



NAVAL POSTGRADUATE SCHOOL

IN REVIEW

MAGAZINE

JULY 2013



GUARDIANS

LARGE SCALE, NPS-LED EXPERIMENTATION IN THE SAN FRANCISCO BAY AND BEYOND IS PROVIDING A BLUEPRINT FOR THE PROTECTION OF AMERICA'S SEAPORTS, AND THE BUSTLING CITIES SURROUNDING THEM.

AT THE GATE

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INSIDE:

Cyber Graduates Honored for Relevant Research
Secretary Mabus Announces New NPS President
Newest Member of the NPS Hall of Fame Inducted



Rear Adm. Jan E. Tighe
Interim President
Naval Postgraduate School

"I am consistently impressed with the caliber of our students, the intellectual capital of our faculty, and the tireless dedication of our staff. The university has been challenged to face myriad changes over these past several months, and I have been proud to see the entire campus community rise up to meet those challenges with an unwavering commitment and dedication to the mission."

It's officially official... Secretary of the Navy Ray Mabus announced the appointment of retired Vice Adm. Ronald Route as the next president of the Naval Postgraduate School early this month, and the next era of leadership at this institution will soon begin. I have been deeply honored to serve NPS these past eight months. I continue to learn and this time at NPS has been some of the most rewarding of my naval career.

I have had the opportunity to experience all sorts of new perspectives of our Naval Postgraduate School. With each new discovery, I am surprised by the breadth and depth of contributions that we make to our Navy, DOD and nation on a daily basis. I am consistently impressed with the caliber of our students, the intellectual capital of our faculty, and the tireless dedication of our staff. The university has been challenged to face myriad changes over these past several months, and I have been proud to see the entire campus community rise up to meet those challenges with an unwavering commitment and dedication to the mission.

As you will see in this edition of In Review, the reputation for academic excellence at NPS is alive and well, as the university continues to stand on the leading edge of demand-driven education and research programs that directly impact the combat effectiveness of the U.S. Navy and the other armed forces.

The initial cohorts of students in our pioneering degree program in cyber systems and operations have graduated, and the results of their research have been lauded in technical circles. In addition, our applied cyber operations degree program, targeted to senior enlisted, will see its first collection of Sailors graduating this September. Our hope is that these programs continue to develop and add to the CNO's arsenal of "Cyber Jedi."

Coincidentally, the preeminent cyber leader of our time, Army Gen. Keith B. Alexander, Commander of the U.S. Cyber Command and Director, National Security Agency/Chief, Central Security Service, was inducted into the Naval Postgraduate School Hall of Fame during the Spring Quarter graduation ceremony. I have worked with General Alexander for a number of years and I have witnessed firsthand his unwavering dedication and inspirational leadership. We are honored to have him join the Hall of Fame, as well as address our newest class of graduates.

NPS students, both past and present, continue to excel in their chosen fields of study, and in their professions. With the latest selection of NASA astronaut candidates, another NPS alumnus has been selected for potential space flight. Furthermore, faculty-driven student research, highlighted in this issue, continues to directly impact broad aspects of national security, from directed-energy weapons and the systems that power them, to the application of military technology to disaster relief and humanitarian assistance.

We enjoy a unique symmetry between the students and faculty, and cumulatively their combined experience and expertise produces a one of a kind educational experience. This is perfectly exemplified in our cover story spotlighting an international two-week experimentation effort entitled Maritime Interdiction Operations (MIO) 2013. Dr. Alex Bordetsky has spent the last several years tirelessly applying his expertise in tactical networking to the detection, analysis and neutralization of dangerous materials entering the country through America's ports. Bordetsky's program is an excellent example of how complex global security challenges can be tackled through the application of student research, interagency collaboration, and international participation.

After several years of building partnerships, and educating countless students along the way, MIO 2013 brought countless stakeholders to the table to examine every aspect of this complex issue. From stand off detection, to real-time subject expert analysis anywhere in the world, to interdiction operations, this experimentation program provides an excellent example of how research enriches the student experience while simultaneously tackling real-world security issues.

Hope you enjoy this issue. See you in the Fleet!



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Student-led research by the first cohort of NPS' cyber systems and operations graduates is already demonstrating results in the modern era of cyber warfare.



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On The Cover

A mammoth container ship steams toward the Golden Gate Bridge, majestically spanning the entrance to the San Francisco Bay Area and the Port of Oakland. With millions of Americans just a handful of miles away from this modern wonder of the world, protecting the nation from a dirty bomb snuck into one container requires vigilance across several U.S. agencies and international partners.

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Secretary of the Navy Names New University President

Secretary of the Navy Ray Mabus announced the appointment of retired Vice Adm. Ronald A. Route to the position of Naval Postgraduate School President in a statement, July 16.

Route will replace NPS Interim President Rear Adm. Jan E. Tighe later this year following her several months at the helm of the Navy's graduate university — a period of leadership Mabus described as, "nothing short of remarkable." Tighe is scheduled to return to the Office of the Chief of Naval Operations in Washington, D.C.

Mabus also expressed confidence in the incoming president's leadership abilities and referenced his more than three decades of military service.

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

Tighe echoed Mabus' sentiments and welcomed Route's selection.

"Vice Adm. Route will bring an incredible amount of relevant expertise to NPS in areas that need it the most. The NPS team has worked tirelessly over the last eight months to lay a solid foundation which he will undoubtedly build upon and make us stronger," said Tighe.

Route comes to NPS with over 20 years of leadership at the executive and operational levels. His numerous past leadership positions include tours as Naval Inspector General and commander of the U.S. Navy's Warfare Development Command.



Retired Vice Adm. Ronald A. Route, pictured during his tenure at the Naval War College, was appointed to be the next President of the Naval Postgraduate School by Secretary of the Navy Ray Mabus, July 16.

Vice Chief Ferguson Holds All-Hands Call at NPS

Vice Chief of Naval Operations (VCNO) Adm. Mark Ferguson, a graduate of the university's computer science program, addressed NPS students, faculty and staff during an all-hands call on the university campus, April 25.

"We see this next century as a maritime century," said Ferguson. "A century that will demand our naval forces to be available as the nation's emergency response force. We're agile, deployable and able to operate forward without a permission slip. We have to be where it matters, when it matters and we're positioning the force in order to do that."

Detailing his own experiences

while studying at NPS, Ferguson shared with students the relevance graduate education has had on his military career.

"When I came here, it was my first exposure to officers from foreign countries," said Ferguson, "and with solving complex technical problems. It exposed me to the most advanced research and innovative thinking in industry, as well as within the Department of Defense.

"With the security challenges we're going to face in the future, an officer with a broad-based education that is technical, operational, and jointly-focused, enables them to meet the challenges of the future," he stressed. "We need officers moving forward that can

think, evaluate, judge, decide and act, and this is exactly what this institution produces."

NPS Workshop Helps Senior Leaders Apply Innovation

NPS' Center for Executive Education (CEE) provided a four-day course to flag officers and Department of the Navy civilian senior executives, May 6-9, entitled "Leading Innovation." The course is designed to provide Navy leaders with the skills and mindset to en-

erage innovation as it relates to organizational success in the Navy.



Vice Adm. (sel.) William Hilarides and Dr. Neal Thornberry

The workshop is part of the Navy Executive Development Program, designed to develop senior leaders and their strategic level of execution beyond operational aspects of lead-

ership development.

Dr. Neal Thornberry, Leading Innovation Program Manager, developed the course five years ago and brought it to NPS in 2011. "The course started out as a bi-annual event but due to increase of demand we bumped it up to three-times a year," Thornberry said. "This year we only have one scheduled due to budget cuts but we have three courses scheduled for next year.

"The term innovation is over-used, but very few people know how to utilize it and how to make it happen," said Thornberry. "We're trying to get them to understand innovation as a tool and not a destination. You don't arrive at a town called innovation; you have to know what the intent is."

The workshop incorporates a diverse program of classroom instruction, direct interaction with innovative industry leaders, and case study examination. CEE Acting Program Director, Winli McAnally, notes that it's important to provide real scenarios to achieve the goals of the course.

"Participants will be challenged to broaden their thinking process

through exposure to new ideas in the Navy," she said. "The course is designed to develop a cadre of flag officers able to build and sustain innovative Navy organizations within a business and organizational context."

NPS Alumnus Recounts Efforts to Defeat Piracy

Former Expeditionary Strike Group 2 Commander retired Rear Adm. Terrence E. McKnight, an NPS alumnus, shared his experiences fighting pirates in the Gulf of Aden with NPS students during a Secretary of the Navy Guest Lecture, June 4.



Rear Adm. Terrence E. McKnight

McKnight's experiences are documented in his book, "Pirate Alley," which catalogues U.S. efforts to defeat piracy and his leadership of the anti-piracy force, Task Force 151, off the Somali coast.

He contends that East African piracy is largely the result of poor governance in the failed Somali state, and poverty. He described how years of war, tribalism and the absence of either a Somali Navy or Coast Guard opened a window of opportunity for young men off Somalia's northern coast.

"Ninety-five percent of all goods that come to market are transported by sea," said McKnight. "Thirty thousand vessels travel through the Gulf of Aden each year." With all that commerce, and an absence of a stable Somali government capable of patrolling its own waters, the United Nations, European Union and the U.S. government were forced to take matters into their own hands to quell what he noted was a \$5 billion problem.

McKnight recalled the numerous issues that arose during early

attempts to squash piracy off the Somali coast. Lawyers were tasked with determining the status of pirates, where they were to be prosecuted and if convicted, where they should be jailed.

"We caught pirates, but there were questions about what to do with them once we caught them," he said.

Despite the legal ambiguities that plagued early piracy efforts, McKnight insists that progress has been made. He points to a 64 percent drop in pirate attacks between 2011 and 2012. McKnight attributes this drop to increased international anti-piracy operations in the region and several seemingly basic anti-piracy measures including the presence of security teams, lookouts, alarms and safe rooms.

NATO Explores NPS for Joint Force Training

German Air Force Lt. Gen. Karlheinz Viereck, Deputy Chief of Staff for Joint Force Training at NATO Supreme Allied Command Transformation (SACT) explored several programs at NPS in support of a restructuring of NATO



German Air Force Lt. Gen. Karlheinz Viereck, third from left

training and education requirements. Viereck visited the NPS campus in late April to meet with university officials on the development of new partnerships between NATO, SACT and NPS.

"NATO has restructured its training landscape in the last four years," said Viereck. "Now it's organized in such a way that is inline with international standards. We now understand how to program our requirements and how to manage them.

"Now I'm in a position to get in fruitful discussions with experts in the field of training and education," added Viereck. "The Naval Postgraduate School is one of these experts."

Viereck's visit focused specifically on exploring the establishment of NPS as a training hub for maritime strategy and security, operations research, as well as other areas of potential academic collaboration between NPS and NATO.

DHS Secretary Hosts Five Country Ministerial at NPS

Secretary of Homeland Security, the Honorable Janet Napolitano, welcomed international diplomats and colleagues from across the globe for the first Five Country Ministerial on Homeland Security held on the Naval Postgraduate School campus, July 22.

The forum focused on how close cooperation between the five

said during her opening remarks.

"But we are also bound together by new and evolving threats — from transnational criminal organizations, and terrorism, to those seeking to damage or disrupt critical infrastructure and infiltrate the systems that control such networks," she added.

The establishment of the forum was initiated between Napolitano and the Honourable Jason Clare MP, Australia's Minister for Home Affairs and Minister for Justice during meetings in Canberra, Australia and Washington, D.C., last year.

Participating in the ministerial with Napolitano were the Honourable Steven Blaney MP, Minister of Public Safety, Canada; the Right Honourable Theresa May MP, Home Secretary, United Kingdom; the Honourable Judith Collins MP, Minister of Justice, New Zealand; and, the Honourable Jason Clare



Secretary of Homeland Security Janet Napolitano, center right, at NPS on July 22

nations can be applied to counter-ing extremist terrorism. Participants also discussed collaborative methods to combat cyber-crime, the cyber security of critical infrastructure, and the exchange of criminal history information between the five nations.

"As allies and economic partners, our five countries have a successful history of cooperation in addressing issues — from increased security to facilitated movement of goods and people. We have a unique relationship with one another. We are all democracies, we share the same language, we have strong economies, and we also have engaged citizens who expect action and accountability from their governments," Napolitano

MP, Australia's Minister for Home Affairs and Minister for Justice.

Supply Corps Officer Dominates Spring Quarter Awards

Lt. Cmdr. Autumn Daniel, a Supply Corps officer from remote Roby, Texas, dominated this past quarter's NPS graduate awards, honored with four in total including the prestigious Monterey Council Navy League Award for Highest Academic Achievement.

"It's an honor to be considered for the awards because there is so much talent in both the student body and faculty, and really I should be thanking my classmates and professors who I learned from,"

» continued on page 6



VCNO Ferguson at NPS on April 25

Service Academy Students Spend Summer Break Interning at NPS

Small teams of students from the DOD's service academies spent summer break working with NPS faculty and researchers in fields relevant to their undergraduate studies.

The U.S. Naval Academy in Annapolis sent a group of four midshipmen studying computer science to work with faculty in NPS' Cyber Academic Group (CAG). Sponsored by the National Reconnaissance Office, the interns traveled to the Monterey campus to get hands-on experience in software engineering, cloud computing and computer-controlled systems.

Midshipmen Aaron Fleming, Kyle Hawkins, Ethan Genco and Victor Bowen were each assigned specific tasks to incorporate what they have already learned, but at the same time, were challenged to learn aspects of computer coding language and smartphone application development that they would not ordinarily study back in Annapolis.



With CAG Chair Dr. Cynthia Irvine's mentorship and oversight, two of the four midshipmen worked with computer science Associate Professor Craig Martell in ongoing biometrics research, while the other two worked with research associate Thuy Nguyen on cloud computing and systems security.

Fleming, a computer science/information technology double major at the academy, was tasked with examining multi-level security enforcement in a Linux environment.

"I am working on a project relating to cloud computing which focuses on the idea of having multiple security levels of data on the same cloud," he said. Fleming is developing a test suite to check the different capabilities of security-enhanced Linux to make sure that the multi-level security policies are being enforced.

Hawkins and Genco are working with Martell on the creation of Android apps that he notes will be of direct benefit to the future

graduate studies of NPS students.

"The work that Ethan and Kyle are doing ... will be directly usable by NPS students in my lab to conduct higher-level biometric-authentication experiments. At the same time, they are getting hands-on experience in both programming Android phones and in experimental design," Martell said.

Across the campus Quad, the NPS Department of Defense Analysis welcomed two U.S. Air Force Academy cadets to the Common Operational Research Environment (CORE) Lab to spend their summer studying innovative social network analysis techniques. Both behavioral science majors, Cadets Ayana Cameron and Kara Hovseth worked with Research Associate Rob Schroeder on timely CORE Lab research in intelligence analysis.

"Our cadets are helping us analyze the Syria conflict; they are looking at 'dark networks' and religious fragmentation," Schroeder explained.

Hovseth and Cameron, who will return to the Air Force Academy in August, are already seeing how they can apply the lessons learned here to their coursework at the academy.

"The CORE Lab experience has allowed me to see how the academic work that we are completing at the academy is put into practice," said Cameron. "I am learning what our studies really look like in the real world."

"I am looking for a correlation between violence and religious fragmentation and polarization," added Hovseth. "What we studied here helps me to explore my interests ... It is very applicable and directly relates to what we have been studying."

Cameron intends to continue her education with an eye toward future graduate studies possibly here at NPS. "I am thinking about applying for graduate school here in the future," she said. "It's been an amazing experience and great networking opportunity."

CORE Lab officials note the cadets' contributions to the research efforts have been mutually beneficial.

"They bring a fresh perspective and energy to the lab," said U.S. Army Special Forces Col. Greg Wilson, CORE Lab Co-Director. "These cadets are aspiring to be future information operations professionals and the lab's social media exploitation research is a perfect fit."

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said Daniel. "I think the analytical tools learned in the financial management and acquisition courses here will certainly help me solve problems in my next assignment."

Daniel earned her Master of Business Administration (MBA) degree through NPS' Graduate School of Business and Public Policy (GSBPP). And in spite of all



Lt. Cmdr. Autumn Daniel, left, and USCG Auxiliary National Staff Officer Dr. Tracy Schultz

her accomplishments, she is quick to note that is the experience itself that she found most valuable.

"I will leave NPS with myriad tools that I will be able to utilize and apply throughout the rest of my career, and I know without a doubt that the experience has helped me to become a more well-rounded naval officer," she said.

Professor Doug Brook served as one of Daniel's advisors for her MBA thesis project, and was also her instructor in a defense budget policy course. Brook nominated Daniel and her team to receive a GSBPP outstanding thesis award.

"Daniel led an MBA project team with Lt. Cmdr. Bryan Boggs and Pakistan Navy Cmdr. Syed Ahsan," said Brook. "They built, tested and delivered an optimization model for quantifying port visit decisions in the PACFLT area of responsibility. This was a challenging project and the team did a superb job."

Despite her accolades, Daniel had no time to rest on her laurels. Following graduation commencement, she immediately headed south from Monterey to report to the USS Carl Vinson (CVN 70) in San Diego where she will serve as the principal assistant for services officer aboard the aircraft carrier. **IR**

Minerva Initiative to Fund Two NPS Faculty-led Research Projects

When the Minerva Initiative announced its 2013 selection of university-led proposals to fund, three faculty from the NPS Department of National Security Affairs (NSA) will be at the helm of two of them.

Assistant Professor Dr. Naazneen Barma and Associate Professor Dr. Jessica Piombo received the prestigious grant to act as co-principal investigators (PI) on research aimed at examining the affects public services and foreign aid have on state building and reconstruction, while Associate Professor Dr. Maria Rasmussen received funding to lead an international team of academics delving into individual motivation and attitudes to violence and non-violence.

"It speaks really well to the NSA department that we have two of these grants accepted in terms of our relevance and our ability to combine academia and policy," said Piombo. "It helps NPS maintain leadership in this very important area of study."

"The Minerva grants are unique, to some extent, because they really have two sets of criteria for evaluating the proposals," said Barma. "One is very much academic merit and the substantive content of the research, and the other is the implications research has for policy development."



NPS NSA faculty Drs. Maria Rasmussen, Jessica Piombo and Naazneen Barma, from left to right

"Many of us are here at NPS because we truly care about bridging that academic-policy gap," Barma continued. "This is a recognition of that particular expertise that

we have here ... Personally, that is why I'm a social scientist. I want to have input on some real-world questions, and the fact that this was recognized in this respect was a real delight."

The Minerva Initiative is a Department of Defense-sponsored, university-based, social science research initiative launched by the Secretary of Defense in 2008 focusing on areas of strategic importance to U.S. national security policy. The overall program is aimed at improving the DOD's understanding of the social, cultural, behavioral and political forces that shape regions of the world of strategic importance to the U.S.

OR Professor Selected for Leadership Post in Professional Organization

NPS Department of Operations Research Visiting Professor Dr. Daniel Nussbaum has been elected to serve as a director of the International Cost Estimating and Analysis Association (ICEAA).

"It is always an honor to be nominated by your peers for leadership positions, and I have every hope that I can live up to their expectations," said Nussbaum.

The ICEAA is a non-profit that was formed after the recent merger of two professional organizations, the Society of Cost Estimating and Analysis, and the International Society of Parametric Analysis. Nussbaum says he looks forward to helping the ICEAA achieve its goal of advancing, encouraging, promoting and enhancing the profession of cost estimating and analysis through education and training.

"I expect to be involved in reaching out to other professional organizations and seeking common ground for telling people about the cost estimating profession," said Nussbaum.

Nussbaum also sees an opportunity to build awareness of joint graduate education efforts, some of which he helped develop at NPS, that are helping evolve and develop the cost

estimating and analysis workforce.

"I will certainly be telling people about NPS' joint [program] with the Air Force Institute of Technology and the distance learning Master's in Cost Estimating and Analysis," he emphasized.

In addition to his academic work, Nussbaum is a passionate advocate of volunteerism and participation in professional organizations.

"We often think we don't have time for these additional activities, but the opportunity to serve, especially a cause larger than oneself, should be thought of as a positive and rewarding opportunity, rather than as a burdensome one," said Nussbaum.

Nussbaum was one of six nominees, elected to the open position by the ICEAA's 2,000+ active members.

USAF Chief of Staff Selects NPS Professor's Book for Official Reading List

NPS Department of Defense Analysis Professor Anna Simons' co-authored book, "The Sovereignty Solution," was recently included on the Air Force Chief of Staff's recommended reading list.

"The Sovereignty Solution" was co-written with two of Simons' former students, U.S. Army Special Forces officers Lt. Col. Joe McGraw and Duane Lauchengco. The book was born from an academic experiment wherein Simons was asked to tackle a strategic policy question using 10 students.

"The book grew out of a project that I conducted for the Office of Net Assessment (ONA) at the Pentagon," said Simons.

"The problem we were given was to explore what sort of strategy the U.S. would have to have in place if the U.S. was blindsided by a national-level strategic problem ... Something like the first detonation of a nuclear bomb that would cause the U.S. to have to rethink its strategy overnight," said Simons.

"The book is the product of our seminar addressing that challenge, and offers a new foreign policy direction for the United States that



Department of Defense Analysis Professor Anna Simons

takes the classic American principles of 'don't tread on me' and 'to each its own' and marries them together," continued Simons.

"The Sovereignty Solution" advocates what some might describe as a libertarian approach to foreign policy. The authors create a foreign policy based on principled noninterference and a "you be you" philosophy that they say would result in decreased attacks upon U.S. interests.

"You be you" means there would be no more government-sponsored proselytization of the American Way abroad. There would be no more inveigling by the U.S. government to get others to change. This buttresses the respect that sovereignty is supposed to accord.

"If you have to fight wars, they should be short and decisive. In our rubric, we would have never gone to war in Iraq, and Afghanistan would not have been a drawn out war either ... We would have made a simple ultimatum to Mullah Omar, give up Al Qaeda or you are finished, that's the end of your regime. There would be no nation building, no rebuilding, Afghanistan would then have to come together and rebuild itself."

The authors defend their position by insisting that long wars are divisive and easily exploited. "Foreign policy is the easiest thing that adversaries can use to divide us. We have never remained undivided over long wars. A clever adversary should want to embroil us in a long drawn out war," said Simons.

Another theme of "The Sov-

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ereignty Solution” is the authors’ insistence that aid and nation-building are not only ripe for corruption, they infringe upon sovereignty itself.

“Look closely — the aid industry not only enables governments to avoid having to fulfill obligations to their citizens, but it also fails to impel them to have to live up to their sovereign duties. Or, to put none too fine a point on it — aid not only corrupts, it undermines sovereignty absolutely.”

The authors believe that by focusing on what makes America unique, and by promoting greater, “American indivisibility — where we don’t try to be all things to all people,” that the U.S. government will be able to focus its resources on problems at home while at the same time respecting the right of other nations to find solutions to their own problems in their own manner.

“We argue for preserving what makes us unique as a people. At the same time, if you push liberalism to its logical conclusion, then we Americans should also want to offer total respect to others who choose to live differently from us,” said Simons.

Longtime Faculty Member Honored With Superior Civilian Service Award

During the annual NPS faculty promotion and tenure ceremony, NPS Interim President Rear Adm. Jan E. Tighe surprised NPS Vice Provost for Academic Affairs Dr. Doug Moses with the Navy’s Superior Civilian Service Award for his exemplary service as NPS’ acting provost. The award is the Navy’s second highest civilian service honor.



NPS Vice Provost for Academic Affairs Dr. Doug Moses

“[Moses] was awarded the Navy Superior Civilian Service Award in recognition of the superior leadership he has provided as acting provost and for his selfless dedication to this institution over these difficult last six months,” said Tighe.

During the ceremony, six NPS professors were awarded tenure,

five were promoted to full professor, two to associate professor, and one to senior lecturer.

“I would encourage you to be patient and hold tight to the reasons that brought you here and the tremendous service that you are providing to the Navy, DOD, and the nation through the education of our future leaders,” Tighe noted to the group of honored faculty. “Mission success at NPS rests squarely on the shoulders of its faculty and we are counting on you.”

NPS Center Helps Developing Nations Govern Defense Institutions

A small group of senior leaders from around the world traveled to the NPS campus to attend a defense governance engagement workshop, participating in a series of round table discussions in the Center for Civil-Military Relations (CCMR) conference facility, May 7.

Issues in Defense Governance is hosted by CCMR’s Center for Stabilization and Reconstruction Studies (CSRS), and aims to explore collaboration, leadership and management processes of an effective ministry of defense, expand and enhance de-

fense governance practitioner networks, as well as identify conceptual and cultural challenges associated with the reform of defense governance structures and processes.

“Essentially the workshop brings together international representatives from their respective ministries of defense to talk about different issues relating to the organization and structure of governance,” said Ashley Dusenbury, program coordinator for CSRS. “Participants will gain a deeper level of understanding of the different ministries of defense and their structures.”

Participants in the workshop include representatives from Armenia, Azerbaijan, Montenegro, Norway and Ukraine. “This is an example of the regular types of engagements that CSRS and CCMR participate in all over the world, everyday,” said Nicholas Tomb, a CCMR Lecturer.

NPS Department of Systems Engineering Ranked 21st in the Nation

U.S. News and World Report recently released its annual rankings of the top graduate schools in the country, and the Naval Postgraduate



Members of the NPS’ SE Department evaluate the usage of Unmanned Underwater Vehicles.

School’s own Department of Systems Engineering ranked 21st on the list, standing along side prestigious programs from universities like Georgia Tech, Stanford, UC Berkeley, Virginia Tech and the Massachusetts Institute of Technology.

Notably, NPS’ systems engineering (SE) program was ranked higher than several older and more established national programs, placing the university’s youthful SE curriculum amongst the strongest in the nation. While systems engineering is not new to the Navy, the current program received its ABET accreditation just three years ago in 2010.

“Systems engineering started as a department in 2002, and we first began educating students in 2006. We went from no resident students in 2005 to over 100 students today ... the growth has been phenomenal,” said NPS Department of Systems Engineering Chair Dr. Clifford Whitcomb.

“Our current ranking just shows that we are meeting a need that the Department of Defense has. We have been able to adapt to that need with incredible growth while maintaining a quality, accredited program at the same time,” continued Whitcomb.

“This national recognition, coupled with our recent ABET accreditation, assures our sponsors and students that the SE department provides extremely high-quality education and research to meet the needs of the Navy and other services. For a department only 11 years old, this ranking is a remarkable achievement, especially to be in the top 25 in the country,” noted systems engineering Professor Dr. Dave Olwell. ■

NPS Ops Research Professor Reflects on Mars Mission-Planning Experience

There is arguably nothing more valuable to graduate studies than hands-on applied research. The opportunity to see how classroom concepts and theories are applied to real-world scenarios helps graduate students prepare to be practitioners in their fields.

For NPS Research Assistant Professor of Operations Research Dr. Emily Craparo, that opportunity came in the summer of 2003 when, as a doctoral student at the Massachusetts Institute of Technology (MIT), she was selected to take part in the Planetary Science Summer School (PSSS) at NASA’s Jet Propulsion Laboratory (JPL).

As part of a team of 18 graduate students and postdoctoral scholars, Craparo had the chance to work closely with NASA scientists and peers from across disciplines on the development of a Mars Lander Mission plan.

“[The Mars Geophysical Lander] is aimed at studying the martian interior in search of past habitability and future exploration support,” wrote Craparo’s PSSS team in a follow-up report on their work. “During an intensive week in summer 2003, the PSSS team developed the Mars Geophysical Lander mission concept and gained valuable interdisciplinary skills in mission design.”

The PSSS program, now in its 25th year, is aimed at exposing top young scholars to the kind of real-world work being done by NASA scientists daily at JPL and other research centers around the country. Craparo’s PSSS group would certainly apply to real-world research, and were invited to present their efforts given the similarities between their Mars Geophysical Lander (MGL) mission proposal and the existing NASA InSight [Interior Exploration using Seismic Investigations, Geodesy and Heat Transport] mission, slated for launch in 2016.

These similarities in intricate mission details, notes NASA InSight Principal Investigator Dr. Bruce Banerdt, reflect how compressive the PSSS program is in giving students a true mission-planning experience.

“The unique strength of the PSSS is the way the students are integrated directly into the JPL mission development process, working with exactly the same engineers and processes that are used every other week of the year to develop mission ideas into implementable concepts, including InSight some years later,” said Banerdt. “The eerie similarity of the 2003 mission concept to the current InSight mission demonstrates just how closely the PSSS simulates

the actual planetary mission development process, giving students invaluable experience in turning science ideas into practical missions.”

Craparo was responsible for overseeing the MGL attitude control system portion of the project, which utilized her academic background in aeronautics and astronautics from MIT. Today, Craparo teaches optimization-related courses in the operations analysis, systems engineering analysis, and systems analysis programs at NPS. She has also developed a course for the university’s new energy programs.

“There is a lot that goes into building a sophisticated spacecraft or a sophisticated aircraft. It’s not just aerodynamics and propulsion and the other classical subjects,” said Craparo. “It also includes software design and the development of decision algorithms for autonomous systems. The optimization part of that work really appeals to me. And that ties in to operations research, which is, more broadly, the science of making good decisions.”



“Operations research gives NPS students the tools they need to analyze alternatives quantitatively, and optimization specifically is about finding the best decision that meets a number of constraints that are expressed mathematically,” she stressed.

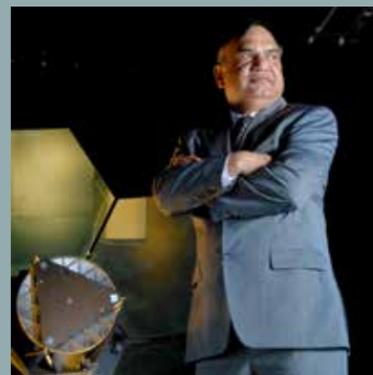
As NASA’s PSSS program marks its 25th anniversary, Craparo fondly recalls the opportunity to take part in the prestigious collaborative research program. The fact that the InSight mission so closely resembles the mission proposed by her group of students makes the summer of 2003 that much more memorable for the team.

“I think it’s neat that a group of students came up with this mission that was so similar in so many ways to what ended up being a real mission,” Craparo said. “The science objectives, the technology and logistics ... and even the cost. It is pretty amazing how realistic a scenario a bunch of Ph.D. students and postdocs can put together in a week.”

Adaptive Optics Workshop Furthers Efforts of NPS’ Center of Excellence

NPS’ Adaptive Optics Center of Excellence (AOCOE) for National Security held its third Adaptive Optics Workshop on the university campus, June 10-13. The workshop provides an enabling forum where leading experts can explore the latest applications in large aperture imaging satellites and high-energy laser (HEL) beam control.

“This workshop provides a unique opportunity for industry, university and government scientists to meet, exchange research, and understand the future direction of adaptive optics,” noted AOCOE Director and Distinguished Professor Dr. Brij Agrawal. “The attendees are considered technical advisors to the Adaptive Optics Center, so we also provide them a tour of the segmented mirror telescope and high-energy laser labs, and we have research-



Mechanical and Aerospace Engineering Distinguished Professor Dr. Brij Agrawal

ers and students provide presentations on their work. This results in direct feedback from leading experts.”

One of the primary goals of the AOCOE is to support and expand opportunities for NPS student research, Agrawal says. Current and former students have worked closely with various DOD partners, such as the Air Force Research Laboratory and the Naval Research Laboratory, in addition to leading universities, companies and research organizations within the field.

“This kind of experience is not available at other institutions,” stressed Agrawal. “This will help when our students go to DOD program offices, and working within a large program in imaging satellites and high-energy laser weapons systems ... The workshop has helped NPS become a focal point of research in AO technologies.”



Naval Postgraduate School cyber graduate, Navy Lt. Billy Brinkmeyer, left, and NPS Department of Computer Science Assistant Professor Rob Beverly, right, are pictured inside NPS' Hamming High Performance Computing Center. Brinkmeyer is one of several students from the university's first cohort of graduates from the cyber systems and operations program.

NPS' First Cyber Systems Graduates Honored for Thesis Research

By Kenneth A. Stewart

THE NAVAL POSTGRADUATE SCHOOL has graduated its first cohort of students through the Master of Science in Cyber Systems and Operations (CSO) degree program, and student-driven research is already showing promise, and producing results.

CSO student, Navy Lt. Billy Brinkmeyer's paper on Internet mapping won first runner-up honors before an international body of experts at the Active and Passive Measurement Conference, where leading Internet measurement researchers and top universities present the results of their research.

"The work that I focused on in my paper is primarily involved with Internet Protocol Version 6 (IPv6) router alias discovery. Essentially, I was trying to develop an accurate map of the IPv6 Internet," said Brinkmeyer.

To accomplish Brinkmeyer's task, he developed what he calls the "Too Big Trick" program — an application designed to illuminate the various hubs, routers and pathways that collectively make up the IPv6 Internet.

"When you send an e-mail or visit a Web page your data travels across the Internet through routers, it's like a freeway and the routers are the overpasses. We are trying to identify the freeways and determine how they connect to one another," said Brinkmeyer.

"We do not know how people are connected to each other and we want to be able to see them across the entirety of the Internet... If these are freeways, we need to be able

to see them so that when an accident occurs, we can find it and deal with it," said NPS Department of Computer Science Assistant Professor Rob

"Sam Trassare's thesis is useful because it allows us to hide our network in such a way that the enemy is not able to identify weaknesses or single points of failure within our network."

Dr. Cynthia Irvine
NPS Cyber Academic Group Chair

From Senior Enlisted to Cyberwar Specialists

Last September, a small group of senior enlisted Sailors came to the Naval Postgraduate School to embark upon an ambitious cyber operations graduate program designed to meet the Navy and Department of Defense's growing need for trained cyber professionals. Those pioneering Sailors now find themselves just a few short months away from graduation, and follow-on assignments at critical commands across the Fifth Domain.

"A couple of years ago, the Vice Chief of Naval Operations asked us to look at creating an opportunity for enlisted service members to receive a master's level education in cyber operations," said NPS Cyber Academic Group Academic Associate Dr. Duane Davis.

The Master of Science in Applied Cyber Operations, or MACO, is the result of that effort, and is open to enlisted personnel with a baccalaureate degree and previous network operations experience. The four-quarter resident program combines classroom and extensive laboratory work, culminating in a comprehensive capstone project.

"The program allows our students to look at a different aspect of cyber than what they are accustomed to in their careers. Cyber is a team activity and our students are working together, particularly through their capstone projects, to expand their knowledge and capabilities," said Cyber Academic Group Chair, Dr. Cynthia Irvine.

Information Systems Technician (IT) 1st Class Thomas Skoff of Charlotte, Iowa and ITC Eyan Dontchev of Monroe, N.Y. are among the first four enlisted students charging their way through NPS' MACO degree program.

"We want to take the knowledge that we get here back to the fleet. The Navy is sending us to strategic commands within the Navy that will benefit from what we are learning here at NPS," continued Dontchev. "It's an honor to be in the first group of students to participate in this degree program. The faculty here is very interactive and as the program develops it will only get better for the second and third iterations of students," said Dontchev.



The first cohort of enlisted service members to attend the Naval Postgraduate School's applied cyber operations degree program, clockwise from top left: Information Systems Technician (IT) Chief Deyan Dontchev, IT1 Thomas Skoff, ITC Rachel Doucet and ITC Javon Burden.

Beverly, who served as Brinkmeyer's thesis advisor.

Brinkmeyer's work stems from a recent government-mandated network upgrade that requires networks to upgrade from IPv4 to IPv6, a mandate that changed the way network managers see the network.

"We are trying to get a picture of the IPv6 network... A lot of people have done a lot of work mapping the IPv4 network, but when it comes to IPv6, nobody has been able to see it correctly. It's a whole new network that the government has mandated providers to adopt," said Beverly.

Brinkmeyer and his associates were able to test their program on a "ground truth system," a known network containing over 50,000 unique interfaces. During their tests, 70 percent of the routers on the network responded to a ping, and of those that responded to the technique, Brinkmeyer was able to identify 100 percent of the responders.

Fellow CSO student, Navy Lt. Samuel Trassare's work is also showing promise. He submitted a paper, still under review, exploring a technique that obscures friendly networks thereby impeding adversarial network attackers.

"When an adversary comes probing for the topology of your network, he uses a program called Traceroute that reports every hop along the path to a destination of the adversary's choosing. I came up with a program that intercepts that probe and instead of returning a truthful route, the program sends back a false route of my own choosing in order to deceive the adversary," said Trassare.

"Sam Trassare's thesis is useful because it allows us to hide our network in such a way that the enemy is not able to identify weaknesses or single points of failure within our network," said NPS Cyber Academic Group Chair, Dr. Cynthia Irvine.

Trassare has gone on to work at the U.S. Cyber Command, commanded by another NPS alumnus, Army Gen. Keith B. Alexander.

"The CSO program is just what the Navy needs if the next big battle is going to take place in the cyber domain," said Trassare. "I am coming to Cyber Command to stand watch for them in their intelligence cell. I have a very strong technical background, but what I got out of the CSO program is insight into how to apply strategy and policy to the cyber domain — how we go about identifying and defending against attacks on friendly networks."

Irvine is visibly proud of her fist batch of cyber systems graduates, and is hopeful the Navy can take full advantage of their unique education.

"We are hoping that the Navy will place our students in areas where they can use their skills," said Irvine. "The Navy has a great need for people with cyber skills, talents and expertise — cyber operations are different from kinetic operations. A new way of thinking is required to operate within the cyber domain and these students have been exposed to that thinking. They can plan and execute cyber missions," said Irvine. ■

GUARDIANS AT THE GATE

BY KENNETH A. STEWART

Seaports are the United States' most powerful economic engine, where every day nearly \$4 billion in goods enters, or leaves, through one of America's oceanic gateways. In 2010, more than 7,500 cargo vessels made 62,700 calls at U.S. ports – and every one of them presented a risk to American national security.

Port and maritime security is a team game, and the players are many.

Port authorities, police and fire departments, homeland security agencies across the board, DOD assets and even international partners all have a role in ensuring one thing never happens...A rogue enemy successfully hides a small, dirty but very dangerous chemical, biological, radiological or nuclear (CBRN) threat into one of a million cargo containers arriving and departing around the American coastline every day.

Deterring the threat is extraordinarily complex, and while advanced security systems and processes are in place, the U.S. must remain imminently vigilant to stay a step ahead of harm's way.

Naval Postgraduate School Department of Information Sciences Associate Professor Alex Bordetsky is an expert in ad hoc tactical networking. Years ago he identified an opportunity to apply the NPS-developed Tactical Network Testbed (TNT) experimentation program to U.S. port security.

Since then, his interests and ideas have now evolved into a broad experimentation program coined Maritime Interdiction Operations (MIO), the latest of which brought an international team of researchers, first responders, DOD operators and scientists together to the San Francisco Bay Area, and overseas, for several days of experimentation designed to detect and destroy ship-borne threats.

Bordetsky and his associates have been quietly working through the complexities of the problem for years. There are many pieces for sure, but Bordetsky has a vision of port security that he passionately describes...

Civilian and military intelligence professionals collect human and signal intelligence, from a variety of sources and sensors, on relevant vessels transiting to and from the United States. Maritime officials, the Navy and the Coast Guard from both the U.S. and its allies share information on suspect vessels when red flags are raised. Advanced tactics and sensors collect additional data on the vessel and the CBRN threat that is then relayed to experts around the globe. The experts analyze the threat and provide immediate feedback. This confirmed analysis is then shared with maritime officers who, when necessary, board, identify and neutralize potential threats.

"The goal is to find the device in the fastest time possible and to establish a security perim-

NAVAL POSTGRADUATE SCHOOL

eter," said Bordetsky. "A central part of our TNT/MIO experiments has been the study of collaboration between boarding and detection officers and remote technical experts...In MIO2013, we explored the collaboration between European and U.S. experts during network-controlled check points, drive-by screenings and stand-off detection during high-speed pursuits."

SHARING INTELLIGENCE

Most port security experts contend that one key to the successful interdiction of a CBRN threat is the sharing of information. This could be resolved by a system known as C3PO CEBOSS, a Web database and portal that supports sharing maritime interdiction and vessel boarding operations information – the database focuses on 16 essential information characteristics.

"C3PO CEBOSS allows maritime security operators to use data worldwide that is gathered during vessel boardings," said DuChancell Engineering and Consulting President and CEO Fernando Cancel, III. "In the past, we weren't able to share information with our allies, we are now fixing that problem. We will upload data into a cloud-based system and make it searchable for all of our allied partners."

Operational Manager Mikel Awad, an official with the U.S. Central Command (Centcom), is currently assessing CEBOSS. The system was integrated into MIO2013 for a COCOM perspective.

"Combatant commands identify an operational need, we work with OSD [Office of the Secretary of Defense] to find a solution...the solution we found was developed with Altascraft. They created a prototype and we have been conducting a military assessment to determine if it has military utility," said Awad.

"C3PO CEBOSS will be the main conduit for sending information to our experts," added Bordetsky.

ADVANCED SENSORS FOR ADVANCED INTEL

Still, it would be impossible to identify every potentially hostile vessel through shared intelligence, and that's where Lawrence Livermore National Lab (LLNL)-developed sensors enter the picture. LLNL is just a short drive from NPS' Monterey campus, and Bordetsky's MIO2013 team has utilized sensors developed by the lab in national and international ports to detect

NAVAL POSTGRADUATE SCHOOL

CBRN threats.

"Large area gamma detectors primarily are used for stand-off detection of vessels in the various modes of the marine, primary nuclear detection function. There are also multi-function systems that can be vessel-mounted or carried in a backpack," said LLNL Health Physicist Dave Trombino, another participant of MIO2013.

These sensors can be used in a number of ways to further examine ships potentially harboring CBRN materials. Suspect ships are tagged, and can then be further examined by a dive team, or by local law enforcement by conducting a "drive-by"

sweep of a suspect vessel. In MIO2013, both the San Francisco and Oakland police departments were involved in the program to develop anti-CBRN tactics and procedures.

"We have the same boat, and the same detectors and we have helped to develop the technology...It's one of our ongoing projects," said Officer Dan Greely with the San Francisco Police Department.

Getting into the detection effort is even sometimes the role of the California Department of Fish and Wildlife (CDFW). "We have inspection authority that actually supersedes some local law enforcement," said CDFW Warden Brian Patrick. "We are working with Dr. Bordetsky to have a permanent sensor mounted, it's an ideal set-up because we are one of the only local agencies that regularly goes offshore."

REAL-TIME EXPERT ANALYSIS

As all of the materials are examined, additional data and information gleaned must be immediately available to anyone, anywhere in the game of port security. During MIO2013, data is constantly uploaded via an ad hoc mobile network for CBRN experts in the U.S., and academics from universities in Europe to analyze.

Professor Alexander Loechel traveled to San Francisco from Germany's

University of Bundeswehr to take part in the experimentation, coordinating between the U.S. and German entities.

"I am looking at the ability of the two groups to communicate," said Loechel. "I hope to see reports on the interaction between the boarding crews and the European experts that can help us to determine what [CBRN material] they have."

NATO CBRN Liaison, Italian Army Lt. Col. Romeo Tomasetti also got involved... His job is to help determine whether or not a given



2013 MARITIME INTERDICTION OPERATION EXPERIMENT

As a simulation for enhancing communications, strategy, management and decision making in maritime interdiction, GSIOS professor, Alex Bordetsky designed a complex experiment spanning two continents and four countries, involving nine governments, eight corporate partners and dozens of on-site operators and researchers. Red and blue teams played an elaborate game of hide-and-seek involving chemical, biological, radiological and nuclear materials in the hands of terrorists. Here is how it played out...

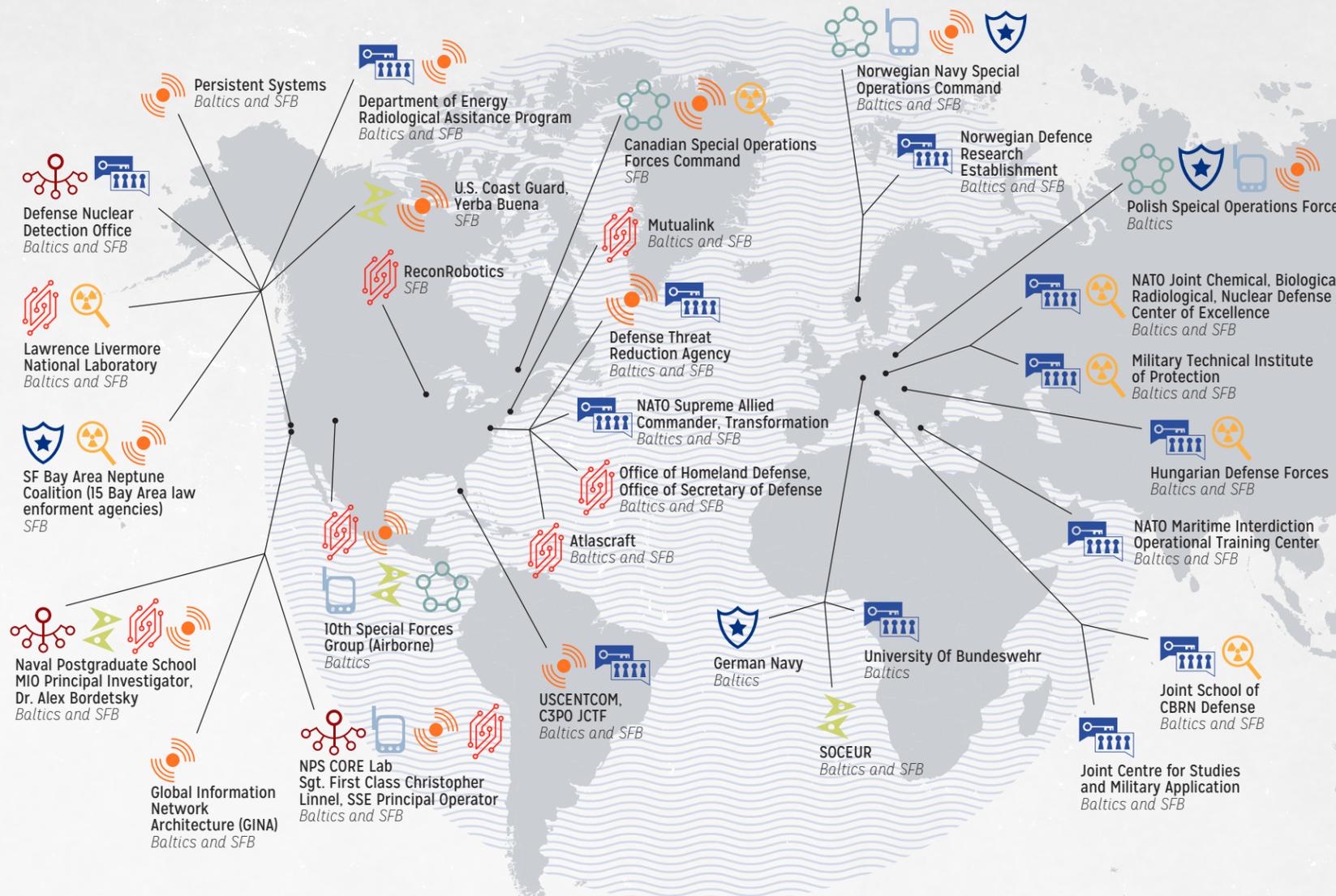
BALTIC SEA SENERIO

- PHASE I** Intelligence is alerted of possible CBRN weapons on the move. A ferry transporting suspect materials is tagged as it departs from Norway to an unknown port. U.S. and NORSOFS conduct SSE at a site in Kjeller, Norway with suspicious chemicals, while another SOF team boards the ferry and detects CBRN materials in a vehicle. All teams transmit their findings to the mesh network (NATO, JFTC NOC, DTRA, RB SME, DHS and DNDO communities).
- PHASE IIa** The ferry with suspect vehicle arrives in Kiel, Germany where port sensors confirm CBRN materials. As the vehicle is tracked in real-time, SOF teams are deployed with SSE kits to a possible meeting place and warehouse location in Berlin. All data is transmitted and analyzed by on-site operators and RB SMEs via the mesh network.
- PHASE IIb** Triggering CBRN sensors, the vehicle moves southeastward to an unknown location. Avoiding detection, NATO SOF elements and Polish special forces pursue target and work together to identify the route then assist with ground element interdiction and SSE operations at suspected rest stop locations. All data is transmitted to mesh network for analysis – subsequently uncovering a CBRN terrorist network.
- PHASE IIIa** Target vehicle is tracked across German-Polish border. As intelligence is reviewed between partner agencies, a terrorist cell and activities are detected with suspect Kiel affiliates in Berlin area coming to light. Stand-off detection and SSE are conducted at several rest stop locations along route, with findings transmitted to the mesh network.
- PHASE IIIb** Pursuit continues when target suspects abandon the vehicle and escape/evade with unknown CBRN materials. Dismounted tracking ensues. All SSE is transmitted to mesh network and reviewed at MOC RB SME sites for evaluation, analyzation and identification.

SAN FRANCISCO BAY SCENARIO

- PHASE IV** Days later a vessel with shielded CBRN materials trigger a stand-off detection alert from a USV buoy southeast of the Golden Gate Bridge. The MOC at the USCG station at Yeurba Buena tags and tracks the incoming vessel. Equipped with CBRN detection sensors and wireless broadband units, forward deployed crews organize to Marine Police vessels and patrol boats to conduct target screening, interdiction and SSE collection. Teams transmit data to mesh network and a throwable UGV streams video surveillance for real-time RB SME analysis. In result of SSE data, the target boat crew and affiliates are found in SF city area – a SOF unit is deployed to search the site.
- PHASE V** The target craft rendezvous with a large simulated oil platform. NPS, SSE, SFPD and international SOF teams communicating via mobile networks start a rapid search of the main deck of the platform, utilizing a UGV for stand-off CBRN and explosive detection. Based on SSE results and RB SME feedback, a second SOF team explores the platform interior using a small Throwbot UGV, capable of providing video surveillance to hidden and difficult to access areas. Concurrently NORSOFS and SFPD divers, communicating via submersed radio frequency, search the target craft and platform perimeter for possible parasite devices.
- PHASE VI** Upon a secondary screening, subsurface divers deploy to conduct surveillance on possible threats from under the target vessel. Divers communicate via near-field underwater touch with tethered "mailbox," which is interconnected with surface MIO operators. The SMEs receive uploaded site data and observe diver actions. Information is shared with mesh network for analysis, including tracking information on vessels, vehicles, dismounted agents, CBRN alerts and intelligence, surveillance and reconnaissance data feeds.

The experiment ends with all CBRN material secure and accounted for with all suspects in custody, intelligence data ready for analyzation and a terrorist network dissembled.



NUMBERS EXPERIMENT



Eleven communication and networking tools



Nine different sensors and CBRN detectors



Seven master's and Ph.D. students conducting thesis research



Three NATO offices in as many countries involved as RB SMEs

ADVANCED TECHNOLOGIES

NAME	CONTRIBUTOR	TOOL FOR:
ARAM sensor	LLNL	Mobile radiation area monitor
ATAK units	USSOCOM	Mobile mapping application that integrates tactical data sharing
BGAN Maritime	CENTCOM	Satellite link to ship for network communications
BGAN Satellite link to MIO testbed	CENTCOM	Satellite link to remote locations for network communications
CEBOSS	C3PO JCTD	Data management system for intelligence collection, sharing and analysis
GINA	NPS	Format data and facilitate sharing across broad spectrum of digital formats
Mutualink	NATO	Real-time interoperable communications multimedia sharing
RIID Sensor	DHS	Hand held radiation detection
Wave Relay	Persistent Systems	Portable broadband tactical network communications/network
Lighthouse SSE	NPS CORE Lab	Data collection application for information analysis and sharing
Targetr	Atlascraft	SA, threat detection and analysis, data capture/sharing
Throwbot UGV	ReconRobotics	Remote controlled lightweight robot designed for CBRN detection

	BALTICS PHASES					SFB PHASES		
	I	IIA	IIb	IIIA	IIIB	IV	V	VI
ARAM sensor	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
ATAK units	Red	Red	Red	Red	Red	Red	Red	Red
BGAN Maritime						Orange	Orange	Orange
BGAN Satellite link to MIO testbed						Orange	Orange	Orange
CEBOSS						Red	Red	Red
GINA	Red	Red	Red	Red	Red	Red	Red	Red
Mutualink	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
RIID Sensor	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Wave Relay						Orange	Orange	Orange
Lighthouse SSE	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Targetr	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Throwbot UGV						Yellow	Yellow	Yellow

KEY

- Control Team
- Logistics
- On-Site Teams (Blue and Red)
- Tech Expert/Provider
- Mesh Network/Communications
- Data/SSE Collection
- Reachback Subject Matter Experts
- CBRN Detection
- Local Law Enforcement

GLOSSARY

- ARAM: Adaptable Radiation Area Monitor
- BGAN: Broadband Global Area Network
- C3PO: Combined End-to-End Expanded MIO Performance Optimization
- CANSOF: Canadian Special Operation Forces
- CBRN: Chemical, Biological, Radiological, Nuclear
- CENETIX: Center for Network Innovation and Experimentation
- COE: Center of Excellence
- DHS: U.S. Department of Homeland Security
- DNDO: Defense Nuclear Detection Office
- DTRA: Defense Threat Reduction Agency
- GSM: Global System for Mobile Communications
- HQ: Headquarters
- JCTD: Joint Capability Technology Demonstration
- JFTC: Joint Force Training Center
- LLNL: Lawrence Livermore National Laboratory
- MIO: Maritime Interdiction Operations
- MOC: Maritime Operations Center
- NORSOFS: Norwegian Special Forces
- NOC: Network Operations Center
- RIID: Radiation Isotope Identifier
- RB: Reachback
- SA: Situational Awareness
- SFB: San Francisco Bay
- SFPD: San Francisco Police Department
- SME: Subject Matter Expert
- SOF: Special Operation Forces
- SSE: Sensitive Site Exploitation
- USCENTCOM: U.S. Central Command
- USCG: U.S. Coast Guard
- UGV: Unmanned Ground Vehicle
- USSOCOM: U.S. Special Operations Command
- USV: Unmanned Surface Vehicle



Research Environment (CORE) Lab on a Sensitive Site Exploitation (SSE) application known as Lighthouse SSE... Seeing its value, the team integrated it into the MIO2013 experimentation program.

Linnel's application attempts to simplify the SSE process by giving context at the point of collection to the plethora of pictures, faces and documents that are encountered during maritime boarding operations.

"This is about enabling analysts to rapidly connect the dots and better inform decision makers," said CORE Lab Co-Director Army Special Forces Col. Greg Wilson. "The ability to rapidly exploit this type of information can enable us to get inside the enemy's decision cycle."

"I take a photo, it is geo-referenced, and metadata is stamped on it with relevant information about the search and the organization that produced the report," added Linnel.

The application is run on a simple Android OS-based mobile device, and connected to a tactical network via a wave-relay radio system.

"By using the wave relay radio, you are able to update on the move and share information in real-time which is funneled through the network to CBRN experts abroad," said Linnel.

Linnel and his team recently returned from the Baltics where they worked with a Norwegian Navy Special Forces team to test the application's networked features.

"This experiment was not only a success, but also sparked the interest of other European nations who seek to participate in next year's experiment," said Linnel. "The experiment next year will evolve even further with a more realistic feel to include shoot houses and military planning amongst participating units stretching across the U.S. and into the Czech Republic."

BOARDING THE VESSEL

With streamlined data collection, advanced sharing and real-time intelligence analysis, the experimentation took the next step, integrating military forces from the U.S., Canada, Poland and Norway to help examine operational tactics once the decision to board a suspect

vessel has been made.

Canadian Army Master Cpl. Jason Charlebois participated in the boarding team. "We use a hand-held Identifier 2 to detect CBRN threats," he said. "We have to be able to integrate seamlessly into other special operations communities and it's exciting to see where this is going."

The team integrated additional robotics technologies into the boarding team's tactical scenarios, such as the Throwbot XT, a lightweight robot that can be thrown over the side of a hull and remotely controlled.

"We have some 3,000 robots being used in Afghanistan right now," said Todd Little with ReconRobotics. "The maritime deployment of the system is a new concept. We are here evaluating the system by using it in conjunction with compliant boardings."

"You can be a football field away from an IED or other device and see it through the bot. It weighs only one-and-a-half pounds and can be thrown up to 120 feet. It can also survive a 20-foot drop onto concrete," said Little. The Throwbot XT can provide live streaming video and audio as it rolls about through passageways and berthings in search of suspect materials and devices.

For larger vessels, NPS Research Associate Eugene Bourakov developed the Segway RMP-400 robot equipped with a nuclear detection sensor. The Segway RMP-400 can be remotely piloted throughout a suspect ship, and it allows boarding crews to locate dangerous materials without exposing themselves to radioactive contamination or attack from hostile crewmembers.

"We are utilizing robots for the first time with a radiological detector. Never before have we used an unmanned ground vehicle with a radiological detection capability in a maritime environment, this is a historic moment," said Bordetsky.

Bordetsky and his diverse team of NPS students, researchers and collaborators are already examining the results from the June 2013 experimentation event, assessing what additional complexities and players need to be integrated into the program for future discovery.

With the value of international trade via seaports estimated to increase to a staggering 60 percent of the total U.S. gross domestic product by 2030, the game of port and maritime security is one that America cannot afford to lose. **IR**

WE ARE UTILIZING ROBOTS FOR THE FIRST TIME WITH A RADIOLOGICAL DETECTOR



IR vessel has a legitimate need to carry CBRN material, such as radioactive isotopes for healthcare.

"There is a network of experts analyzing the data in a special format, and they interact with each other and analyze the data that we send to teams in the field," said Tomasetti. "They also determine whether or not the source is a legitimate substance for that ship, such as a ship carrying cobalt-60 for medical purposes."

REAL-TIME RAPID ANALYSIS

As Bordetsky's team has evolved the MIO program, they quickly realized the format of the data is critical to effective and rapid analysis. NPS student, U.S. Army Special Forces Sgt. 1st Class Christopher Linnel, has been working with the university's Common Operational

NPS Adds Another Astronaut Alumnus With NASA's Newest Class

By Dale M. Kuska

WHEN NASA ADMINISTRATOR Charles Bolden announced the latest class of NASA's eight astronaut candidates, June 17, the Naval Postgraduate School was able to add yet another space-traveling alumnus to its ranks, now totaling 41 and counting.

Lt. Cmdr. Victor Glover, an F/A-18 combat pilot currently serving as a Legislative Fellow in the office of Senator John McCain, was selected from more than 6,100 applicants to begin training at Johnson Space Center in August for potential space flight.

Glover graduated from the Naval Postgraduate School in 2009 through the Master of Systems Engineering Management — Product Development 21st Century (SEM-PD21) program, in addition to receiving a space systems academic certificate in 2005, both via distance learning.

Glover notes the two programs, while both very different, provide a tremendous foundation for the challenging training that lies ahead of him.

"Certainly, the space systems certificate program is directly applicable," Glover said. "It gives you the basics of communications, orbital mechanics, imaging systems... things that are very relevant to the processes of manned space exploration."

But, he continues, his experience in the SEM-PD21 program provided an immediate payoff to his position in the Fleet.

"I was a test pilot, working in the systems engineering field, actually doing test and evaluation under the umbrella of weapons systems acquisition," Glover said. "My work product bolstered my school product, and likewise, my school product improved my work quality."

"Systems engineering has really emerged over the last several years as a critical discipline for the development of systems that meet the needs of the warfighter," added Dr. Cliff Whitcomb, NPS Department of Systems Engineering Chair. "It's an engineering discipline that provides students, especially at the master's level, with a very holistic, balanced perspective."

Not only did the coursework provide an immediate payoff, but its simple availability to Glover was equally as valued.

"The thing that was really amazing about both of these programs is that they are distributed, and they allowed me to continue my professional development through advanced formal education where I was stationed," he stressed. "I actually did the space systems certificate while I was deployed to the Middle East flying combat missions off the *USS John F. Kennedy*."

"Lt. Cmdr. Glover completed our space systems certificate program back in 2005, and I am very pleased to see he will be able to apply some of what he learned to his ambitions in space flight," added Space Systems Academic Group Chair Dr. Rudy Panholzer. "As a Navy pilot, it is very challenging for these officers to remove themselves from the cockpit to obtain a valued, educational experience in the classroom... This is precisely why we ensure our programs are available remotely, and in the more condensed format of our academic certificates."

Although a few years removed from his time at NPS, Glover was re-

called by his former advisers and teachers as an overachiever.

"I remember Victor Glover as an exceptional student in the product development 21st century (PD-21) curriculum," noted Dr. John Osmondson, a Research Associate Professor in the NPS Department of Information Sciences and co-advisor on Glover's thesis. "He was extremely enthusiastic and always produced very high-quality, technical work. It was clear from his interactions with the rest of his PD-21 cohort that Victor was a natural leader."

Glover says that while he is eager to get started on his training, he is also still trying to absorb the reality of his accomplishment.

"It still hasn't completely set in that this is really happening. It's an amazing opportunity professionally, and personally. This is an amazing group of people that I have been selected to join, and it truly is overwhelming on so many levels," Glover said.

"The next achievements in space will require a great deal of work by many of us selected now," he continued. "I am happy to be associated with the accomplished and capable people that are going to be a part of making that happen." **IR**

"I actually did the space systems certificate while I was deployed to the Middle East flying combat missions off the USS John F. Kennedy."

Lt. Cmdr. Victor Glover



Lt. Cmdr. Victor Glover, right, shakes hands with Maj. Gen. Thomas L. Conant, USMC at NPS during graduation in Aug. 2009. Glover was announced as one of only eight new astronauts by NASA Administrator Charles Bolden, June 17, becoming NPS' 41st graduate to become a NASA astronaut, more than any other postgraduate university in the world.



Dr. Douglas A. Hensler addresses regional media during a press conference announcing the beginning of his tenure as provost, June 5. Hensler will serve as the Naval Postgraduate School's 14th chief academic officer following a lengthy career in both academia and industry.

Naval Postgraduate School Welcomes New Provost to Campus

By Dale M. Kuska

DR. DOUGLAS A. HENSLER officially began his tenure as 14th provost of NPS in early June. Hensler joins NPS following five years as dean of the W. Frank Barton School of Business at Wichita State University, and a lengthy career in both academia and industry.

"Dr. Hensler's background and management experience will without a doubt contribute significantly to NPS' effectiveness, as together, we continue to pursue our educational mission," noted NPS Interim President Rear Adm. Jan E. Tighe. "I'm sure that Doug and Janie Hensler will find that NPS is not only a great place to work, but a great place to live."

Hensler hit the ground running with a packed schedule of meetings and briefs during his first few days on campus, but noted he has been eager to get started since accepting the position in April.

"I have been looking forward to this day for some time," Hensler said. "The Naval Postgraduate School has an outstanding academic reputation, and in combination with its mission for the Navy and Department of Defense, the university truly is a critical asset for our national security. Serving as provost for this institution is an honor for me professionally, and a wonderful opportunity for my family."

NPS' new chief academic officer highlighted several unique aspects of the institution that helped support his decision to accept the challenge.

"The work done by NPS faculty, past and present, speaks for itself," he noted. "The Naval Postgraduate School is the nation's premiere defense-focused graduate institution because of the work done by its dedicated faculty. Their commitment to the education of our nation's finest is evi-

dent in the caliber of our distinguished graduates and their outstanding contributions to our nation.

"Our students are not just beginning their careers, they are mid-career professionals whose academic work here translates into immediate gains in their respective fields, and to the advancement of our nation," he continued. "It is a profound honor to serve beside them."

As Hensler wrapped-up his comments to the gathered media, he stressed the importance of strong leadership in guiding the institution forward.

"I understand the challenges before me and recognize that there is a great team in place to help with my transition. I want to especially recognize Admiral Tighe's contributions during the short period of time she has been here, as well as that of Acting Provost Dr. Doug Moses," he said.

"Under Admiral Tighe's leadership, the way ahead for NPS looks bright," Hensler continued. "She and her team have laid a solid foundation that will no doubt ensure that NPS is postured for continued and future success."

Secretary of the Navy Ray Mabus selected Hensler for the position of university provost in mid-April following a diligent search and review process.

"For more than a century, the Naval Postgraduate School has provided high-quality, relevant and unique advanced education and research opportunities," Mabus noted in a statement announcing Hensler's selection. "I appreciate Admiral Tighe's leadership during this time of transition and welcome Dr. Hensler as we begin the next chapter in this storied institution's history." ■

U.S. Cyber Command Chief Inducted Into NPS Hall of Fame

By Kenneth A. Stewart

U.S. ARMY GENERAL Keith B. Alexander, Commander of U.S. Cyber Command, and Director, National Security Agency/Chief, Central Security Service, was inducted into the Naval Postgraduate School Hall of Fame during the university's Spring Quarter graduation ceremony, June 21.

"It is my privilege to welcome Gen. Alexander to NPS' distinguished Hall of Fame. I was blessed to work for Gen. Alexander for five consecutive years, including a year on his personal staff," said NPS Interim President Rear Adm. Jan E. Tighe. "I witnessed firsthand his inspirational leadership and his unwavering dedication to our nation. It is truly an honor to preside at today's ceremony."

Alexander earned advanced degrees in systems technology (electronic warfare) and physics while attending NPS in the '80s. Tighe commented on both the academic and professional accomplishments that led to Alexander's induction.

"Gen. Alexander's contribution to our nation's security and to our great institution are long standing, and will endure well beyond his tenure," said Tighe. "His induction into the Hall of Fame is in recognition of these contributions, his continued commitment to professional excellence, and his tireless efforts to defend our nation in cyberspace."

As head of Cybercom in Ft. Meade, Md., Alexander is responsible for planning, coordinating and conducting cyber operations, as well as the defense of Department of Defense (DOD) computer networks. In his capacity as NSA director, he is responsible for a DOD agency with national-level foreign intelligence, combat support, and U.S. national security information systems protection responsibilities.

"I think one of the most important things we can do for our students here is to prepare them for the future roles they will play in the military," said Alexander.

"From my perspective, having people that are educated and who understand the technical side of cyber, especially information technology, computers, how they communicate, how people hack into them, and what must be done to protect them, takes great technical skill," he continued.

"What NPS does is train people at the fundamental level on how these things operate ... students can then take that deep technical understanding and use it in military operations around the world," Alexander added. "I believe educating our military force, enlisted

and officer, is one of the most important things we can do and we really appreciate what you are doing here to help build that force in this area."

Alexander also spoke of the evolving nature of U.S. Cyber Command and the need to build an educated cyber force.

"The mission for the U.S. Cyber Command is evolving. We are responsible for the nation against a cyber attack, as well as for operating, building and defending our DOD networks," said Alexander. "In my opinion, the easiest way that the adversary can come against us is

cyber — that is where we are going to be challenged the most and in the near term. We have to build the force, train them and get them ready to do that which our nation depends upon us to do."

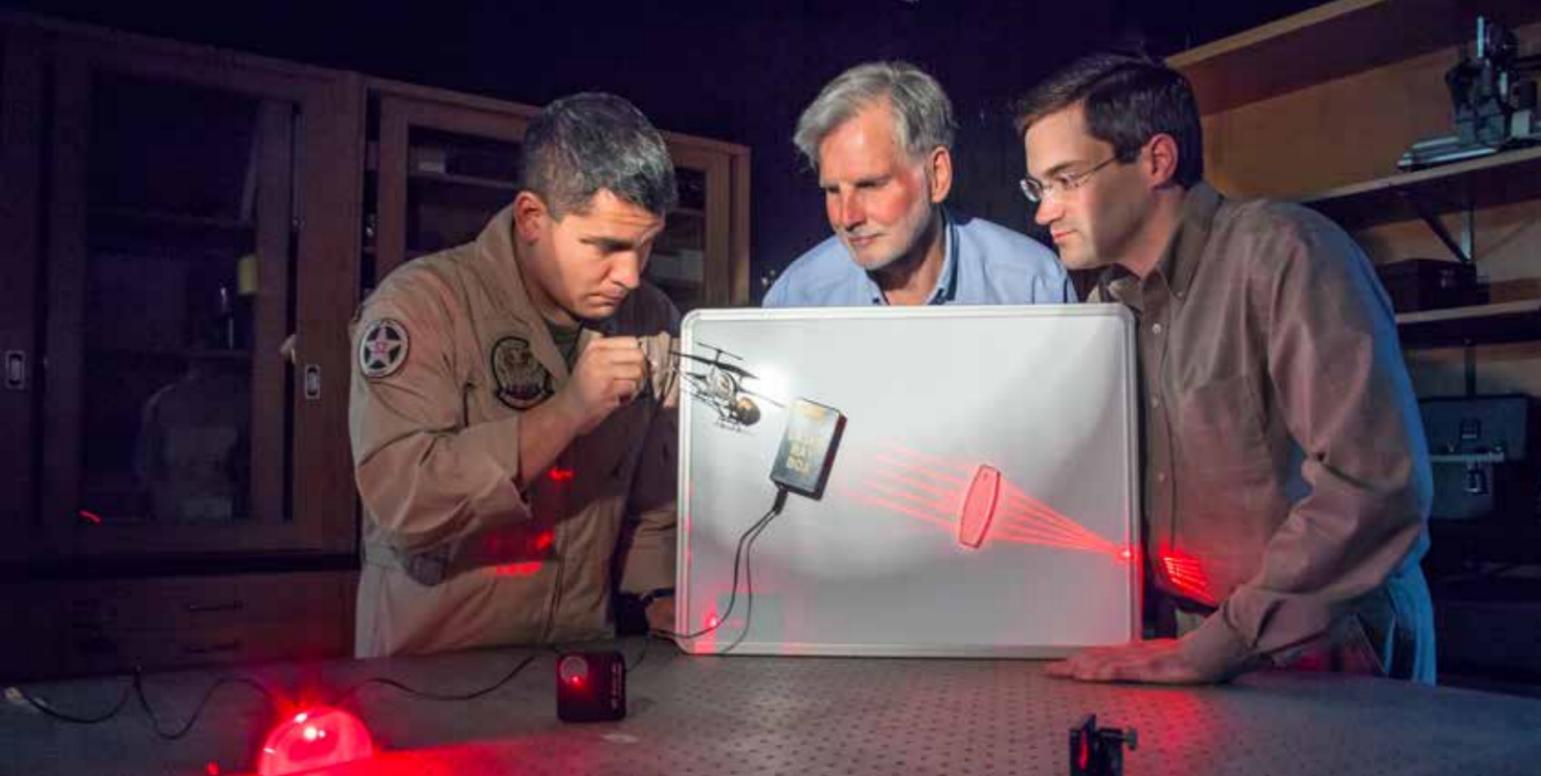
The NPS Hall of Fame was established to recognize the accomplishments of the university's most distinguished alumni and friends who, through the attainment of positions at the highest levels of public service, have made the greatest contributions to society, their nations and to the Naval Postgraduate School. Alexander is the 20th inductee into the hall. ■

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Rear Adm. Jan E. Tighe
NPS Interim President



U.S. Army Gen. Keith B. Alexander, Commander, U.S. Cyber Command and Director, National Security Agency/Chief, Central Security Service, is officially inducted into the Naval Postgraduate School's Hall of Fame during the Spring Quarter graduation ceremony.



Distinguished Professor of Physics Dr. William Colson, center, along with Research Assistant Professor Keith Cohn, right, are using NPS' long-time directed energy research program to examine potential power supply systems for ship-borne, solid-state lasers. Marine Corps Capt. Miguel Alvarez, left, is examining the laser's potential application on helicopters.

NPS' Long-Time Directed Energy Program Turns to Power Supply Systems

By Kenneth A. Stewart

PHYSICISTS AT THE Naval Postgraduate School are collaborating with researchers at the University of Texas to develop the power supply that will help support the realities of ship-born laser weapons on deployed U.S. naval vessels.

"The University of Texas is a great partner," said Distinguished Professor William B. Colson of the NPS Department of Physics. "We have worked with them on these models in the past, we are adapting the old models to the new technology."

NPS Research Assistant Professor of Physics Keith Cohn insists that current technological advancements have created an opportunity for directed energy weapons. "The technology has reached a point that it matches the threat that we are trying to counter," he said.

According to Colson and Cohn, directed energy weapons like both solid-state and free-electron lasers are ideal missile-defense weapons and are applicable to a variety of threats to contemporary naval operations.

"The problem with shooting a bullet or a missile at a target is that by the time you have fired the munitions, the target is already half-way to

the ship," said Cohn. "Lasers operate at essentially the speed of light, allowing operators to defeat threats at greater distances."

"Radar knows exactly where the target is, but if the enemy is being evasive, your bullet goes to the wrong target. The offense always has the disadvantage, except for when you are operating at the speed of light," added Colson.

Colson has been an integral leader in a long-established research effort in directed energy at the university, noting that lasers are a very cost-effective means of meeting mission requirements.

"Lasers are essentially electric weapons. As long as you have power to them, you have munitions — you never run out of either bullets or missiles," said Cohn. "From a cost perspective, laser weapons are beginning to make more and more sense."

There are advantages in safety and storage space as well, without the need to maintain as large a supply of explosive missiles within the ship. But all of the advantages of laser weapons are unrealized without effective power. Insufficient power sources means the laser has little hope of

"A laser is a very precise weapon. As Marines, we often need to disable vehicles, particularly at checkpoints — a laser allows us to do that with much greater accuracy. A laser can disable a vehicle or other target without potentially killing the occupants."

U.S. Marine Corps Capt. Miguel Alvarez

defeating modern ballistic threats, and that's where the work of Colson and his team comes in.

"The power has to come from the ship ... We are exploring how to use either batteries or capacitor banks that we have modeled. The laser would draw from the stored power, so the lights stay on inside the ship when the laser is fired," said Colson.

Colson has been conducting laser research at NPS since 1989. He began working on lasers in the '80s with then President Ronald Reagan's Strategic Defense Initiative, or "star wars" program, which would have utilized a massive free-electron laser. He continues to explore free-electron laser technology, but acknowledges the value of the solid-state lasers that the Navy is currently testing.

"Instead of going with the big laser, that the Navy still wants, we are focusing on smaller lasers that are still capable," said Colson. "Having worked on the concept of shooting things down with lasers since the '70s, it's not the laser that I've been focusing on, but it is amazing."

Direct energy weapons bear little resemblance to the blasters and laser weapons popularized in science fiction movies. Modern lasers are complex, precision weapons that target a specific threat area.

"In the movies, you hit a target and the target just disappears," said Colson. "We are targeting a modest amount of the missile, UAV or boat ... The good side is that in modern warfare we do not necessarily want to destroy the entire target. This is a more 'surgical' weapon ... We are exploiting vulnerabilities, like blinding a missile so that it is unable to locate where its target is."

NPS alumnus Dave Keel, one of Colson's former students, is currently leading an effort to place solid-state lasers on ships. His work was recently featured in the national media, where a laser successfully shot down an airborne drone during a test fire.

Keel utilizes commercial lasers using a tenth of the power gobbled up by free-electron lasers and which are already available commercially.

"Solid-state lasers have about a 20th of the power we want, but if we can get them on ships, we can put them out there and allow the Navy to train on them and work out the tactics, while we work on more complex missions," said Colson.

NPS researchers are also working with other partners on the tactical usage of a helicopter-borne laser weapon. U.S. Marine Corps Capt. Miguel Alvarez, a helicopter pilot and NPS student, is working on both the tactics and engineering aspects of a helicopter-borne device. He has identified several key advantages to using direct-energy weapons on helicopters.

"With a 50 caliber, we can do two or three passes and we are out of ammo, and have to return to station to rearm ... A laser weapon does not have that limitation," said Alvarez.

"A laser is a very precise weapon. As Marines, we often need to disable vehicles, particularly at checkpoints — a laser allows us to do that with much greater accuracy," added Alvarez. "A laser can disable a vehicle or other target without potentially killing the occupants."

The potential use of direct-energy weapons by the Marine Corps differs from the use of laser platforms by the Navy due to the Marine Corps' unique mission set.

"The Navy is making a laser system that looks at a longer range, as Marines we are operating at a much closer range. The use of a precision electric weapon with greater accuracy can help us to augment our ground forces," said Alvarez.

"Another advantage to using a directed-energy weapon on a helicopter is that it allows us to have greater range. We can engage from up to 4 kilometers away without putting ourselves at visible risk to the adversary," continued Alvarez.

And the logistical advantages of using directed-energy weapons that could be realized in the Navy could apply to the Marine Corps as well. "A laser weapon means greater range, because we are required to carry less weight. Energy weighs significantly less than traditional munitions, and we are able to fly further and augment forces longer," said Alvarez. ■

Exploring Laser Weapon Defense

As directed-energy weapons research has been underway well beyond the U.S. borders and those of its allies for decades, the Naval Postgraduate School has also spent several years exploring defensive technologies and techniques.

"For many years, the U.S. government and many foreign countries have been working on developing high-energy, directed-energy weapons ... But I think the subject has matured in the last couple of decades, and now laser and microwave weapons are very lethal," explained Professor S.S. Sritharan.

Sritharan and Research Assistant Professor Nathan Moshman of the Space Systems Academic Group teamed up with researchers at the Space and Naval Warfare Systems Command, focused on the detection of high-energy laser (HEL) beams. The team has developed software that they hope will lead to additional research, and eventually, an onboard laser weapon detection system.

NPS researchers see the potential for the laser beam detection to position the Navy to more safely fulfill their mission when faced with new and emerging threats.

"These efforts are of great importance to the Navy's mission," explained NPS Mechanical Engineering Research Associate Professor Lewis DeSandre. "The Navy and Marine Corps forces will be operating in hostile areas where directed-energy weapons will be employed by adversaries on an ever-increasing frequency. High-energy laser systems have the potential to disrupt Navy and Marine Corps operations and place lives in jeopardy. These projects will lead to an enhanced aircraft platforms survivability margin to HEL attack and greater aircraft and personnel survivability."

The collaborative research allows the expertise of both NPS and SPAWAR researchers to be applied to a common defense challenge. The NPS team has been working directly with personnel at SPAWAR Systems Center Pacific's San Diego, Calif., office.

"Our objective at SPAWAR Systems Center Pacific is to provide the scientific and technical understanding required to develop the sensor capability to detect and characterize lasers from bistatic geometries," explained SPAWAR scientist Dr. Ike Bendall. "The laser and geometric information extracted from the signal will increase the Navy's ability to counter laser directed-energy weapons."

"The work at the Naval Postgraduate School is critical to unraveling this complex interrelationship," he continued. "The end result will be a greater ability to collect laser MASINT [Measurement and Signature Intelligence] information or counter laser threats that could disrupt Navy and Marine Corps operations or harm personnel."

RELIEF Helps First Responders Evaluate Modern HA/DR Technologies, Scenarios

By MC3 Shawn J. Stewart

A LARGE TEAM of Naval Postgraduate School students, faculty and researchers, along with broad swath of engineers, technologists, and emergency and first responders, wrapped up the latest edition of the Research & Experimentation for Local & International Emergency & First Responders (RELIEF) field-training exercise in Camp Roberts, Calif., May 10.

RELIEF is an NPS-led, field-experimentation program that provides participants from multiple organizations and branches of government access to the university's U.S. Special Operations Command (USSOCOM) Tactical Network Testbed (TNT). Their focus ... to experiment, evaluate and assess modern technologies specifically for humanitarian assistance and disaster response utilization.

For those in attendance, such as annual participant and Monterey County Emergency Services Manager Sherrie Collins, the event helps participants understand the needs of humanitarian personnel.

"Combining the research and development from a multitude of organizations has and will continue to prove invaluable to humanitarian efforts and those in need of it," said Collins. "Opportunities like RELIEF allow local, military, government and private-sector individuals a chance

to synergize and create a think-tank for the benefit of humanitarian and disaster response."

The weeklong exercise featured a plethora of unmanned aerial vehicle (UAV) experiments. One of those experiments featured the Department of Homeland Security's (DHS) Federal Emergency Management Agency (FEMA) Corps, who conducted field-training exercises in conjunction with UAVs provided by Lockheed Martin.

"RELIEF is giving us the ability to test new ideas, and be able to directly affect change in the products that can help us save lives now, and in the future," said FEMA Corps Team Leader at AmeriCorps National Civilian Community Corps (San Diego), Ebony McElroy.

Ebony McElroy
FEMA Corps Team Leader

"The UAVs absolutely worked," she continued. "I was able to split my team and maintain communications inside of a simulated disaster area by pinging the UAV. This is substantial because in a real-world scenario, where we would lose cellular communication and visual information, these UAVs would provide invaluable capability to humanitarian efforts."

The scenarios outlined through RELIEF are proving what UAVs can offer, with faster and more accurate responses possible to humanitarian efforts, according to Jeffrey Sapp, a Chief Engineer at Lockheed Martin.

RELIEF is giving us the ability to test new ideas, and be able to directly affect change in the products that can help us save lives now, and in the future."



A participant hand-launches a Unicorn unmanned aerial vehicle (UAV) during the Research & Experimentation for Local & International Emergency & First Responders (RELIEF) field-training exercise in Camp Roberts, Calif., May 8. RELIEF is an NPS-led, field-training exercise focused on humanitarian assistance and disaster response missions.

Originally used by the Air Force in their FPASS (Force Protection Airborne Surveillance System) program, the modular design of the Desert Hawk III UAV allows it to be easily re-purposed for humanitarian assistance and disaster response operations.

"Today, we used a radio relay mod which gives us the ability to fly over an area where radio systems may not exist anymore," said Sapp. "A single FEMA agent would be able to go to the disaster area and launch a UAV within a 15-minute time span ... providing hours and hours of video, photo or radio coverage."

NPS' RELIEF field-experimentation program holds multiple training and analysis events annually, providing an assessment capability that would otherwise not be available.

"The idea is to create a multi-institutional learning environment," said RELIEF Director, NPS Department of Information Sciences Associate Professor Dr. Ray Buettner. "With RELIEF, the government can acquire products from a knowledgeable standpoint. Instead of blindly purchasing without any idea of a product's capability ... You can see a product in action and explain [to the engineers] what you need in-person." IR



Lt. Meghan Gray is pictured outside the campus facility where a weeklong exercise in ballistic missile defense, part of the U.S. Strategic Command's Nimble Titan program, was held, June 24-28. Gray graduated from NPS' national security affairs program a few days prior, and will be heading to Bahrain working with an integrated air and missile defense cell.

NPS Student Participates in Nimble Titan Exercise Held on Campus

By MC3 Danica Sirmans

WHEN THE U.S. Strategic Command decided to hold a multi-national, tabletop exercise in support of Nimble Titan on the NPS campus, June 24-28, they also extended an invitation to the university's students to participate. It turned out to be perfect timing for Lt. Meghan Gray who had just graduated from the national security affairs program a few days prior.

"It was a great opportunity and it worked out perfectly," said Gray whose thesis focused on ballistic missile defense in the Middle East. "After writing my thesis and doing so much research, it's rewarding to see how missile defense is happening operationally. I thought it was a really good segue between school and going to my next job ... It's a lot like interning before my next assignment."

Gray will be heading to Bahrain working with an integrated air and missile defense cell, and says she wanted to participate in the exercise to see how ballistic missile defense is approached in an international, operational setting.

"I wanted to get involved with the Nimble Titan exercise to learn more about missile defense in real-world application. It's a great networking opportunity, and I get to talk to the people that actually make these deci-

sions," Gray said.

Breaking down boundaries, physical and cultural, Stratcom has dedicated the last eight years to leading international cooperation in missile defense through the Nimble Titan effort.

"What we are doing is building human capital with nations that have begun to think about and work in missile defense," said U.S. Army Col. Mike Derrick, Director of Allied Integration for Stratcom's Joint Functional Component Command for Integrated Missile Defense (JFCC/IMD).

The Nimble Titan initiative was developed to address missile defense challenges, specifically the communications challenges, across national boundaries. With 22 countries participating, Nimble Titan is separated into multiple two-year factions, and at the end of each campaign, progress is assessed and goals are set for the upcoming faction.

"What I like about Nimble Titan is that, although Stratcom is the sponsor, Nimble Titan really is the result of the contributing nations," said U.S. Army Lt. Gen. Richard Formica, Commanding Officer of Stratcom's JFCC/IMD. "It's driven by international contribution as opposed to having

sole input from the U.S. and its agencies."

Gray's opportunity to participate went beyond just simply observing the exercise, as she was integrated into one of the Nimble Titan tabletop exercise cells to assess its outcomes.

"My role is to help create an end-of-action report — it helps to have a better understanding of the findings and happenings of this tabletop exercise," Gray explained. "We're offering the follow-up information ... Each cell has an observer from my team collecting data."

As she completed her participation in the weeklong exercise, Gray stressed that Nimble Titan provided her a great opportunity to get involved in something directly applicable to her future job in the Navy.

"I think this is a really great forum for students, especially those that are looking for thesis topics, to come and interface with these different agencies to learn what they are working on," Gray said. "When I was doing my thesis research, it felt like there was a disconnect between outside agencies and NPS, I don't think that they realize that we are a resource ... Nimble Titan is one of those rare opportunities to improve that." IR



Dr. Bradley Strawser, an Assistant Professor with the NPS Department of Defense Analysis, is pictured with his new book, "Killing by Remote Control: The Ethics of an Unmanned Military."

Challenging Students to Examine the Ethics of Modern Warfare

By Amanda D. Stein and Kenneth A. Stewart

MODERN CONFLICT HAS evolved immeasurably over the past few decades, in nearly every capacity. Thrust into this ever-changing battlefield is the supersonic pace of technological development, especially in the realms of cyber warfare and unmanned systems.

NPS' Department of Defense Analysis houses two of the university's many curricula, but its mission is singular, to prepare U.S. and international military professionals and interagency personnel with the requisite critical thinking and specialized skill sets to prevail in the modern theatre.

Part of this set includes an expanding and challenging academic exercise into the examination of the ethical implications of modern warfare ... Achieved through the expertise of two very different faculty. One is an iconic veteran in the field of information assurance and an inaugural inductee into the national Cyber Security Hall of Fame, while the other is a rising star who taught at the Air Force and Naval Academies prior to bringing his expertise in unmanned systems to the university.

Together, as defense analysis Chair Dr. John Arquilla notes, the faculty offer a compelling addition to the student experience. "It's crucial for our students to have an opportunity to explore the ethical implications of their decisions, especially as they practice their profession in an era of protracted warfare against shadowy opponents," he said.

Cyber Security Hall of Famer Dr. Dorothy Denning, and the Ethics of Cyber Operations

Defense Analysis Distinguished Professor Dr. Dorothy Denning is an icon in the field of information security, but has spent the last several years adding the ethics of cyber warfare to her fields of exploration.

Denning teaches a class titled "Conflict in Cyber Space" that attempts to address the legal and ethical issues driven by cyber warfare. Her students include members of NPS' recently inaugurated Master of Science

in Cyber Systems and Operations (CSO) degree program, as well as students within the defense analysis department.

Denning helps her students to navigate the murky waters of cyber ethics, where battlefields may consist of layers of code rather than the mountains, seas and plains that have historically defined combat areas of operations.

Despite the legal ambiguity of some questions, Denning makes a seemingly powerful case for both the legality and the moral imperative

to seek cyber approaches to conventional warfare objectives.

"If you can achieve the same effects with a cyber weapon versus a kinetic weapon, often that option is ethically preferable ... If an operation is morally justifiable, than a cyber route is likely preferable, because it causes less harm," said Denning.

Denning and fellow NPS Assistant Professor Bradley Strawser make the argument in a recent paper addressing cyber ethics.

In a paper she coauthored, "Moral Cyber Weapons," Denning argues, "At least with some kinds of cyber weapons, not only can they adhere to the principles of just war theory but that a positive duty to employ them can arise, at least in certain contexts ... The reason for this moral obligation is that cyber weapons reduce both the risk to one's own military and the harm to one's adversary and non-combatants. Overall, cyber weapons are more humane, less destructive, and less risky than kinetic weapons for achieving certain military effects."

Still, Denning notes that the red line in the realm of cyber warfare — which, if crossed, could lead to kinetic warfare — has not been breached.

"We haven't crossed the threshold where a cyber attack has initiated a kinetic response," she said. "What we are seeing primarily is espionage, and we have never responded with military force to espionage."

Much of the espionage that Denning refers to centers on business and economic interests, but Denning is quick to point out that in our global economy, there are limits to what state actors can do without harming their own interests.

"Our interconnected economies serve as a deterrent to cyber sabotage that would damage the economy. I think that a state would be very cautious about damaging another nation's economy because it would likely damage their own economy in the process," said Denning.

The conversation on the ethics of cyber operations will no doubt continue — the U.S. military and both its allies and foes have made tremendous human and economic capital investments into the burgeoning arena of cyber defense. What will come of these investments remains to be seen, but their ethics and conformity with international law is already an area of particular emphasis within the cyber operations community at NPS.

Unmanned Systems and the Implications of Remote Control Warfare

NPS Department of Defense Analysis (DA) Assistant Professor Dr. Bradley Strawser served as co-author with Denning on the aforementioned paper, "Moral Cyber Weapons." A relatively recent addition to the DA faculty, Strawser is a philosopher and ethicist, and has spent a great deal of his career addressing the intricacies of utilizing unmanned systems in warfare.

His new book, "Killing by Remote Control: The Ethics of an Unmanned Military," addresses the many dimensions of unmanned systems, and the role they play in military operations. A compilation of the works of 10 contributing experts in their fields, the book looks at such topics as just war theory, martial virtues, the morality of lethal autonomy, and the use of unmanned systems in humanitarian operations.

"I brought together a mix of philosophers, political scientists and legal scholars to address moral questions about drones that have been out in the national discussion for a long time, but nobody has ever sat down

and done an intense analytic dissection of the issues," explained Strawser.

"I'm excited and proud of it because it really pushes the debate on drones forward," he continued. "Most of the books out there on drones are either specifically about the law, or they engage questions on specifically-U.S. policy. This book is not that. It is really asking the deeper moral questions behind this form of warfare in general."

Beyond the conversations in his ethics class, Strawser is pleased by the traction the topic has gained globally. The issues surrounding drone

warfare have been so prominent and dynamic that he and the other contributors had to evolve their content as the issue progressed. He sees this as a good sign that defense leaders and scholars are ready to delve into the issues, or at least begin to.

"As the drone debate has changed, we had to change what the book was going to be. At times we would have ideas for certain chapters and then some new angle in the drone debate would come up and we would have to address it," Strawser explained. "The whole drone debate is expanding so fast, that it's hard for ethicists and policy people to keep up."

"What I really hope this book does is pose and frame the big questions. This doesn't solve all of the ethics questions about drones, in fact it just kind of opens the debate on a lot of it," he said. "We are still just at the very beginning, the tip of the iceberg of the ethical questions surrounding drone use. But this is really the first academic book of its kind to look just at the abstract moral question of drone use in general. It is critical that this part of the debate be moved forward, and that is precisely what I hope this book will do." ■

"Cyber weapons reduce both the risk to one's own military and the harm to one's adversary and non-combatants. Overall, cyber weapons are more humane, less destructive, and less risky than kinetic weapons for achieving certain military effects."

Dr. Dorothy Denning
Defense Analysis Distinguished Professor



Distinguished Professor Dorothy Denning has built a legendary resume in the information security arena, but has spent the last several years examining, and teaching, about the ethical challenges of cyber warfare.



Naval Postgraduate School faculty follow graduates into King Auditorium for the Spring Quarter graduation, June 21. More than 300 graduates earned their advanced degrees during the ceremony.

Latest Class Honored During Spring Graduation Ceremony

By Kenneth A. Stewart

THE NAVAL POSTGRADUATE SCHOOL welcomed U.S. Army Gen. Keith B. Alexander, Commander, U.S. Cyber Command and Director, National Security Agency/Chief, Central Security Service to keynote its 2013 Spring Graduation ceremony in King Auditorium, June 21.

Alexander, an NPS alumnus who holds two advanced degrees from NPS, delivered a short but poignant commencement speech. Much of his address was focused on Gen. Douglas MacArthur's famed, "Duty, Honor, Country" speech given to members of Alexander's other alma mater, the U.S. Military Academy at West Point.

"Duty, honor, country ... Those three hallowed words reverently dictate what you ought to be, what you can be, what you will be. They are your rallying points to build courage when courage seems to fail, to regain faith when there seems to be little cause for faith, to create hope when hope becomes forlorn," quoted Alexander.

Alexander also spoke of the ability of WWII era intelligence officers to break the German code that had previously defied intelligence experts throughout the war.

"During WWII we had the ability to break an 'enigma.' Everyone thought it was impossible, but nine months later we break the code and

changed the course of the war," said Alexander.

Drawing upon that famed accomplishment, Alexander emphasized that it was up to the current generation, including those in attendance at the ceremony, to carry the gauntlet forward and create a more secure world through technical innovation and education.

"You are the leaders that will lead us into a new world," said Alexander. "We cannot do that without people that are educated at your level. You have the knowledge necessary to change our world for good."

Alexander pointed to several examples of innovation born of advanced technical studies that have led to major breakthroughs since his initial attendance at NPS in the '80s, notably, the adoption of advanced network technologies that led to the creation of the Internet as we know it today.

Finally, Alexander thanked the graduating class for their contribution to their respective nations' defense with an eye to their future accomplishments.

"Thank you for what you have done for the security of our nation and what you will do in the future," said Alexander.

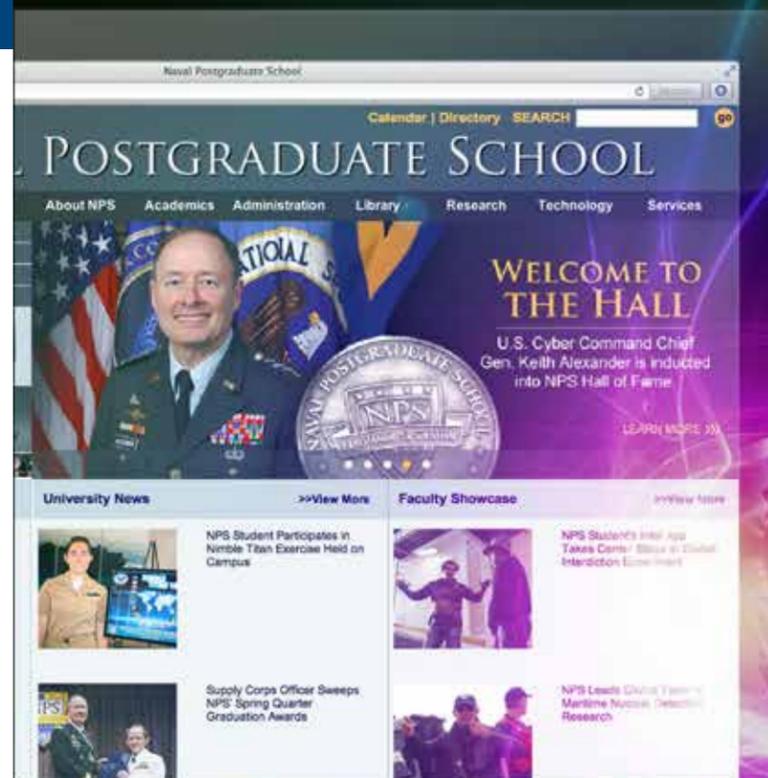
Some 306 graduates earning 309 degrees from a host of defense-related disciplines crossed the stage during the quarterly ceremony. [IR](#)

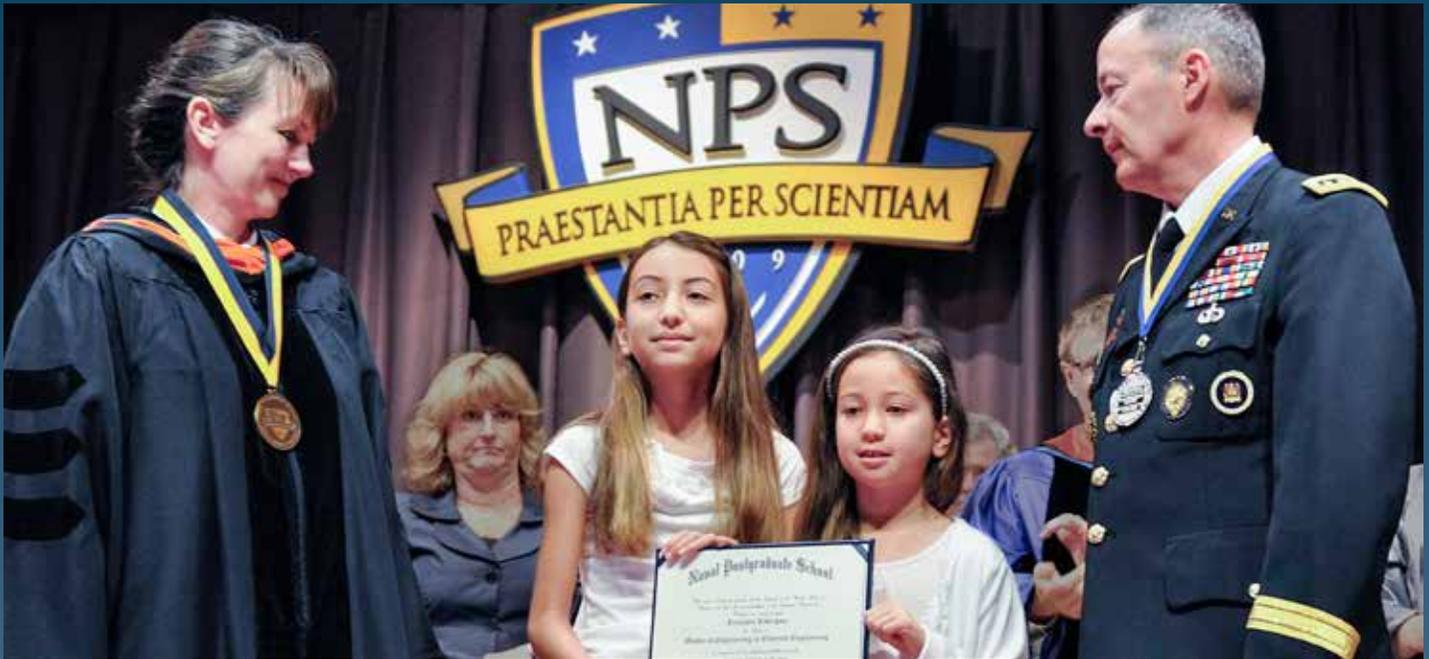


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Semper Fidelis

Honor. Courage. Commitment.

These core values of the United States Marine Corps are more than just words, they are fundamental qualities of character that dictate how a Marine will think, act and fight on the battlefield.

Maj. Francisco "Cheech" Rodriguez was commissioned as a second lieutenant in the Marine Corps following graduation from California State University Bakersfield in 1997. He had long dreamed of becoming a pilot, and pursued his aspirations with determination, hard work and courage — and he achieved them.

Rodriguez exemplified the core values of a Marine as he served his nation in the cockpit of an EA-6B Prowler. He completed a combat tour in the Middle East, a tour overseas in Japan, and was a rising star, selected for graduate education at the Naval Postgraduate School.

It was during his time at the university, however, that Rodriguez would be thrust onto his most virulent battlefield. In August of 2012, an acutely ill Rodriguez was diagnosed with an aggressive form of pancreatic cancer.

Well into his studies in electrical engineering, and true to the Eagle, Globe and Anchor he earned, Rodriguez honored his values, fighting his illness while maintaining a near perfect academic performance in one of the university's most rigorous and challenging curricula. Committed to completing what his nation had asked him to do, Rodriguez fulfilled his requirements for graduation before passing on April 30, 2013.

To a standing ovation of fellow graduates, family members and friends during the Spring Quarter graduation ceremony, keynote speaker U.S. Army Gen. Keith B. Alexander and NPS Interim President Rear Adm. Jan E. Tighe presented the master's degree in electrical engineering Marine Corps Maj. Francisco Rodriguez earned to the daughters he dedicated his life to.

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