



NAVAL POSTGRADUATE SCHOOL

UPDATE
NPS

Naval Postgraduate School Collaborates With Microsoft to Bring Emerging Technologies to the Fleet

By Lt. Cmdr. Ed Early

The Naval Postgraduate School (NPS) is teaming up with Microsoft to explore how rapidly evolving commercial technologies can solve operational challenges faced by the U.S. Navy and U.S. Marine Corps.

This collaboration will bring together two of the nation's major centers for innovation and development in a cooperative research effort that aims to tackle several highly complex issues associated with rapidly integrating and adopting new technologies in support of warfighting and national security. It also provides the potential to revolutionize how the services organize, train, equip, fight, and win by combining the best of industry, academia, and the government.

"Today, so much innovation and technological research and development is powered by America's robust corporate base. The Department of the Navy has been trying to find ways where our organizations can emulate and evolve with the nimble agility of these organizations, and with success," said Aaron Weis, the Department of the Navy's Chief Information Officer (DON CIO). "This agreement between NPS and Microsoft takes that initiative to the next level, creating a defined cooperative research collaboration between a global tech giant and the capabilities it brings to bear, with the Navy's leading science and technological university, where operationalizing innovation is core to their mission."

“For over four decades, we've worked with the U.S. Department of Defense on a longstanding and reliable basis in support of its mission to ensure our national security. This Cooperative Research Initiative with the Naval Postgraduate School will provide a remarkable opportunity for us to work shoulder to shoulder with our nation's brightest leaders and servicemembers and help them solve the complex challenges they face. And through this collaboration, we look forward to sharing our latest research and furthering our joint efforts to empower our military to make our nation safer.”

-Jason Zander, Executive Vice President, Microsoft

Microsoft became the latest industry member to team with NPS following the signing of a Cooperative Research and Development Agreement (CRADA) between the two organizations. CRADAs allow U.S. government research facilities to engage in collaborative efforts with non-government entities. These types of cooperative efforts benefit the Department of Defense (DOD) and industry leaders by providing opportunities to conduct joint research and learn from each other.

Under the CRADA, NPS will collaborate with Microsoft on select research efforts. The goal is to leverage the latest in commercial technologies and expertise to advance Navy and Marine Corps operations, while sharing any insights gained with the broader public.

To read the rest of the article, visit our [website](#).

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May 2022

NPS Faculty Recognized for Interdisciplinary Work with Annual Hamming Award

By MC1 Nathan K. Serpico

The Naval Postgraduate School (NPS) recognized two outstanding faculty members for interdisciplinary scholarship with the presentation of the 2022 Richard W. Hamming Faculty Award for Interdisciplinary Achievement.

Dr. Bonnie Johnson, a senior lecturer in the NPS Department of Systems Engineering, and Dr. Marko Orescanin, an assistant professor in the NPS Department of Computer Science, were selected for their innovative accomplishments that support and enhance interdisciplinary activities at NPS.

Johnson, who has more than 25 years of leadership and experience in naval engineering research and development, focused on two areas for her research – automation and artificial intelligence (AI) for defense applications, and directed energy (DE) warfare studies. These broad topics involve interdisciplinary research for which she collaborated with various organizations across multiple service branches, as well as industry partners. Within NPS, Johnson leads projects involving faculty in the systems engineering, information sciences, and physics departments, as well as the Modeling, Virtual Environments and Simulation (MOVES) Institute.

“When I learned that I have been selected for the award, I was thrilled,” said Johnson. “I appreciate the outstanding mentoring and the many opportunities I have received. I am fortunate to be surrounded by so many inspirational leaders, researchers and thinkers.”

Johnson has advised more than 240 students who have graduated in their master’s degree research, and she is currently advising 40 students working on their graduate research who will graduate in 2022 or 2023. She and her students have demonstrated the use of automation and AI for tactical battle management aids for air and missile defense in the fleet. As part of her DE research, she has worked closely with faculty from MOVES and the physics and meteorology departments to develop a shipboard laser weapon modeling and simulation capability to support student research on shipboard power requirements for lasers, maritime atmospheric effects on lasers, methods for battle damage assessment, and integration designs for laser placement on ships and for coordination with existing kinetic weapons on ships.

Johnson has developed course work in directed energy and is the course coordinator for a set of four DE courses taught jointly by system engineering and physics. She has also developed course work in AI and supports an interdisciplinary NPS course for DOD personnel in the Joint AI Center (JAIC) taught by computer science and systems engineering. She has partnered with faculty in the NPS Energy Academic Group to conduct a broad study to achieve naval net-zero emissions by 2050 and to study the use of AI to detect cyber attacks from energy monitoring data.

“There are two things that really stick out as the ‘best’ part of my job,” Johnson noted. “First, the incredibly brilliant people I get to work with – our amazing faculty and ‘rock star’ students. Also, having the freedom to pursue research of interest – the Navy is rife with fascinating and ‘hard’ problems and I’m always able to find a way to study the topics that interest me.”



2022 Richard W. Hamming Award for Interdisciplinary Achievement:

Dr. Marko Orescanin
Dr. Bonnie Johnson

Naval Postgraduate School faculty members Dr. Marko Orescanin, assistant professor in computer science department, and Dr. Bonnie Johnson, senior lecturer in systems engineering, are the recipients of the 2022 Richard W. Hamming Faculty Award for Interdisciplinary Achievement. (U.S. Navy graphic by MC1 Nathan K. Serpico).

Orescanin leads an interdisciplinary team of faculty and students conducting cutting-edge research at the intersection of computer science, meteorology, oceanography, operations research, physics, systems engineering and undersea warfare. This team is advancing the Navy’s ability to obtain accurate weather forecasts – a critical capability for warfighting and for addressing other national security interests such as climate change. Since joining NPS in 2019, Orescanin has been involved in advising or co-advising 23 master’s degree students and two doctoral students.

“I was very humbled and honored,” said Orescanin. “While I have not been at NPS for very long, I am deeply committed to its mission, and am very happy to expand my interdisciplinary research capabilities while educating and mentoring students.”

Orescanin’s work on uncertainty quantification is the most promising path toward integration of new artificial intelligence/machine learning (AI/ML) synthetic products into Fleet Numerical Meteorology and Oceanography Center (FNMOC) operations. He teamed up with Assistant Professor Scott Powell of the meteorology department to form an ongoing collaboration with the Naval Research Laboratory’s Marine Meteorology Division in Monterey and the University of Maryland’s Cooperative Institute for Satellite Earth System Studies to test out new synthetic products with the Navy Environmental Prediction System (NAVDAS).

Orescanin also led the establishment of an interdisciplinary research program on the application of AI/ML to undersea warfare in cooperation with the NPS’ Undersea Warfare Academic Group, Naval Surface Warfare Center Carderock Division, Naval Information Warfare Center Pacific, and the Norwegian Defense Research Establishment. The AI/ML technology developed through this research is being transitioned into operational use as part of the Future Naval Capabilities program.

NPS Researcher Mentors the Next Generation of Robotics Engineers

By MC2 James Norket

For six weeks, students and mentors from Santa Catalina School in Monterey meticulously crafted a robot to compete in the regional For Inspiration and Recognition of Science and Technology (FIRST) Robotics Competition, a held at Seaside High School, March 24-26.

Santa Catalina, an all-girls boarding and day school at the high school level, is a perfect example of why FIRST was created.

In 1989, entrepreneur Dean Kamen and physicist and MIT emeritus professor Woodie Flowers noted the lack of younger students – particularly female and minority students – who considered career fields in science and technology, and the FIRST program was developed to be part of the solution. Fast forward 30 years, and the latest FIRST Robotics Competition now includes 3,898 teams with more than 97,000 students and 29,000 mentors from 34 countries.

Santa Catalina initially reached out to the Naval Postgraduate School (NPS) in 2018 in search of mentors for the team they had coined “Nuns and Bolts,” and Brandon Naylor, a faculty associate for research in the NPS Energy Academic Group, answered the call.

At that time, the team was just getting started, with just two students and a lot of passion to field a robotics team at their school.

“The team was started by a pair of ambitious students, but the school didn’t have any faculty with the right combination of availability and relevant experience to supervise and mentor the students,” Naylor said. “I had done FIRST robotics in high school, minored in robotics as an undergrad, and had a supervisor who was OK with me adjusting my schedule to accommodate meeting with the team every day after work.

“As a mentor with the team, I teach the girls everything from how to use tools to design principals to computer aided design and coding,” he continued.

Naylor has acted as a mentor for the team for almost four years now, committing time after his work day to support the students and assist the team, which is especially active during the competition season.

“Each year in January, FIRST releases a new game for the season, and my goal is to help the students bring their ideas to life in the form of a functioning robot that accomplishes the game objectives,” Naylor described. “Ultimately, I want the students to build a robot they designed themselves and to teach them skills they otherwise would not have access to.”

And according to Steve Nixon, a teacher at Santa Catalina who serves as the lead mentor for the team, Naylor’s support and instruction has been a difference-maker, allowing the team to field a competitive robot in the latest competition, and bring in new students to the team.

“Brandon’s brain has been invaluable to the team,” said Nixon. “I don’t



NPS Faculty Associate for Research Brandon Naylor, standing, has served as a mentor for the Santa Catalina School student robotics team for the past four years. With his help, Catalina, an all-girls boarding and day school at the high school level, was one of 30 teams competing at the regional FIRST Robotics competition at Seaside High School, March 24-26. (U.S. Navy photo by MC2 James Norket).

know how we would’ve gotten as far as we have had it not been for him. He has been here since the team’s very first year and has been a crucial part of the team’s success.”

More than just a helping hand, Naylor has offered his expertise in all aspects of the robots’ build, and is able to challenge the students to create more complicated designs and helps them bring their ideas to reality.

“[Naylor] is the only dedicated building mentor that we have on the team,” said Caitlin Sullivan, a senior at Santa Catalina and the robotics team’s student leader. “He brings a lot of great ideas to the team and brings a great perspective that is typically different from ours.”

Naylor said that he loves working with the students at Catalina. Not only does it provide him with an opportunity to give back to the community, he says, but it also helps integrate a more diverse population of young students building a passion for robotics, a field that Naylor himself is pretty passionate about.

As a graduate school, the role of NPS is to support the development of knowledge and one of the best things we can do, as NPS staff and students, is to help share that knowledge with the next generation, Naylor added.

FIRST Robotics consists of hundreds of regional-level competitions where schools from across the country will come together and test their robots in a multitude of challenges, including throwing balls into goals, placing inner tubes onto racks, and hanging onto bars. Winners of the regional competition are then invited to compete at the national level, scheduled for April 20-23 in Houston, Texas.

NPS Applies System Engineering to Bolster Marine Corps Reserves Education System

By Matthew Schehl

As Great Power Competition intensifies, the United States Marine Corps is increasingly being called upon as the nation's premier expeditionary force. Critical to its success is the strength of its Reserve component, and the ability to augment active duty USMC forces with trained and ready Marines.

[Marine Corps Forces Reserve](#) (MARFORRES) is tasked with this mission. To facilitate this, it assigns active duty Marines to Reserve units as Inspector-Instructors (I-Is), whose job it is to maintain the daily operations of the unit until Reservists report for training. During training periods, the I-I cadre serves as advisors and subject matter experts for the unit.

Historically, however, I-Is were at a disadvantage when reporting to their units. Few of them had ever served in a Reserve unit and they faced a steep learning curve in acclimating to the unique needs and culture of the Reserves.

To help overcome this challenge, MARFORRES turned to the Naval Postgraduate School (NPS).

"They decided that they really needed to try and see if there's a better system for presenting information and transferring knowledge that the I-Is require, so they reached out and asked 'Can you help us? What are the different ways we can make this happen?'" recalled Dr. Andy Hernandez, associate professor in NPS' [Systems Engineering](#) department.

In 2014, MARFORRES established a partnership with NPS to examine the existing I-I education system and to address identified shortcomings in the program. Hernandez, as principal investigator (PI), drew on the wealth of NPS subject matter experts and looked to applied systems engineering – the interdisciplinary study of the design, integration and management of complex systems over their life cycle – to take this on. The team included faculty and students from systems engineering, center for executive education, the former CED3 now GEAC, and defense management.

"We began by asking 'What is the problem? Let's dissect the problem,'" he said. "We developed a clear problem summary and the functions of what the education system ought to do. We basically used a systems engineering approach to break down the bigger problem into smaller solvable problems."

Through this process of functional decomposition, the NPS team and MARFORRES were able to break down in detail the activities that must occur for the overall system to achieve its main purpose. Subsequently, the team developed a set of requirements for designing the education system.

"How do you go about educating the I-Is when they're scattered over 150 separate locations in the contiguous United States, as well as Puerto Rico?" Hernandez said. "That was the original problem. But the other problem was how then do you continue providing information and educating them with fresh information?"

"You need to convey the most recent information," he continued. "You need to be able to engage with them directly. You need to have



Launched in 2014, an evolving effort by the NPS Department of Systems Engineering provides the Marine Corps Forces Reserve with a comprehensive educational system for active duty Inspector-Instructors, critical personnel in ensuring reserve units are well trained and ready to respond. (Graphic by Marine Corps Sgt. JVonnta Taylor, Marine Corps Forces Reserve).

continued information updates, and you have to figure out how to do this in a distributed fashion."

To accomplish this, the NPS team devised a three-pronged approach: a formal orientation conference with educational lectures; distance learning (DL) with a reach-back portal; and, practical exercises for experiential or scenario-based learning.

Held on an annual basis, the I-I orientation conference introduces basic knowledge about the Reserves, and internal processes that active duty units do not have in particular. Additionally, it's an opportunity to develop relationships among the I-I cadre as well as MARFORRES Headquarters staff.

"There's a need for formal lectures, just like we do here at NPS," Hernandez said. "Sometimes there's just a need to have a face-to-face interaction. Specifically, the commanding general at the time said 'One of the reasons we have an orientation conference is because we want I-Is and headquarters staff to meet one another. The I-I should meet some of the people they're going to be working with at least once so when they call up headquarters, they know who they're actually speaking with during their two- or three-year assignment.'"

The NPS team also developed an interactive, web-based learning portal and designed a series of educational modules to guide incoming I-Is through MARFORRES processes and policies. Created within the university's [Sakai](#) learning management system, the DL program allowed participants to learn and retain information better than receiving a one-time deluge of PowerPoint slides.

"With the DL portion, now we could go ahead and talk to everybody ahead of time," Hernandez said. "Once you identify who is coming to the command, you can provide this education right at the beginning of their duty time."

NPS Scores High Marks in Annual Grad School Rankings, Again

By MC2 Tom Tonthat

When “U.S. News and World Report” (USNWR) released its well-known annual rankings of U.S. graduate schools, March 29, the Naval Postgraduate School (NPS) once again maintained high marks in several programs, including a program tied for #1 overall.

In fact, since USNWR added the specialization category of Homeland/National Security and Emergency Management for its rankings of public affairs schools in 2020, NPS has been ranked at or tied for the top overall spot.

Additionally, NPS comes in ranked 34th in Industrial/Manufacturing/Systems Engineering, 39th in aerospace engineering, and jumping an impressive 25 spots from last year to 75th in electrical engineering in the latest rankings. In the cumulative overall rankings, the school came in 109th in general Engineering school rankings, and 65th overall in USNWR’s ranking of public affairs schools.

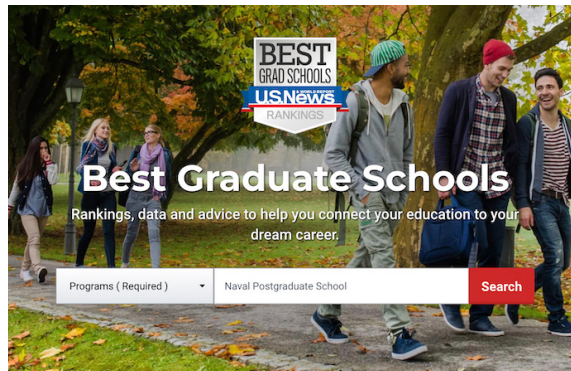
“With five academic programs ranked in the top 75 of our country, including the nation’s number one Homeland Security Program, and a ranked and ABET accredited engineering school, NPS continues to demonstrate outstanding teaching and research that place it among the nation’s top graduate institutions,” said Dr. Scott Gartner, NPS Provost and Academic Dean.

USNWR employs both statistical

surveys and peer assessments in evaluating programs, which are determined eligible through their accreditation. While the rankings began as a service to prospective students and parents exploring graduate program options, the popular rankings have become a critical measure of a university’s quality in instruction, research and degree value.

For a unique institution like NPS, school leaders say the rankings are a direct reflection of NPS’ ability to execute its mission at a high level of excellence.

“NPS strives to conduct high quality, innovative academic teaching and research that support and augment our nation’s military, especially its Naval services, to provide a cutting-edge warfighting advantage today and moving forward,” said Gartner. “The continued excellent rankings of NPS programs demonstrates the high quality of our academic programs, and why they can be impactful to America’s security.”



NWC-at-NPS Awards Academic Honors for Winter Quarter Class

By NPS Public Affairs

The Naval War College (NWC) Monterey program for Joint Professional Military Education (JPME) recognized 13 graduates from its latest class earning academic honors for the Winter Quarter of the 2022 Academic Year.

Graduates earning “with Highest Distinction” honors by completing the Command & Staff program in the top five percent of their class are Navy Lt. Benjamin Rowe and Army Majs. Bryan H. Harrison and Caleb J. Edwards.

Graduates earning “with Distinction” honors by completing the Command & Staff program in the top 15 percent of their class are Navy Lt. Cmdrs. Yolanda E. Gutierrez and Joseph B. McGinnis; Navy Lts. Kuran W. Bricker, Mitchell Wagner Nuss and James E. Wigle; Marine Corps Maj. Daniel J. Paton; Army Maj. Randall P. Groller; and, Army Capts. Nathanael B. Anchor, Andre K. Gatlin and Mary K. Lord.

CAMPUS news & notes

Team NPS,

The Provost, Chief of Staff, and I continue to be deeply impressed by the innovative solutions developed by our diverse LOE teams as NPS continues to transform to better meet our Nation’s and Naval Services’ pacing threats. We are advancing our transformation efforts towards increasing our relevance through focusing on enhancing warfighting and warfighter development. We have challenged interdisciplinary teams of academic and command leaders to think differently about how NPS approaches curricula and research to improve outcomes for NPS graduates and the Naval Research and Development Enterprise and they have delivered.

The Curriculum Content and Delivery Plan Line of Effort (LOE 1.1) answered the call by providing their innovative solution to increase efficiency while developing transformative approaches to defense-unique and naval-focused educational offerings. Under the leadership of the Provost and Vice Provost of Academic Affairs, NPS will focus curricula on operational warfighting problems by reducing, consolidating, and bundling stove-piped curricula into interdisciplinary Academic Program Areas.

Ann E. Rondeau, Ed.D.
Vice Admiral, U.S. Navy (Ret.)
President, Naval Postgraduate School

Send your campus news and notes to update@nps.edu.

NPS Students Explore Potential Cost Efficiency of Battery-Powered Warships

By Rebecca Hoag

When Naval Postgraduate School (NPS) Financial Management students Lt. Cmdr. Evan Bloxham and Lts. Christopher Masters and Ashraful Haque started their joint research project on the financial feasibility of powering warships using lithium-ion (Li-ion) batteries, they were admittedly skeptical it would actually yield any results favoring this form of electrification.

“We found a lot of research and were very interested in the progress that had been made by lithium-ion batteries, as well as how much investment in both the public and private sector was going into it,” Masters explains. “We were both kind of skeptical about the application of and the actual savings that lithium-ion batteries can provide. And so we just wanted to look into it and see if, on a long-time scale or large project, is there potential for cost savings?”

The student team’s capstone project was funded in part by a Naval Research Program (NRP) grant secured in October 2021 to explore net-zero pathways for the operational Navy. At the end of the project, they presented their work in a virtual brief, which was attended by many experts at NPS as well as outside interests, including the senior climate advisor for the Navy. There will be three additional projects briefed through the grant over the 2022 Academic Year.

“There’s been a lot of interest in the Pathways to Net Zero Emissions because of the push within the DOD and other federal agencies to reach net-zero by 2050,” says Kristen Fletcher, a Faculty Associate for Research in the Energy Academic Group (EAG) at NPS. Fletcher was one of the students’ advisors, along with Dr. Simona Tick, an NPS manpower and economics lecturer in the Department of Defense Management.

The students conducted a cost-benefit analysis on converting a gas-powered warship to be powered using a Li-ion battery system, eventually developing a working financial model that can be used to calculate the carbon emissions of the service fleet using gas turbine as well as the battery alternative over the span of 15 years.

The costs they look at included the energy needs of the warship to run for a year, the cost of the battery and the conversion process, the cost of fuel prior to conversion, the social cost of emissions, and the difference in maintenance costs between gas and Li-ion powered ships. Emissions are relatively straightforward for a gas-powered warship, but they also calculated the emissions associated with using U.S. domestic energy, which is not all from renewables.

They used the U.S. Energy Information Administration’s conversion rates to determine the energy use in gas-powered ships versus Li-ion battery powered ones. The team also looked at three different oil price scenarios based on market volatility.

Under the methodology employed by the student team, the results demonstrated significant savings in manpower. Specifically, they found that Li-ion batteries required no mechanics and nearly half as many electricians. This alone could save the Navy over \$435 million a year fully realized.



Recent NPS graduates Lt. Cmdr. Evan Bloxham and Lts. Christopher Masters and Ashraful Haque took advantage of Naval Research Program grant to support the DOD’s effort to achieve net-zero emissions by 2050, exploring the fiscal viability of lithium-ion battery powered warships. (U.S. Navy illustration by Andre Adams).

Recognizing the battery systems would require replacement after the 8th year of operation, the team also factored in potential cost savings through the resale of recyclable materials. And they estimated the cost of switching out batteries to be about half the cost of the initial conversion from a gas-powered turbine to electric power.

According to the team’s estimates, the Navy would spend between \$138 million and \$256 million to switch a gas-powered warship to run on a Li-ion battery. Juxtaposed with the potential estimated savings of anywhere between \$38 million to \$156 million, per year, by making the switch, the team says their results speak volumes.

“Even in the most limiting scenario, which is the low oil price scenario, still 62 percent of the time it came out that [the Li-ion switch] was preferred, which to us suggests it does present significant cost savings to the government, at least from a strictly financial standpoint,” Masters said during the team’s final briefing.

Most of the savings comes from the reduction of energy needs, the team reported, but they did also look at other gas-powered turbine options that might increase a warship’s cost savings or energy efficiency without the wholesale switch to electrification.

It’s an area of potential further research, as is the maintainability, reliability and survivability of Li-ion batteries, the students said. There are also possible hybrid energy solutions, and the maritime applications of Li-ion batteries in coastal waters and within smaller crafts, as additional areas of research.

All three students have graduated, and are now in follow-on assignments, or preparing for them. Masters is attending a submarine officer advanced course in preparation for going back out to sea, Haque is working on the budget for Marine Corps medical care, and Bloxham started at the Presidential Helo Program (PMA 274) as a deputy business financial manager.

NPS Research in Extreme Weather Prediction Prepares for Future Computing Capabilities

By Matthew Schehl

The Naval Postgraduate School (NPS) has received a major grant to explore a groundbreaking new way to model hurricanes and other extreme weather events.

The three-year grant from the Office of Naval Research, awarded in February, will allow mathematicians at NPS and the Naval Research Lab in Washington, D.C., (NRL-DC) to apply new approaches, including machine learning, to high-fidelity computer models to more accurately and efficiently model hurricanes. This will enable the Navy to best predict - and mitigate - these storms' impact on marine battlespace environments the world over.

"This is a game-changer," said Dr. Frank Giraldo, Distinguished Professor and Chair of the Applied Mathematics department and co-lead on the project along with Assistant Professor Anthony Austin, who leads the machine learning aspects of the project. "The novelty of our approach is, in my opinion, the only possible way to ever make weather models scalable on exascale computers."

The Department of Energy is slated to bring the first exascale computers – next generation computers capable of a billion billion operations per second – online within the next few years. Given computing limitations, current weather models are incapable of fully drilling down to the necessary scale for accurate prediction.

Dramatic changes at the turbulent scale within the first 24 hours of a hurricane's formation lead to its rapid intensification, with winds whipping up to at least 35 miles per hour and pressure plummeting 42 mbars. Current models are incapable of predicting rapid intensification at that scale, Giraldo said, which is really at the heart of why hurricane behavior and strength remain relatively unpredictable.

"That's literally a killer because you don't know where the storm is going to go," he said. "If you don't fix that problem, you won't be able to predict or track hurricanes."

Experts suggest hurricanes have increased in frequency and intensity in recent years, and point to climate change and warmer oceanic waters around the world as the culprit for stronger storms, presenting increased risk to coastal areas, Naval commands, and of course, vessels at sea.

It's a problem the Navy is keenly aware of.

In his 2021 strategic guidance for the Navy and Marine Corps, Secretary of the Navy Carlos Del Toro specifically identified climate change as one of the most pressing challenges the services face today.

"It is a national security and warfighting imperative for the Department of the Navy to address the impact of climate change on our readiness, operations, and ability to fight and win," Del Toro stated. "Climate change increases risk and exposes vulnerabilities to our people, installations, platforms and operations, and it impacts and expands the mission set our naval forces must support."

In working closely with NRL-DC, the NPS team hopes to arm the Navy with an effective means to accurately predict hurricanes, from



Researchers in the NPS Department of Applied Mathematics are supporting an ambitious research effort to apply new approaches in high-fidelity computer modeling, including machine learning, that will take advantage of future computing capabilities and realize the potential for significant improvements in the accuracy of hurricane prediction. (Stock image)

inception through evolution.

Doing so requires predicting cloud formation and behavior at the turbulent scale, which is impossible with current techniques. It's not the actual computation of data, Giraldo says, but the communication of computation instructions that is too much for computers to handle. A "bottleneck" occurs when massive amounts of sub-processes attempt to communicate at that scale, he notes.

"Communication is what kills an application on a high-performance computer," Giraldo explained. "We're trying to fix that problem by saying, 'OK, let's do it in a way that minimizes communication. Let's do the problem in a very different way.'"

Machine learning algorithms, a form of artificial intelligence, learn to perform tasks without being explicitly programmed to do them. For each of those sub-processes, the algorithm is able to independently make a prediction without being told to; i.e., without having to re-invent the wheel each time a prediction is made.

This essentially side-steps the communication bottleneck and opens the door for a whole new fidelity in making weather predictions at that scale. With a team of exceptional mathematicians and post-doctoral students, Giraldo says, NPS has the unique capability to team up on this project.

"Our group's expertise is in high-performance computing," he said. "We run on the biggest computers in the world and so we understand what it takes to run these models."

"We have built a really special program in computational mathematics in our NPS Applied Mathematics department," Giraldo added. "Computational mathematics, scientific computing, really is at the heart of everything that's done across the DOD."

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www.militarycrisisline.net

Project



1 Small ACT



**ASIAN AMERICAN
PACIFIC ISLANDER
HERITAGE MONTH**



Any Day at NPS

STUDENT voice

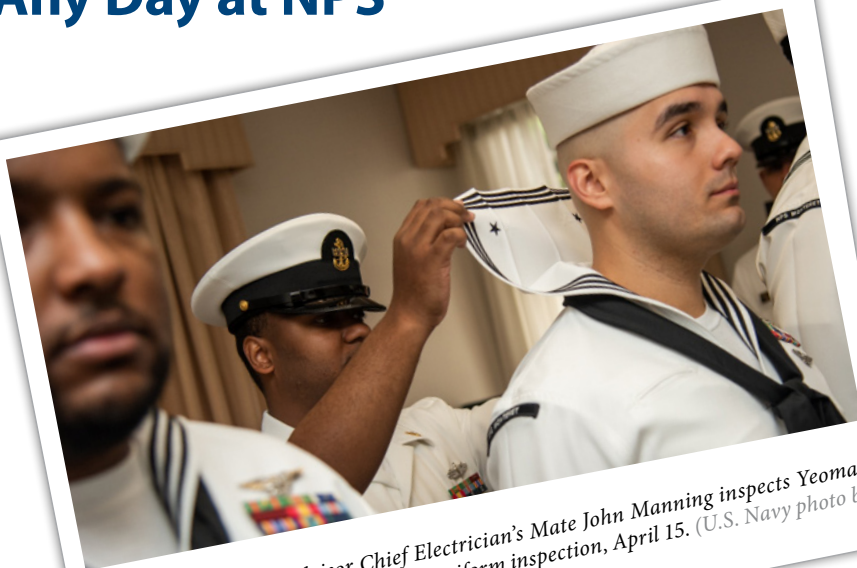
Hello, Peacocks!

We are moving smoothly through the quarter! On behalf of the President's Board for Student Affairs (PBSA), thank you for your continued feedback and support. Our team serves as the communication bridge between students and staff to make an actionable impact on our quality of life. The team and I look forward to hearing about your experiences thus far. Contact us through our [Student Recommendations Link](#) or email me directly at domonique.hittner@nps.edu.

Our general student body meeting will be on May 12, 2022, from 1200-1240, on campus outside of the Dudley Knox Library. During this time, we will be taking nominations for the First Command Leadership Award. Please email pbsa@nps.edu if you are unable to attend but would like to join one of our planning meetings. Follow these links to register for the [President's Cup](#), [Discovery Day at NPS](#), and many other [volunteer opportunities](#). We look forward to seeing you around campus!

Domonique Hittner
Chair, Presidents Board for Student Affairs

<https://nps.edu/group/pbsa>



NPS Senior Enlisted Advisor Chief Electrician's Mate John Manning inspects Yeoman 3rd Class Brandin Carcamo during a uniform inspection, April 15. (U.S. Navy photo by MC2 James Norket)



NPS Professor Douglas Horner, right, describes the surface and underwater reconnaissance capabilities of the hybrid mobile vehicle Aqua-Quad to Rear Adm. Douglas Perry, Office of the Chief of Naval Operations Undersea Warfare Division (N97), during his tour of NPS, April 21. (U.S. Navy photo by Javier Chagoya)



Madame Tsiporah Fried, Senior Civilian Advisor for Prospective and Strategy to the Chief of Defense, French Armed Forces, talks about where France stands during the upheaval of the world during a hybrid in-person and virtual lecture held in Glasgow Hall, April 21. (U.S. Navy photo by Javier Chagoya)

On campus this month

May 11-12

Acquisition Research Symposium
Online



May 12

Meet NASA Astronaut Capt. Victor Glover
King Hall / Naval Postgraduate School



May 13

Discovery Day at NPS
Naval Postgraduate School



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