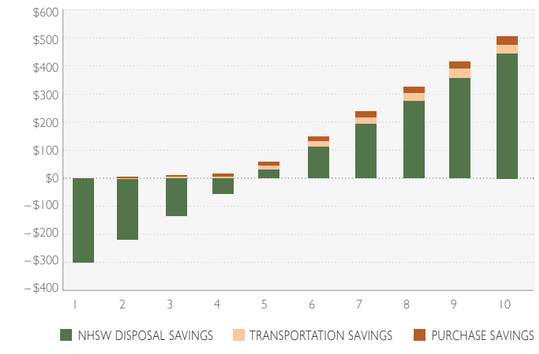
Brown graduated in December 2011 after 18 months of study with a Master of Science in Management and transferred to Marine Corps Systems Command in Quantico, Va., where he says he hopes to apply some of his research.

"It's a matter of getting the word out there more than anything," he said. IR

BATTERY WEIGHT COMPARISON
OVER 30-DAY PERIOD WITH DEMAND OF 182 UNITS PER DAY



DOLLAR SAVINGS PER BATTERY
OVER TEN RECHARGES



research... IN THE moment

Student research at the master and doctoral levels is a requirement of a successful graduate education experience. At the Naval Postgraduate School, four classes of students complete that experiential and demanding obligation each year, culminating in a triumphant walk across the stage in King Auditorium to receive their degrees.

The impact of research at NPS is powerful indeed … where operationally-experienced students from across the services and around the world apply real-world knowledge to explore solutions to today's most pressing national security issues.

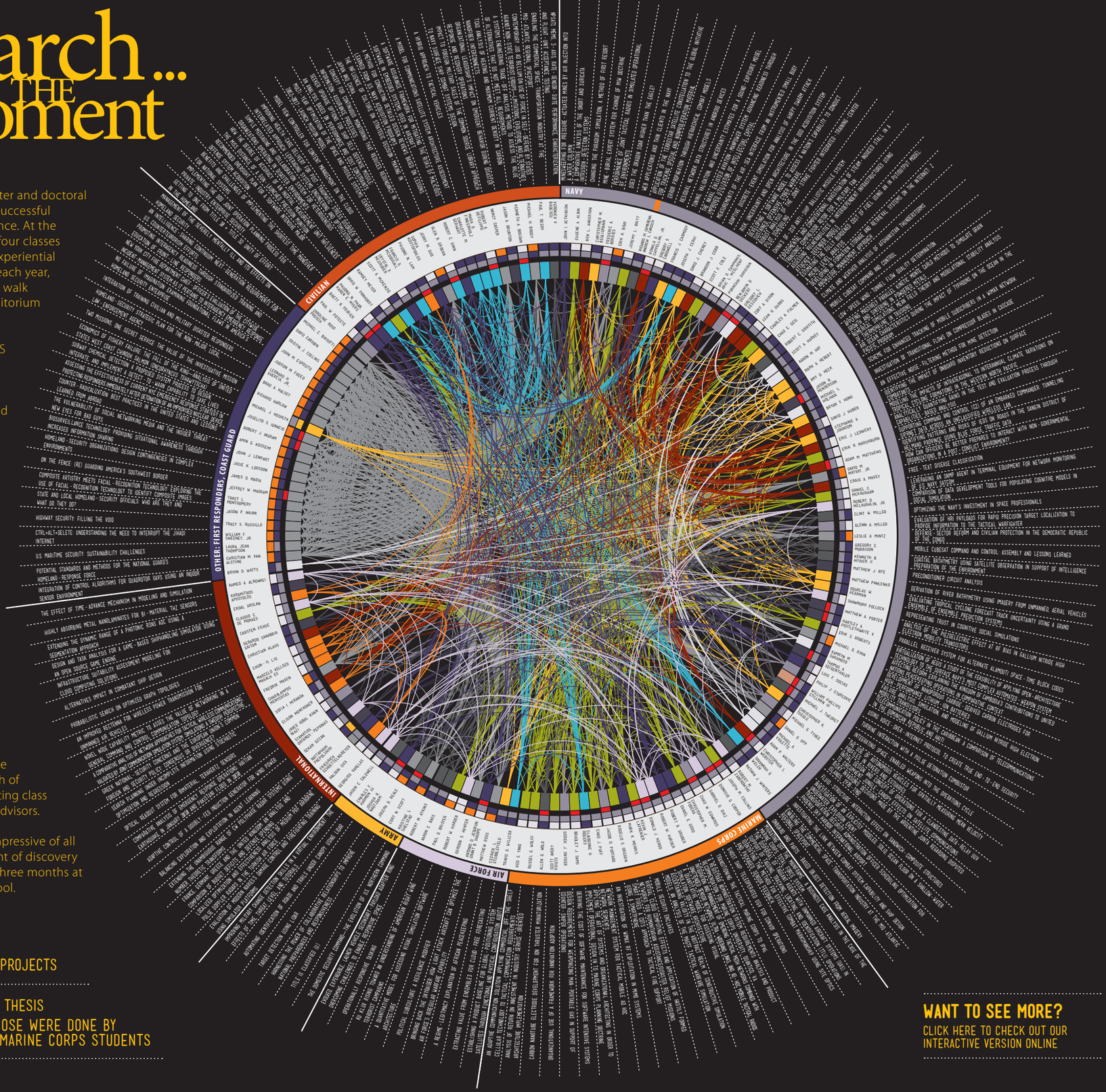
We set forth on the challenge of creating an image of what just one graduating class contributes to national security's body of knowledge. Using the "Compilation of Thesis Abstracts" produced by NPS' Office of the Vice President and Dean of Research, a wealth of information can be captured in just a single display — author, service, degree, theme, and the relationships between them, and much more.

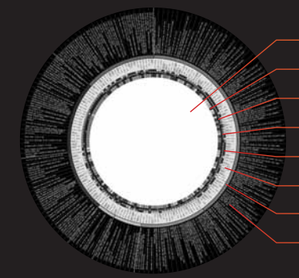
Collectively, it is an impressive display of one quarter's worth of discovery by a single graduating class and their respective faculty advisors.

But what is perhaps most impressive of all is that this collective moment of discovery occurs not once, but every three months at the Naval Postgraduate School.

170 RESEARCH PROJECTS

19% CLASSIFIED THESIS
64% OF THOSE WERE DONE BY NAVY AND MARINE CORPS STUDENTS





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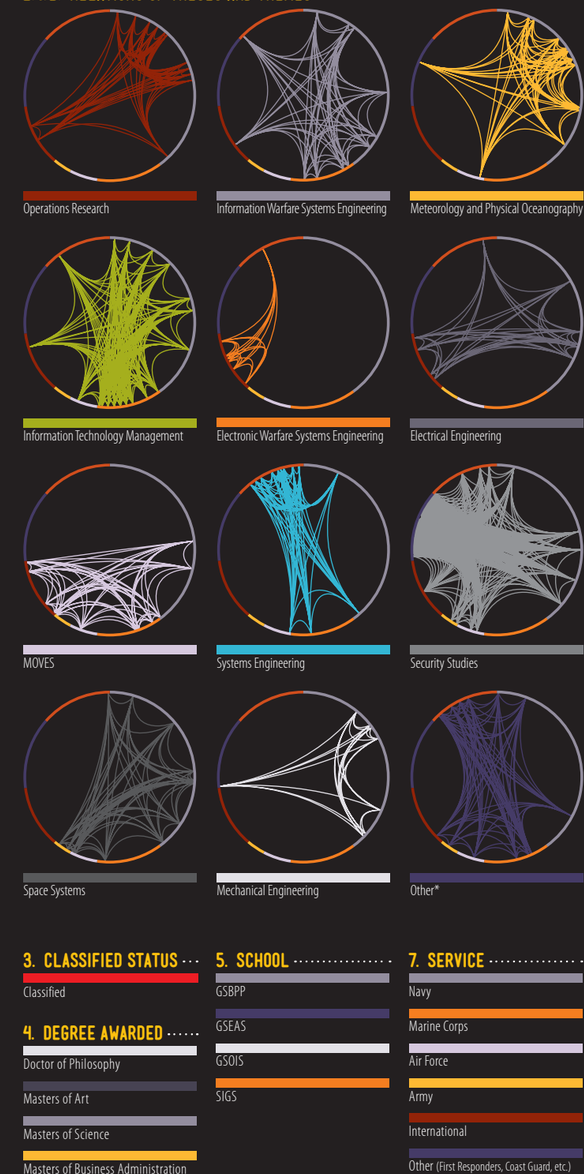

3. CLASSIFIED STATUS

Classified

4. DEGREE AWARDED

Doctor of Philosophy

Masters of Art

Masters of Science

Masters of Business Administration

5. SCHOOL

GSBPP

GSEAS

GSOIS

SIGS

7. SERVICE

Navy

Marine Corps

Air Force

Army

International

Other (First Responders, Coast Guard, etc.)

Civilian

*'Other' denotes specialized theses themes that were too limited in numbers to list in individual categories.

WANT TO SEE MORE?
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NPS students and faculty — from right, Marine Corps Maj. Thomas Dono, research associate Michael Day, Turkish Navy Lt. Umit Soylu, Assistant Professor Tim Chung and Tunisian Air Force Capt. Riadh Hajri — hold five of NPS' 30 Unicorn unmanned air vehicles being used to test 'swarming' and other counter UAV tactics.

Faculty Explore Defensive 'Swarming' Strategies to Counter UAVs

By Amanda D. Stein

UNMANNED SYSTEMS HAVE proven valuable and are well integrated into offensive mission sets — from gathering ISR (intelligence, surveillance and reconnaissance) to delivering payload. While researchers at the Naval Postgraduate School are examining a wide variety of these and other uses of unmanned systems, NPS faculty have also began looking into expanding the use of unmanned air vehicles (UAVs) in defensive missions as well.

"Research into concepts and tactics to counter unmanned systems is as important to military operations as research into our use of these systems," explained retired Navy Capt. Jeff Kline, Senior Lecturer in NPS' Operations Research department and Director of the Consortium for Robotics and Unmanned Systems Education and Research (CRUSER). "Many of our potential adversaries have advanced unmanned capabilities that present real challenges to our operating forces."

NPS Assistant Professor and Director of Research and Education for CRUSER, Dr. Timothy Chung, is working on developing a way to test swarm versus swarm tactics to counter an adversary's UAVs. He is the Principal Investigator on a project titled, "A System-of-Systems Testbed for Counter Unmanned Systems Tactics Development and Research," which looks at creating a competitive environment for swarm UAV testing.

"Swarming is the notion of having multiple agents that work in a coordinated manner to achieve some sort of objective," explained Chung. "It is relevant in our work here at NPS because with the 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."

CRUSER's research in swarm UAV tactics is, in part, in support of a classified research report known as Project Jason, established by Kline. Project Jason attempts to characterize and understand the threats posed by swarms of UAVs, such as the Harpy, an unmanned air vehicle produced by Israel Aerospace Industries. Project Jason has led to a number of classified student theses projects exploring these threats.

"These Harpy UAVs are deployed in large numbers, and they typically zero in on a particular high value target and dive bomb it," explained Chung. "Project Jason is essentially studying the problem of defeating the Harpy threat."

One of the obvious challenges in operating swarms of UAVs is getting the systems to coordinate themselves and maintain their mission capabilities even in the event that one or some of the vehicles malfunctions. Chung noted that the solutions to these challenges cannot be solved by only one discipline or department, and his research has and will continue to draw from the expertise of various departments across campus. He cites a recent example which includes the university's MOVES Institute to explore the human component of unmanned systems.

"What are the limits of a human operator's attention?" Chung said. "When something in a complex system of systems goes wrong, how do you deal with it? You don't want the operator to have to drop everything. You don't want the shepherd to ignore the entire flock if just one sheep goes astray.

"So the swarm system needs to be smart enough to adaptively reconfigure to adjust for that loss," he continued. "Or if I send in reinforcements, they should be absorbed by the swarm without explicit direction by the operator. They should deduce and response to changes themselves. And that's where the autonomy research and the artificial intelligence of these systems comes into play."

The CRUSER team sees NPS as the ideal place to implement such multidisciplinary research in unmanned systems. Since unmanned systems dominance remains a top priority across the services, Chung is working to establish a grand challenge competition, which would put the students' experience and education to the test with live-fly experiments involving 50 versus 50 UAVs. His goal is to have the competition operational by 2015, and open for NPS and interested teams to "duke it out over the skies of Camp Roberts," referring to the site of active NPS field experimentation efforts.

One of Chung's key research visions is to inspire researchers and students at NPS and beyond to explore the operational potential of swarming unmanned systems and innovations in tactics they will require. The emphasis is in employing these systems to enhance the defense of the Fleet and armed forces; however, the competition highlights the need to pursue both sides of combat.

"Despite the real-world threat that swarm UAVs could pose, we cannot just study defense," he said. "Defense is closely integrated with offense, so combining those two in kind of a competition environment allows both teams to develop both offensive and defensive tactics."

In DoD, academic and industry contexts, large-scale experimentation of swarming aerial robots has yet to mature significantly, although recent projects have begun to push the envelope. Such a swarm test-bed presents several challenges for researchers looking to get 100 or more five-foot wingspan UAVs into the air at one time — as would be the case in the competition.

"The way UAVs are currently operated, you could probably have one person operating three of four vehicles, but you would still need people to help launch and people to take over in the case of an emergency," explained Chung. "Right now, the requirements typically are one or more people per platform, which is clearly infeasible with 100 UAVs. We need to develop the capabilities and the technology to be able to manage larger numbers." Understanding the full implications of these system-of-systems also calls for analysis of issues such as maintenance and manning, test and evaluation, and even total ownership costs.

There are plenty of basic and applied research challenges, let alone logistical ones, presented when trying to conduct a mission employing many UAVs in the sky simultaneously, but Chung feels that NPS is uniquely equipped with the initiative, resources and expertise to be the first to fully explore the potential of these future defensive unmanned system swarms.

On this point, "the greatest assets are the students themselves," remarks Chung. "Our students are operationally seasoned with incredible real-world experiences. In fact, many of them have performed missions with existing unmanned systems, if not innovated their employment tactics themselves." He goes on to say, "these students are the forerunners of the next generation of military leaders of the robotics era."

With future concepts and experimentation efforts such as the competition, Chung hopes to educate and inspire further generations to come. IR

Welcomed Additions

Naval Postgraduate School leaders, students and guests gathered on the roof of Spanagel Hall, Jan. 11, to welcome two new unmanned surface vehicles (USVs) to the university's research community, and to celebrate the establishment of the new Sea Web and Wave Glider Laboratory.

The two vehicles, referred to by the Navy as Sensor Hosting Autonomous Remote Crafts (SHARCs), were appropriately named Tiburon and Mako, and christened with a stream of champagne carefully poured on the crafts.

During the christening ceremony, retired Rear Adm. Jerry Ellis, Director of the Undersea Warfare Research Center, offered confident predictions that the crafts would be invaluable additions to the institution. "I christen you Mako and Tiburon, may you always provide good research for the Naval Postgraduate School and may you always return to your home base."

NPS has long invested time and research into a wide range of unmanned systems, and the addition of the USVs will only help broaden the scope of the university's research. Ellis noted that Navy leadership had vowed, only days before, to make unmanned systems a main objective for fiscal year 2012.

Joe Rice, Research Professor of Physics, joined Dr. Phil Durkee, Dean of the Graduate School of Engineering and Applied Sciences, in cutting the ribbon to the new Sea Web and Wave Glider Laboratory, noting how long the program has been without lab space, and the excitement of having a place for research.

"Previously, Sea Web has developed experiments of opportunity around the world. We have done over 50 trials at sea, and that has been our laboratory," said Rice. "We're very pleased to finally have a home base here on campus. The lab will provide us some continuity in our research and development. It will support the engineering work on these wave gliders … [And] most importantly, having a lab here on campus will provide an opportunity for our students to be more directly involved in the work."

NPS Faculty Secure Government Patent for Fuel-Saving Plan

By Amanda D. Stein

SENIOR LECTURER JEFF KLINE recently saw years of research pay off in a big way when he received a U.S. Government patent for an idea sparked 20 years ago when he applied his NPS Operations Research (OR) education while a ship's Commanding Officer in the fleet.

The patent — jointly awarded to Kline, Distinguished OR Professor Gerald Brown, Distinguished OR Professor Alan Washburn, and the late Distinguished OR Professor Richard Rosenthal — is a transit planner for "Mixed-Mode Fuel Minimization." An abstract on the patent explains the fuel-saving concept that is now property of the Navy.

"A mixed-mode method for operating a vehicle's propulsion plant to travel at a selected average speed using the minimum amount of fuel," the patent states. "The method involves traveling in one mode at a high speed part of the time, and in a different mode at low speed part of the time, in such a way that the average speed is the selected value."

The initial transit planner was developed in 1992 after Kline, then a Lieutenant Commander, took command of one of the Navy's few Pegasus-class hydrofoils, the *USS Aquila*. Applying concepts learned in his OR studies, Kline decided to run the hydrofoil's duel engines in a way that would significantly reduce the amount of fuel being used, without compromising the ship's performance.

"I started getting impressive fuel savings relative to the other hydrofoils in the class," Kline recalled. "Our commodore noticed that we started getting fuel savings, so he sent his combat systems officer down to go through the plant to talk to the engineer and me to find out what we were doing different.

"Our schedule was the same, yet we were getting five to ten percent savings in fuel over the other ships," he continued. "He thought it might have been a mechanical issue and he wanted to understand how we were configuring the engineering plant. I knew that it was simply an extended use of this little fuel planner that I had designed and provided to my navigator and engineer. And we executed our operations based on that."

Impressed with Kline's plan, the PHM (Patrol Hydrofoil Missile) squadron started using it with the other hydrofoils as well. The plan, however, was short-lived with the decommissioning of the hydrofoils only months later.

Pleased with the results of his fuel-saving plan, however, Kline sent a letter to his former professor at NPS, Dr. Richard Rosenthal, sharing what he had done. That letter re-appeared when Kline returned to NPS as a Senior Military Faculty member in the OR Department, and got other faculty members engaged in ironing out the applications of his plan.

"When Jeff joined our faculty, we decided to see if any other Navy ships could benefit, and once we got our hands on engineering data for fuel consumption, we discovered potential savings in every ship class," explained Brown. "With some ship designs, this offers savings on the order of eight percent.

"We've shown how to save fuel using nothing more than mathematics," Brown added. "There is no additional hardware, gizmo or gadget required. Just follow the optimal policy we advise, and you save fuel." IR

From left to right, Distinguished Professors of Operations Research (OR) Alan Washburn and Gerald Brown and Senior Lecturer Jeff Kline, present a plaque noting their newly-secured patent — a transit planner for "Mixed-Mode Fuel Minimization" — to OR Professor and Chair, Dr. Robert Dell.

NPS Oceanography student, Portuguese Navy Lt. Ricardo Vicente, stands beside one of NPS' high-frequency radar systems. Vicente's thesis research will utilize data collected by this system and others lining the California coast.

University Faculty, Students Operate World's Largest Coastal Research Radar Network

By Amanda D. Stein

UP AND DOWN the coast, a network of transmitters and receivers that is the largest-of-its-kind in the world dot the beaches of California, silently reflecting high-frequency radio waves off of the surface of the water to help researchers map local currents. At the Naval Postgraduate School, faculty and students help maintain nine of the 54 observing stations throughout the state, and utilize the data gathered to provide a map of the current patterns along the West Coast.

These maps are key for a number of institutions and agencies, including the State of California as they look at potential oil spill dispersion, and for the U.S. Coast Guard to help locate missing swimmers. The data is also made available to the public.

"In 2004 the state of California issued a call for proposals for creating a network of monitor stations that would help pollution and oil spill response," explained Paduan. "At that point, NPS and several other campuses combined to create a consortium that responded to that proposal and was then funded to expand from Santa Barbara and Monterey out to the rest of the state."

NPS maintains the systems from Point Sur in the south to Half Moon Bay in the North, and is part of the much larger West Coast network commissioned by the state for coastal research. The system remotely transmits the data back to NPS where it is utilized in a number of diverse research endeavors.

"We are not as interested in the real time data flow, as much as looking at the historical data to determine what the patterns of circulation are like in different seasons – for example, summer versus winter in the Monterey Bay," Paduan explained. "The analysis has a lot of impact on the local biology. The marine biologists in the area where the data are collected are very interested in seeing what the current patterns are like in the different seasons because a lot of the coastal species depend on the currents for larval dispersal."

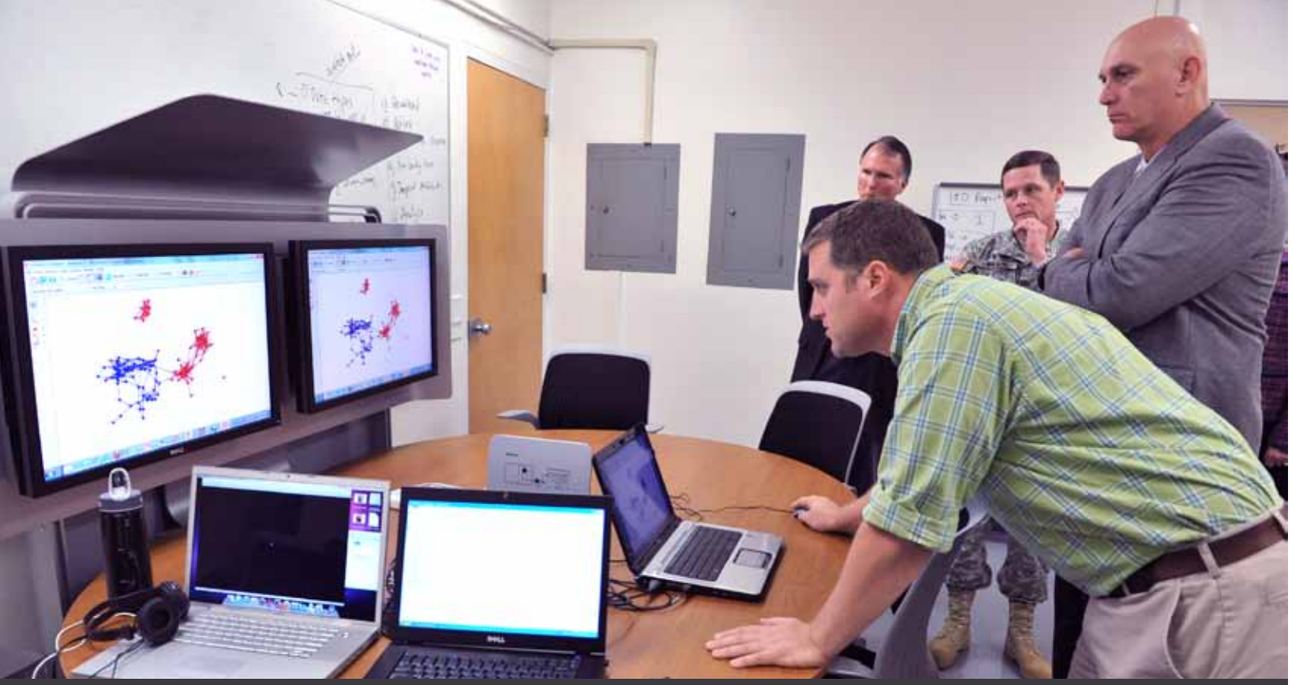
The historical data can also provide valuable information to responders in the event of an oil spill or pollutant off the coast. In 2007, the current patterns and predictions from the West Coast Radar Network helped crews determine the dispersal path of over 53,000 gallons of oil when the COSCO *Busan* container ship hit the Bay Bridge.

Student involvement has also been a key success, not only for NPS but for all of the partner institutions, in monitoring the data and finding real-world applications for it.

Oceanography student Lt. Ricardo Vicente, a Portuguese Naval officer, explained how his thesis work with Synthetic Aperture Radar (SAR) will help prepare him for his duties in the Oceanography department of the Hydrographic Institute in Portugal.

"My thesis will be an effort of characterizing SAR image features of the ocean as a function of wind speed," Vicente explained. "To accomplish this, I'll overlap wave mode SAR images with High Frequency Radar (HDR) data. By combining both remote sensing systems, the potential final product is a high-resolution, wind-driven surface currents map, from the coastline to approximately 100Km.

"The ultimate goal is to develop our knowledge of the oceans," he continued. "SAR and HFR systems create synergies that have a direct impact on a range of maritime operations such as search and rescue, oil spill tracking, ship routing, offshore engineering and fisheries." IR



Defense Analysis student Lt. Deak Childress, foreground, briefs Army Chief of Staff Gen. Raymond Odierno on Project Lighthouse, an effort utilizing social network analysis to identify and illuminate potential Improvised Explosive Device (IED) networks.

Army Chief of Staff Odierno Briefed on NPS' Defense Analysis Education, Research

By Amanda D. Stein

ON NOV. 4, Army Chief of Staff Gen. Raymond Odierno visited the Naval Postgraduate School to learn firsthand about the education and research programs underway at the university. Specifically, Odierno was briefed by several faculty and students in the school's Defense Analysis department, which enrolls approximately half of the Army students studying at NPS. Odierno assumed the position of 38th Chief of Staff of the Army (CSA) on Sept. 7, and has over 35 years in the service.

Odierno began his visit to NPS with a Command Brief offered by Associate Dean of the Graduate School of Operational and Information Sciences, Army Col. Robert Burks, providing an overview of the university's mission, programs and research. Odierno then attended a Defense Analysis brief presented by department Chair Dr. John Arquilla.

"I was very impressed with the depth and utility of the program of instruction at the Naval Postgraduate School," Odierno said. "Guided by a dedicated and expert faculty, the students are receiving a first-rate education that will serve them well as our nation's future senior leaders."

"A little over one in 10 NPS students are Army officers," explained Arquilla. "But in the Defense Analysis department, they make up about half, in fact over half of our students. And roughly half of all Army students at NPS are in Defense Analysis.

> *"The wide variety of research and analysis that the NPS students are conducting is extremely relevant to today's complex and uncertain strategic environment. I am also impressed with their enthusiasm and intellectual curiosity, attributes that will serve them well in the future as agile and adaptable leaders."*
>
> Gen. Raymond Odierno
> U.S. Army Chief of Staff

"Beyond special operations and information operations, I think the Army has been interested in the larger questions of Defense Analysis, which is what I think our department is all about. When you think about which of the curricula at our school are specifically, operationally oriented, this is one that seems to fit very neatly into the needs of the Army," he continued. "That's one of the reasons that we see such a concentration of Army officers in our department.

"The general wanted to spend a little time figuring out what his officers were studying," Arquilla added. "So we gave him an overview of the Defense Analysis department, [with] the key point being that for many, many years we have taken a cross-disciplinary operational approach to graduate education for our military officers."

Arquilla also encouraged the Chief of Staff to take advantage of NPS' resources and exceptional faculty for Intermediate Level Education for all Army officers, noting the university has a broad community of expertise that the service could capitalize on.

With an opportunity to see specific research projects in action, Odierno was briefed by Defense Analysis students Lt. Deak Childress and Lt. John Taylor on Project Lighthouse. For the students, it was a unique opportunity to directly brief a service chief on their thesis research, which utilizes social network analysis to identify and illuminate potential Improvised Explosive Device (IED) networks. Childress noted that he and Taylor both felt fortunate for the opportunity to brief the CSA, and to bring some attention to their research. They hope that their project will have lasting real-world military applications.

"We were … both extremely impressed with how quickly Gen. Odierno was able to pull the value out of a very brief discussion, and the understanding he showed of the analysis we are doing, as evidence by a couple of very pertinent questions he asked," explained Childress.

"It is absolutely vital to keep DoD senior leadership abreast of the different types of research ongoing here at NPS. I think it shows them that the investments they are making by sending folks here is paying off, and the time spent here at Monterey is definitely not wasted. We are both Navy guys, so we didn't approach this project with any one service in mind, but our research is definitely geared more to ground operators."

At the completion of the briefing, Odierno complemented the students on their project, and encouraged them to continue the research.

"The wide variety of research and analysis that the NPS students are conducting is extremely relevant to today's complex and uncertain strategic environment," Odierno said. "I am also impressed with their enthusiasm and intellectual curiosity, attributes that will serve them well in the future as agile and adaptable leaders." IR

Defense Analysis (DA) department Chair Dr. John Arquilla, right, briefs Army Chief of Staff Gen. Ray Odierno, left, on current education and research initiatives during a campus visit, Nov. 4. Nearly half of the Army students enrolled at NPS are studying in the DA program.

Army's Intellectual Center Commander Continues What CSA Odierno Started

The Commanding General of the esteemed 'intellectual center' of the Army, the Combined Arms Center (CAC), Lt. Gen. David Perkins visited the Naval Postgraduate School in January for a series of briefings and meetings with faculty, staff and students as a follow-up to the visit by Chief of Staff of the Army, Gen. Raymond Odierno, in September.

As the Army continues to support and potentially expands interest in different programs offered at the university, Perkins expressed interest in the abilities education provides his soldiers, and discussed his educational goals with leaders at NPS emphasizing the need for training programs to adapt to a changing world.

"Advanced schooling is a critical element of the professional development of our soldiers," said Perkins, "because it gives them technical skills and problem solving skills that I think are critical to operate in this increasingly ambiguous environment."

Perkins was briefed in full on the Defense Analysis program, but also explored other curricula and research currently underway within the Graduate School of Operational and Information Sciences, the School of International Graduate Studies and their Department of National Security Affairs (NSA). NSA curricula represent an intricate part of the educational requirements of Foreign Area Officers, a discipline the Army holds in high regard.

Although NPS is a Naval institution, its joint, multilateral research and educational programs have been held in high respect by Army leadership for many years. As Perkins wrapped up his visit, he praised the school's international community that exposes soldiers and other service members to a similar environment they would see in the real world, an experience that would prove crucial to the formation of any leader.

"NPS has a great academic reputation," said Perkins. "It has a unique capability to focus on problems that the military is particularly concerned about. It's very difficult to see everything in one day but I think I was most impressed by the enthusiasm and dedication of the faculty, staff and students. Obviously they are very renowned for their academics but their commitment, and in many cases sense of service, were outstanding."

Graduate School of Business and Public Policy Senior Lecturer and Academic Associate E. Cory Yoder, left, presents a lesson titled, "Basics of Acquisition and Contracting Processes," to Rear Adm. (sel.) Ken Perry, Vice Commander, Naval Mine and Anti-Submarine Warfare Command, during the latest round of the Transition Support Program, Dec. 6. Perry previously served as executive assistant to the Supreme Allied Commander, Europe.

NPS Continuing Education Program Delivers Personalized Courses to Transitioning Flag Officers

By Amanda D. Stein

ON DECEMBER 9, Rear Adm. Dixon R. Smith officially took command at Navy Region Southwest headquartered in San Diego, Calif. Several weeks before that, he spent an intense three days a few hundred miles up California's coast at NPS.

While the university's student population typically provides mid-level officers with a defense-based education, roughly 15 times a year, the campus welcomes senior Navy Flag Officers as they take part in the Transition Support (TS) Program, hosted by NPS' Center for Executive Education (CEE).

> *"I was a bit hesitant to attend the course as I felt I didn't have the time to spend. After talking to some folks who had previously attended I decided to give it a try. I'm glad I did as I will now go into my new job and do some things differently. If I hadn't attended and increased my knowledge in those areas I knew I was weak in, I would have continued doing the same things as I had previously and wondered why nothing improved."*
>
> Rear Adm. Dixon R. Smith
> Commander, Navy Region Southwest

Smith explained his initial concerns about finding time to attend the courses, but left noting that his time in Monterey was well spent. He sees this as a program that will have lasting value for the Navy and for him in his new position.

"I was a bit hesitant to attend the course as I felt I didn't have the time to spend. After talking to some folks who had previously attended I decided to give it a try," explained Smith. "I'm glad I did as I will now go into my new job and do some things differently. If I hadn't attended and increased my knowledge in those areas I knew I was weak in, I would have continued doing the same things as I had previously and wondered why nothing improved.

"I found the executive coaching sessions to be of the most value," he continued. "It was a time to reflect on my strengths and weaknesses as a leader, and to then discuss how to leverage them to improve my leadership and communication skills."

The TS program, part of the overall Navy Executive Development Program, utilizes NPS' experienced faculty to help flag-level officers transition into positions of increased responsibility. The admirals visit NPS for two or three days between assignments for tailored, one-on-one discussions with subject matter experts to help them prepare for the challenges that await them in their new position.

CEE Director Ron Franklin and Deputy Director Winli McAnally recently had the opportunity to brief Chief of Naval Personnel and NPS alumnus Vice Adm. Scott Van Buskirk on the value of the program in a visit to Washington, D.C., Nov. 9. This was Van Buskirk's introduction to the Navy Executive Development Program and to the concept and goals of the TS Program. Van Buskirk expressed strong support for this unique mission for NPS and its exceptional value to the Navy leadership.

"At the same time, this is an exceptional opportunity for the Naval Postgraduate School — to be involved in the development and education of the senior leadership of the Navy," added Franklin. "This is the first time in the history of the school that the executive leadership of the Navy is coming to NPS for their own advancement and professional development."

Flag officer participants for the program are selected by the Flag Development Office on the Navy Staff, ensuring that those who selected are not simply transitioning laterally within the Navy, but are moving into more senior positions.

"The Flag Development Office advises us on the admiral's current position, the job they're going to, and where they are in their career; then it is easy for us to shape one-on-one, desk-side chats with specific faculty and subject matter experts who can almost serve as confidants in the discussion of the admirals' future job," said Franklin.

McAnally coordinates directly with participants before they arrive to understand what areas of concern he or she might have, and what topics are recommended by their predecessor. Smith found that element of the program to be exceptionally rewarding.

"Having the ability to tailor your program to areas where you want to build your knowledge level and understanding is key," said Smith. "Trying to carve out the time to stop and think about where you're headed next, and to spend some time thinking about it is tough. Developing your own program to what you want and need incentivizes you to visit NPS and advance your knowledge."

Franklin explains that NPS has such a diverse and exceptionally-qualified faculty that finding the right subject matter expert to facilitate the TS discussions is not a problem.

"We know talent and where to find it. We will find the best person to address the issues desired by the visiting admiral. Our faculty have excellent credentials and absolutely pertinent research expertise that relate to our Navy's leadership and their requirements," he continued. "And that's just the academic background. There is also the practical or functional background that is also invaluable."

Another component of the TS program that Franklin and McAnally find valuable is the 'reach back' opportunity. Once the admirals see the resources and expertise available to them, they will often seek follow-up engagement with NPS faculty once they are in the new job.

"The TS program began in mid-2010. In the first few months, it was apparent that we should offer the opportunity for the admirals to follow up with some of these specialists," explained Franklin. "It became obvious that we should invite the admirals to reach back and continue development and application.

"The point is that the admirals get a chance to continue the TS discussions in their new job with the new leadership team," he continued. "Specific examples are commander's conferences held by an Expeditionary Group Commander on the East Coast last year and a similar leadership conference for Commander Seventh Fleet we will host in Japan in December this year. These are senior leadership meetings, to plan strategy and team building — the seeds of which had been planted when the admirals were here at NPS — and now there is the opportunity to mature and develop a full-blown leadership plan within the first three months." **IR**

Incoming Commander, Navy Region Southwest, Rear Adm. Dixon Smith, left, sits down with NPS Senior Lecturer John Mutty for a one-on-one course to assist in transitioning to his new position. Dixon attended two days of courses under the Transition Support Program, a Navy-wide senior officer support program.

2011 Transition Support Alumni

Rear Adm. John N. Christenson
President, Naval War College

Vice Adm. Gerald R. Beaman
Commander, U.S. 3rd Fleet

Rear Adm. Robert O. Wray
President, Board of Inspection and Survey

Rear Adm. (Sel.) Cynthia A. Covell
Director, Total Force Requirements Division

Rear Adm. Sean A. Pybus
Commander, Naval Special Warfare Command

Rear Adm. Patrick Driscoll
Deputy Chief of Staff for Global Force Management, Joint Operations and Fleet/Joint Training

Rear Adm. Arthur J. Johnson
Director, Assessment Division

Rear Adm. (Sel.) Barry Bruner
Director, Undersea Warfare Division

Rear Adm. Earl Gay
Commander, Navy Recruiting Command

Rear Adm. Peter Fanta
Commander, Expeditionary Strike Group Five

Rear Adm. Thomas Rowden
Director, Surface Warfare; Chief of Naval Operations

Rear Adm. Vincent Griffith
Deputy Chief of Staff for Fleet Ordnance and Supply; Fleet Supply Officer, U.S. Fleet Forces Command

Rear Adm. Richard Butler
Head, Strike Aviation Programs

Vice Adm. Scott Swift
Commander, U.S. 7th Fleet

Rear Adm. Dixon Smith
Commander, Navy Region Southwest

Rear Adm. (Sel.) Victorino Mercado
Deputy Director, Surface Warfare; Chief of Naval Operations Staff

Vice Adm. (Sel.) William French
Commander, Navy Region Southwest

Rear Adm. Terry Kraft
Commander, Navy Warfare Development Command, Norfolk

Rear Adm. (Sel.) Kenneth Perry
Vice Commander, Naval Mine and Anti-Submarine Warfare

Rear Adm. Scott Sanders
Reserve Deputy Director, JCW J7, Joint Staff

Faculty cross Spruance Plaza during the graduation procession for the Fall Quarter commencement ceremonies, Dec. 16. A total of 365 students earned advanced degrees during this quarter's ceremony.

Campus Icon Wayne Hughes Encourages Graduates During Fall Commencement Ceremonies

By MC1 Rob Rubio

"YOU SHOULD BE justly proud of what you have accomplished here. We will be proud to call you NPS alumni, and look forward to hearing great things from you in the future."

With these words by university President Dan Oliver, so began commencement ceremonies for the Fall quarter's round of graduates. In introducing this quarter's guest speaker, retired Navy Captain and NPS Professor of Practice Wayne Hughes, Oliver remarked, "He is a universally esteemed colleague among his peers, a revered mentor to his students … One of the great pleasures of my tenure here is that it has overlapped some of his."

Hughes highlighted his keynote address by reminding these new graduates that, as they return to their services, they are following in the wake of generations of NPS alumni who have impacted the world around them. He added that while they all come from diverse personal backgrounds and professional duties, they are returning to their jobs better equipped to take more varied tasks in the future. "Expand your horizons, because this is the essence of leadership," he noted.

Hughes closed by saying, "This is not an egalitarian creed that aspires to achieve equal wealth and happiness for everyone in society. In my society, in the Navy, at the Naval Postgraduate School and the nation, I look for the lions. They are the leaders who will take charge selflessly and make a better society … To the graduating class, I ask you to find two or more lions and nurture their careers, to make our entire profession a better one."

Hughes' exemplary career includes more than 60 years of service to the nation, including 30 years of active duty military service. "The reason I've stayed around here so long is that these are the best students in the world," he added.

Lt. Cmdr. Sarah F. Michael is the Fall quarter's recipient of the Monterey Council Navy League Award for Highest Academic Achievement. She said, "I am extremely honored to have been nominated for the Navy League Award, and even more so to have been chosen as this year's recipient. My tour at NPS and in the Monterey area has been a time of significant personal and professional growth. I am very grateful to the Navy for the opportunity to be here, and I hope to someday return to the area for a Ph.D."

Capt. Yuval Nevo of the Israeli Air Force won the Outstanding Academic Achievement Award for International Students. He commented that his time here at NPS was an amazing experience for him, due in part he says to Operations Research (OR) department faculty and the enriching interactions with other OR students.

"The professors are very dedicated to our success and our understanding of the things we study, especially my thesis advisors from whom I learned a lot with the many valuable lessons they provided," remarked Nevo. "I learned a lot about OR from the other students and their many other perspectives both American and international, which was an amazing experience," he added. "And I did try scuba diving while I was here, which is not something that I did in Israel. California is one of the best places in the world to see, hike and travel around."

A total of 365 students earning 369 degrees graduated this quarter, with 316 students crossing the stage in King Auditorium to receive their diplomas. A total of three Ph.D.s were awarded along with two engineer degrees. Two individuals earned dual degrees and one earned a triple degree. This quarter's class included 62 international graduates representing 21 different countries. IR

University Inducts Two New Members into Prestigious Hall of Fame

By MC1 Leonardo Carrillo

THE NAVAL POSTGRADUATE SCHOOL inducted two new members, retired Adm. Stan Arthur and Dr. J. Phillip (Jack) London, to its Hall of Fame during a ceremony, Dec. 2.

Adm. Stanley Arthur served as Commander, U.S. Seventh Fleet and Commander, U.S. Naval Forces Central Command for Operations Desert Shield/Desert Storm, and as Vice Chief of Naval Operations. London served as a naval aviator during the Vietnam War, and Aide and Administrative Assistant to the Vice Chief of the Naval Material Command during his active duty service. Following his naval career, London has been instrumental in the growth of CACI from a small consulting firm, to a global professional and information technology services provider to the defense, homeland security and intelligence sectors. With more than 14,000 employees worldwide, London currently serves as Executive Chairman for CACI.

"The Hall of Fame was established 10 years ago to recognize members of the NPS community who have committed their careers and lives to public service," said NPS President Dan Oliver during his opening speech. "Today, we welcome Dr. Jack London and Admiral Stan Arthur among them."

Oliver presented Admiral Stanley Arthur as the 16th member of the Hall of Fame praising his more than 38-year career serving actively in the U.S. Navy. He said that Arthur "exemplified the leadership qualities that are most critical for members of the armed forces."

"It's truly an honor to be among you all today. Never in my wildest imagination would I think that I would be here to accept this special honor," said Arthur. "This school is a very special place. It has provided quality education to so many over so many years … bringing innovation and informed decision making to this country's military."

Oliver then presented the 17th new member of the Hall of Fame, Dr. J. Phillip (Jack) London. Oliver pointed out London's contributions to some of the nation's most innovative and historic endeavors such as his participation as a member of the recovery team for Col. John Glenn's space flight aboard *Freedom 7*.

He emphasized London's continuous service throughout his career in the Navy and as a civilian, being actively involved with multiple organizations of social and national value. London took the podium and thanked Oliver, as well as all in attendance, for the prestigious honor.

"To be even considered to the NPS Hall of Fame is an honor that I would have never expected," said London. "At the same time, I am very proud to have been a graduate of such a fine institution.

"The Naval Postgraduate School instilled in me a certain framework for decision-making, through many courses, hundreds or maybe thousands of hours of studying that in the long run made me a better leader," said London. He listed several commands and situations where he was faced with challenges and difficulties, but he was able to face them because of what he learned at the school. "Nothing could beat the commitment and intensity that I discovered at NPS."

The NPS Hall of Fame was established to recognize the accomplishments of the university's most distinguished alumni and friends who, through the attainment of positions at the highest levels of public service, have made the greatest contributions to society, their nations and to the Naval Postgraduate School. IR

Dr. J. Phillip (Jack) London, middle, retired Navy Adm. Stanley Arthur, left, and NPS president Dan Oliver, right, are captured near the Hall of Fame display in Herrmann Hall following the induction ceremony that welcomed the newest members into the exclusive and prestigious group of distinguished NPS graduates and friends.

Two NPS Students Stabilize Shark Attack Victim at Nearby Marina State Beach

By MC1 Rob Rubio

ON A CRISP Saturday morning, Oct. 29, Monterey County resident Eric Tarantino, 27, was bitten along the right side of his neck and shoulder by an estimated 15–20 ft. great white shark while surfing at Marina State Beach in nearby Marina, Calif. As Tarantino and his friend struggled to paddle back to shore, they were fortunate to find two Naval Postgraduate School students — Army Maj. Jonathan Bleakley and Master Sergeant Garric Banfield — who just happened to be on the beach, getting ready to paddle out and hit the waves themselves.

The two active duty service members, and NPS Defense Analysis students, with advanced training to treat acute trauma like this, immediately knew something was wrong, and jumped into action.

Naval Postgraduate School Defense Analysis students, Army Master Sergeant Garric Banfield, left, and Maj. Jonathan Bleakley, right, stand at the location where they quickly applied their acute trauma training to stabilize a recent shark attack victim until paramedics arrived.

"We could tell something was going on when these two were paddling to the shore and then ran up onto the beach," Banfield said. "Someone said that he was bit by a shark, and we knew what was obviously going on. Even before we got there, we were yelling for first aid kits and one of our friends went to his vehicle to get one. With our Army training, the combat life saver training kicked in and we were calm and able to assist the victim."

Bleakley added, "The guy's buddy helped him onto the beach and we saw them, met them halfway, and helped to bring him up to the parking lot and laid him down on the sidewalk where Garric and I just kind of took over. Another individual with obvious medical training helped us … Other people grabbed towels and sheets and one got a sleeping bag. We appreciated all of the efforts."

The victim was conscious and talking, and had good color, they noted. Banfield applied pressure inside the wound to the neck, while Bleakley was tending to the wounds on the forearm where he had cuts of approximately four inches on the top and six inches on the bottom. A towel was wrapped around the shoulder and arms where pressure was being applied.

After what seemed like an eternity for both the victim and rescuers, paramedics arrived in just eight minutes to take over. The students knew the victim was experiencing significant blood loss, and their quick response limited this, but they take little credit for their actions.

Bleakley remarked, "I take no credit for it other than having the Army training that I did. I was very impressed with how my training turned to him. I'm thankful that we have that training."

Army officers get advanced trauma care training at Fort Bragg, Banfield added. "We're not medics by any means, but we have been trained in Tactical Combat Casualty Care, which is similar to the Army's combat life saver training with some more advanced trauma care thrown in."

"I'm glad that I was able to do it. I'm glad that I had the training to be able to do it," Bleakley noted. "I feel privileged that I was able to help him out … and was able to use my training when it was needed."

Amazingly, both rescuers still did go out into the water later that day, just not there at the Marina State Beach location. A friend of theirs, also studying at NPS, was with them for his first day of surfing, and in spite of witnessing the shark attack, still went out with both students for his first surf.

Bleakley, who later that week welcomed his third son, said it was a pretty eventful week for him and his family. And while their families were not wholly pleased they still went out surfing, both men remarked that their significant others were proud of them, and were glad that they had been there to assist Tarantino.

Banfield has been in the Army for almost 20 years, while Bleakley has 11 years as an officer after three years in the Enlisted Reserves. Both arrived at NPS in June 2011 into the Defense Analysis curriculum from the 95th Civil Affairs Brigade currently at Fort Bragg, N.C. Civil affairs units help military commanders by working with civil authorities and populations to lessen the impact of military operations during peace, contingency operations and declared war. Civil Affairs officers focus on humanitarian assistance and training, and building partner nation capacity through advancements in economic, health and educational systems. **IR**

Network-in-a-Box

In late 2004, a 9.0 magnitude earthquake struck the Indian Ocean, setting off a series of tsunamis that would devastate coastal cities in 11 countries, from Thailand to Africa. Days later, NPS researcher, retired Lt. Cmdr. Brian Steckler, made a trip to Thailand's devastated coast — it would be a trip that would forever change the course of his career.

Steckler was originally going to demonstrate a remote surveillance package he was developing for the Royal Thai Armed Forces when he quickly realized the collection of communications hardware in his possession could be used as an *ad-hoc* mobile communications, command and control capability for Thailand's emergency responders.

Since that fateful trip, Steckler has led a team of faculty, students and researchers in evolving that very idea — and today, his "network-in-a-box" has developed into a full suite of equipment that provides a complete self-powered, self-contained Emergency Operations Center, and it all fits into a few airline-checkable boxes weighing less than 100 lbs. each.

The self-contained system is at-the-ready, and can be setup anywhere, anytime should disaster strike. And it's been put to the test too, establishing full communications and network capabilities within hours following Hurricane Katrina in 2005, and providing MediVac communications to the *USNS Comfort* from the island nation of Haiti following its devastating earthquake of 2010.

It's just one example of how innovative research at the Naval Postgraduate School is in direct response to the current and evolving needs of U.S. national security interests around the world. In this edition of "In Review," we capture just a very small selection of current efforts, and provide a snapshot of student theses over just one quarter. While Steckler's self-contained "network-in-a-box" stands to change the game in humanitarian assistance and disaster response missions, every research effort at NPS is grounded in the same philosophy — to improve the effectiveness of the Navy, Department of Defense and enhance our national security.

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