2019-2020 NPS ALUMNI ASSOCIATION & FOUNDATION Research Report

-John Kroger, U.S. Navy Chief Learning Officer

NPS ALUMNI ASSOCIATION & FOUNDATION

01/01/19 - 12/31/19

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OUR MISSION

To support our nation's top military and civilian leaders as they overcome the defense challenges of today and tomorrow

A Message from Our CEO and Vice President

Rich Patterson, CEO
Todd Lyons, Vice President

The idea to create our first annual report on the outcomes of funding research at the Naval Postgraduate School (NPS) came about prior to the COVID-19 outbreak. As we began editing the content, it became even more clear how interconnected our world is, and that the research taking place at NPS is more important than ever before.

In order to take this report beyond faculty research that we have supported, we are including student research projects. Looking forward, we are also highlighting key NPS research priorities in artificial intelligence, cyber, autonomy, and innovation. NPS is just now beginning a new era of strategic partnerships with leading corporations in critical fields aligned with these priorities. The intellectual alliance of NPS with leading industry partners offers unique opportunities for collaboration that will ultimately increase the capabilities of NPS in response to the key operational challenges facing the Department of Defense.

The Naval Postgraduate School Alumni Association & Foundation (NPSAAF) funded research created the opportunity for us to partner with NPS on initiatives that will have broad impact across campus. In this report, you will read about the SLAMR project, which will help redefine interdisciplinary research at NPS in autonomy and multi-domain operations. You will also see how other initiatives are coming online, and driving the discussion about how to foster innovation at NPS in support of the broader Naval Education Enterprise. From courses like Innovation Leadership to new curricula like Applied Design for Innovation in the Defense Analysis Department, our support will accelerate the ability of NPS to shape the future leaders of the Navy, Marine Corps, and their sister services.

Our goal in providing this report is to exhibit the value of our investment in the research at NPS, and how it provides the critical margin of excellence for NPS to stay five years ahead of DoD requirements. It is not just to show you some products of the national security work we have funded, but to look ahead to the aspirations that NPS is pursuing. NPS is more critical to the success of our country than ever before.

NPS alumni are making extraordinary contributions to the current crisis and preparing for the emerging new normal. The stakes are higher, and the pressure is as great as it has ever been. The future of our military and the security of our country depends in part on the support the students, faculty, and leadership of NPS receive.

RICH PATTERSON

TODD LYONS

FOUNDATION PRIORITIES

Cyber

Our adversaries exploit the cyber domain to gather intelligence, gain advantage, and prepare the operational environment for future operations. NPS is the only graduate education institution in the Department of Defense that bridges the gaps between offense and defense, between hardware and software, and between those creating the tools and those developing policies to guide the use of those tools. NPS also hosts the Center for Homeland Defense and Security (CHDS). CHDS brings together first responders from federal, state, and local governments to integrate their efforts across the seams of the governmental agencies. NPS is unique in that no other institution in the Department of Defense offers a similar interdisciplinary opportunity to explore the full range of expertise and tools across classification levels, fields of study, and organizational boundaries.

Artificial Intelligence (AI)

The Naval Postgraduate School is uniquely positioned to bring the depth of expertise to deliver an AI-ready workforce. The Department of Defense is investing billions of dollars over the next five years in research, development, testing, and acquisition of Artificial Intelligence. In the Fiscal Year 2020 National Defense Authorization Act, Congress will fully fund the Joint AI Center at a cost of $208 million. As the committee stated in the NDAA, "Recent developments in commercially available technology have made it possible to develop, manufacture, and deploy technologies that can process information more effectively and efficiently and at lower cost that legacy systems." Those massive expenditures require a concurrent effort to develop the educated workforce that will be able to leverage the DoD investment.

Autonomy

The leading efforts in the Department of Navy and the Department of Defense to prepare for and adapt to increasingly autonomous operations are happening at NPS. The focus is putting *humans* back at the center of the conversation. Autonomy is about enabling the humans to sense accurately, decide ethically, and act effectively at a tempo that is relevant on the battlefields of the future. The force that can observe, orient, decide and act faster that their opponents will set the terms of future conflicts and exercise an inordinate level of deterrence.

FUNDING RESEARCH

Our SEED program uses a venture capital model to support early stage research projects that originate from boots-on-the-ground experiences unique to service members. When we add private funding to the specialized perspectives, intelligence and work ethics of NPS faculty and students, big things happen.

First, we identify seed projects to fund. If initial research is promising, these seeds can advance to become "seedlings" and receive additional funding. These projects enable NPS to accelerate three to five years ahead of Department of Defense requirements and create opportunities for interdisciplinary research in critical areas. Throughout the report, you will see examples of research that demonstrate the connection between the support we provide and the priorities of NPS in Cyber, AI, and Autonomy.

Seed ($10,000)

- Improving Safety during natural Disasters
- ***Cybersecurity Exercises for All: Content Development and Usability Improvements for Labtainers***
- ***Media's Supporting Role in China's Foreign Affairs Aspirations***
- ***Phase Change Materials***
- The NPS Cabled Acoustic Observatory
- ***Tracking Great Power Influence in Africa: Implications for U.S. Strategy***
- Porting the CyberCIEGE Video Game for Broader Use
- Adapting Commercial Technologies to Modernize Tactical Communications
- Naval Postgraduate School Emerging Technology Center

Seedling ($100k-$200k)

- ***Classrooms of the Future***
- ***Warfighter Acquisition Simulation Environment (WASE) Case Study Initiative.***
- Strengthening Foundations for Innovations in Deep Learning
- ***ASTROBATICS: a new way to fly the NASA "Astrobee" Space Robot on the International Space Station***

Strategic Initiatives ($200k+)

- ***Sea, Land, Air Military Research (SLAMR)***

***Bolded and italicized projects are featured in this report**

SEED: Cybersecurity Exercises for All: Content Development and Usability Improvements for Labtainers

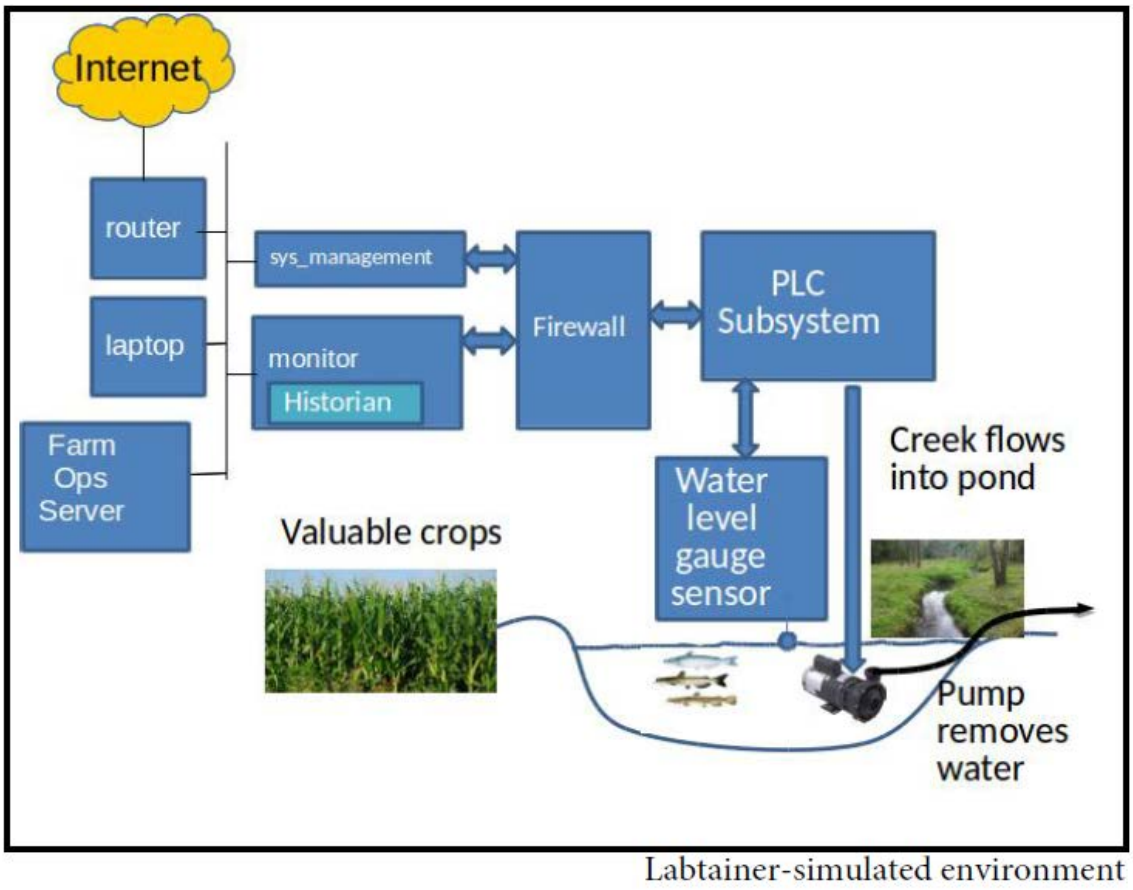


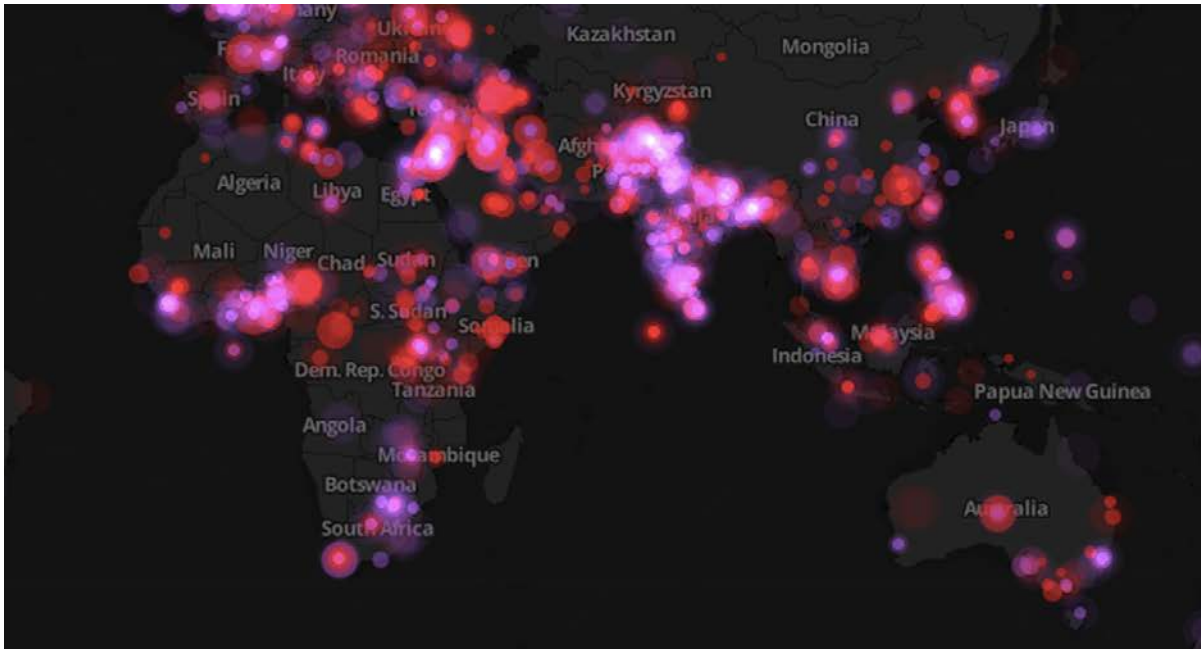
Figure 1: Network topology for the Labtainer plc-app lab exercise

Commander Chad Bollman USN, an assistant professor at NPS, is developing training modules for new intrusive detection systems in engineering spaces for Navy shops. Labtainers are environments for creating and deploying Linux-based cyber exercises, which are useful for student education and professional development. They offer realistic, complex exercises with multiple networked computers. These exercises have been incorporated into courses at NPS, the University of Chicago, the University of Florida, and CSU-Long Beach, among others, and have potential to be effective training aids for other Department of the Navy organizations.

This project will expand the library of Labtainers exercises and develop new labs to support cybersecurity education. It will also enhance the Labtainers lab authoring tools by creating an integrated development environment. These tools will make it easier for professors to develop new training modules. Easier development of modules means more time can be spent focusing on the content and emphasizing takeaways.

-Commander Chad Bollman USN, Associate Professor of Electrical and Computer Engineering, Director of the Center for Cyber Warfare

SEED: Media's Supporting Role in China's Foreign Affairs Aspirations

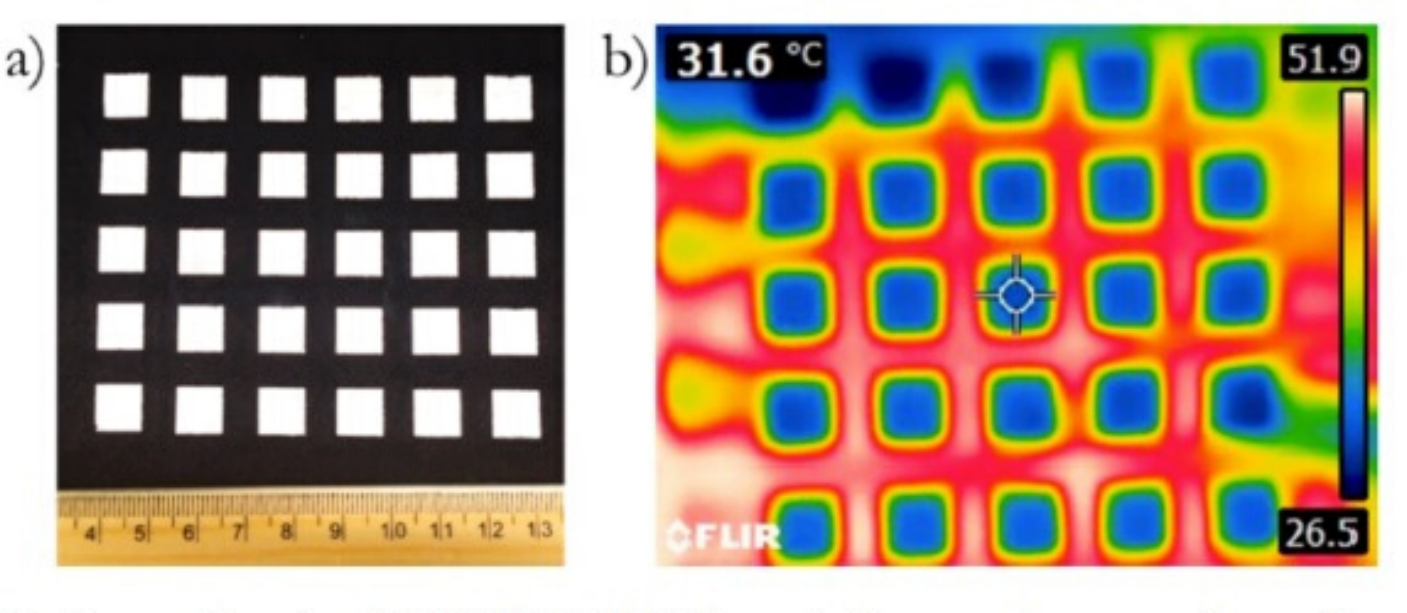


Dr. Elizabeth Gooch is investigating the media's role in China's foreign affairs aspirations. As an economist with the NPS Defense Resources Management Institute, she recognized the wealth of information available in the Global Database of Events, Language and Tone (GDELT). The GDELT is a massive project to catalog the world's news and understand its connections. Dr. Gooch set out to tap into this resource to examine how China's nation-state media use their news outlets to achieve foreign policy objectives.

China is exerting soft power toward its Asian neighbors through the Belt and Road Initiative (BRI). The BRI is a $40 billion undertaking to facilitate improved trade between Asia, Africa, and Europe. This research investigates media activity on these initiatives by analyzing reporting by the Xinhua News Agency, China's official State news service. The average emotional tone of media coverage can be used to quantify the interest of the Chinese government. This is also reflected in the frequency of articles as well as the positivism with which the articles were written. Dr. Gooch began by creating a query interface within an app that allows easy access to the GDELT 2.0 global news database. It also allows the average person to access media that has covered Chinese activities since 2015. The query interface will lay over GDELT (dataset) and will draw out subsets from GDELT according to user inputs. This research draws upon a unique multi-billion observation dataset of the global media to assess the events and emotional tone of news coverage of China's activities in BRI countries. Additionally, the research will quantify trends in broadcasts to highlight indistinct international interests of the Chinese government and draw qualitative comparisons between the discovered news trends and the Party's official foreign affairs agenda. This research will help to augment our understanding of China's intentions abroad.

-Dr. Elizabeth Gooch, Assistant Professor of Economics

SEED: Phase Change Materials



(a) An image showing EC-PCM40-BN10 formulation template casted on nylon; (b) thermal image of the sample showing temperatures close to 50 degrees celsius in the fabric alone while sections containing EC-PCM40-BN10 remain at 31 degrees celsius.

Professor Claudia Luhrs led a research project to develop systems containing epoxy resins-phase change materials, with the aim of developing a material that improves the thermal performance of living and storage spaces. This material can literally absorb and release heat to help regulate temperatures, which opens the door to many applications in the U.S. military and beyond. For example, it can be used in liners that can be easily installed and removed as needed to buffer the temperatures of living and storage spaces. This material could be helpful in disaster relief operations such as temporary housing. With more investment and further development, these materials could be used in wearable fabrics.

Seed funding made it possible to acquire initial chemicals and provided traveling funds to get a collaboration started in developing a model to estimate energy savings if these materials are to be used. The research also highlights the opportunity to commercialize this technology and scale it up with the assistance of an industry partner.

-Dr. Claudia Luhrs, Professor of Mechanical and Aerospace Engineering

SEED: Tracking Great Power Influence in Africa: Implications for U.S. Strategy

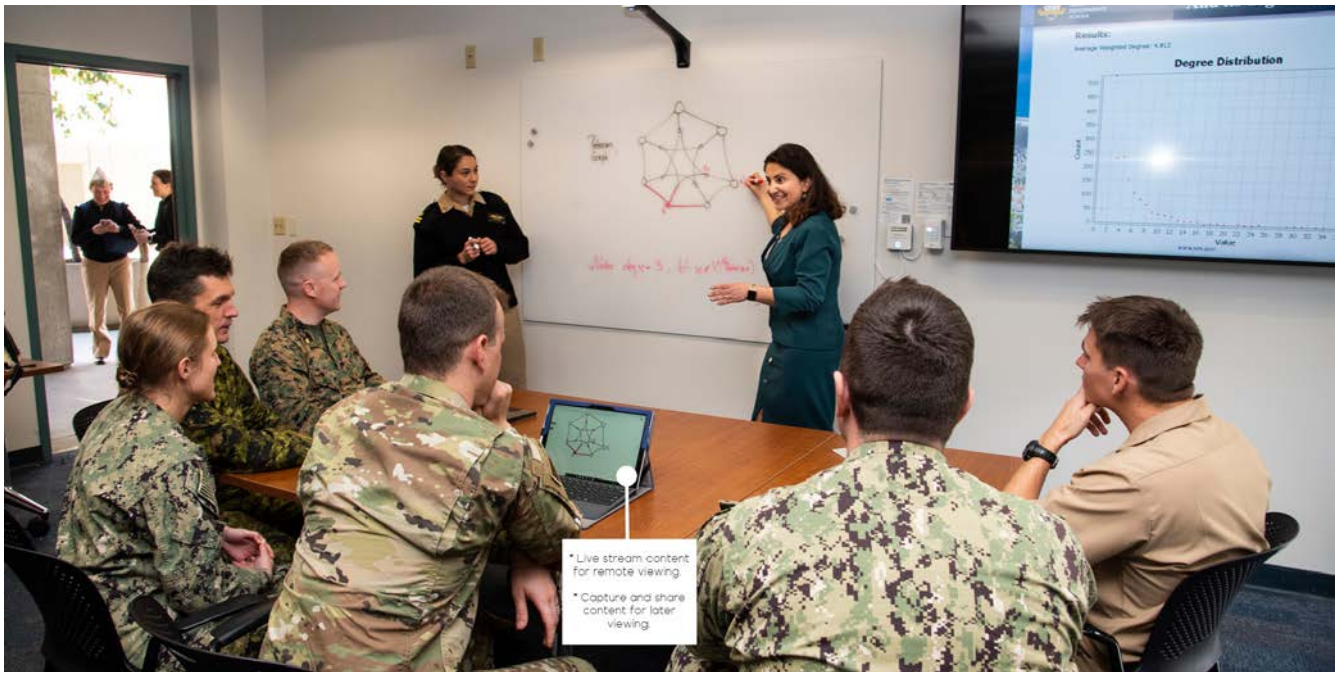
Professor Rachel Sigman leads a team of NPS faculty and students in the Department of National Security Affairs to research the impact of great power competition within U.S. defense and national security strategy in Africa. The research raises a host of questions about the state of U.S. influence in countries around the world and offers perspectives on how to measure the relative influence of the U.S. in this emerging region.

Africa is home to large supplies of natural resources, a growing population and significant economic potential. Although the U.S. government has invested billions of dollars in security sector assistance and development aid in recent years, they require a better understanding of how these activities promote (or undermine) U.S. influence in the region. This research will provide insight as to how and why African governments respond to U.S. and Chinese investments, which can help the U.S. identify opportunities to invest and strengthen ties with African partners. It will also examine how trade and investment can strengthen U.S. partnerships with African countries and mitigate the expansion of Chinese power in Africa.

One of the most important potential outcomes from the research is an influence tracker. Influence is the ability for a country to adapt a favorable behavior or side with the U.S. in some common interest. Currently, it is not known how certain activities do or do not translate into influence. To better understand this, the team is developing a way to measure influence in relation to policy decisions. This research can provide insight as to how and why African governments respond to Chinese investments, which can help the U.S. identify opportunities to invest and strengthen ties with African partners. This research provides the potential for a more systematic and coordinated prioritization of our activities. The influence tracker also has potential to be used for other regions outside of Africa.

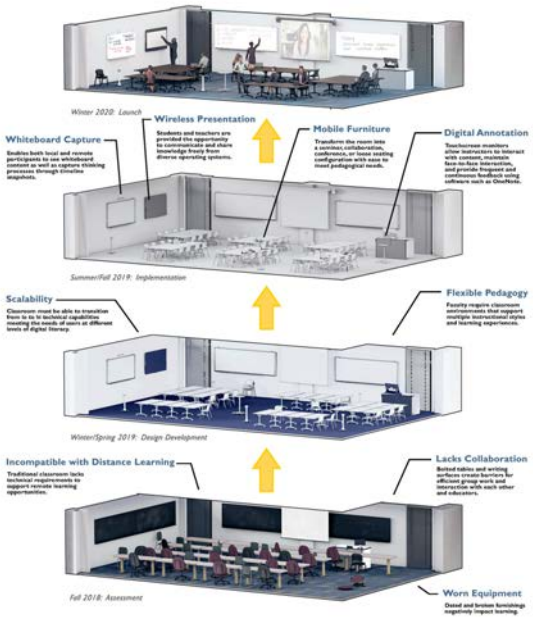
-Dr. Rachel Sigman, Assistance Professor of Political Science

SEEDLING: Classrooms of the Future



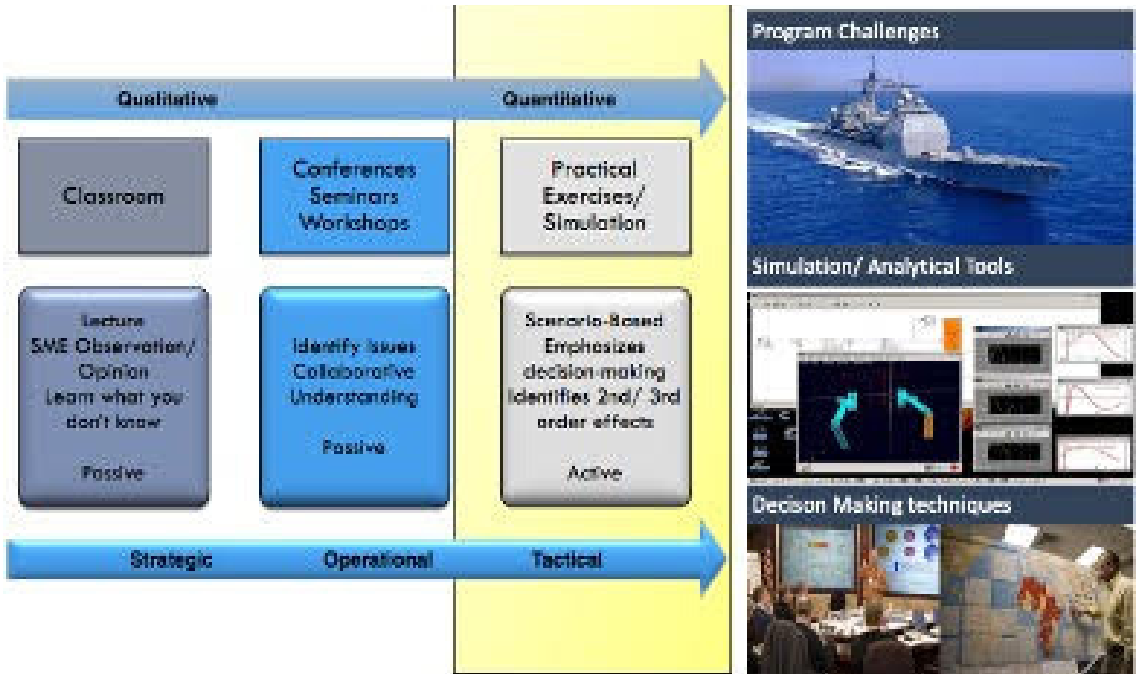
Prof. Gera's group work using Kaptivo's whiteboard capture with a live streaming on the laptop.

Professor Ralucca Gera is leading a new initiative at NPS, Flexible Learning Experiences (FLEx), as the output of the Classrooms of the Future project. This Teaching and Learning Commons' initiative postures NPS to best utilize portions of the Navy's funds invested in NPS research and education infrastructure over the next five years. Professor Gera and her team focused the use of resources on the implementation of four FLEx space prototypes, one for each NPS school, based on the requirements of each school. The NPS project transforms the traditional classroom to an adaptable learning lab where faculty can explore pedagogy. The use of versatile mobile furniture and technology integration allow students to take a more active role in their learning. The purposefully designed spaces support ubiquitous technology and collaborative learning while facilitating a shift from content-based learning to student-centered learning based on skills and experiences.



-Dr. Ralucca Gera, Professor of Mathematics and Associate Provost for Graduate Education

SEEDLING: Warfighter Acquisition Simulation Environment (WASE) Case Study Initiative.



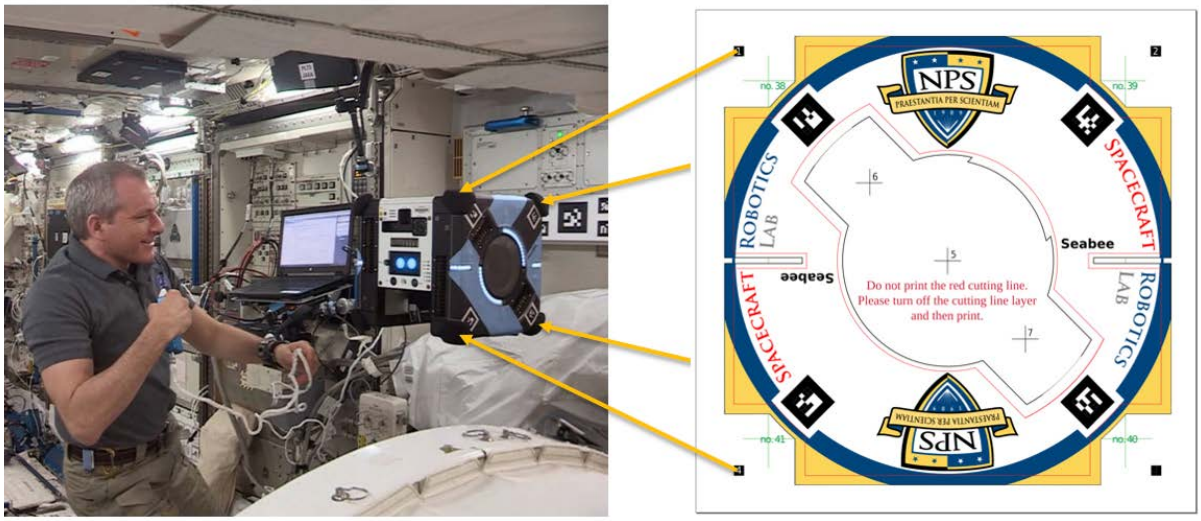
U.S. Army Colonel (ret) and Professor of Practice Ray Jones and Professor Charles Pickar, PhD, are leading an effort to develop a Warfighter Acquisition Simulation Environment (WASE) which immerses participants in actual strategic scenarios in which the defense business community must adapt to the changing nature of warfare. Phase one of this effort focuses on case studies that emphasize the dynamic nature of warfare, unlike past cases, which tend to emphasize static and compartmentalized problems with predetermined solutions.

WASE cases provide a historically grounded, dynamic, scenario-driven framework in which NPS educators urge students in the classroom and in the Graduate School of Defense Management (GSDM) WASE to develop innovative acquisition solutions under experiential participant driven conditions. WASE will bring together NPS students as well as defense leaders and policy makers. Two cases have already been produced that support classroom education. The next two cases, (being developed in 2020) will support the initial integration into the WASE.

“It is critical that future leaders in the business of defense learn to effectively solve complex problems through realistic scenarios grounded on historical lessons. Case studies provide the foundation for these scenarios, which can be integrated into dynamic warfighting experiments that stress the decision making of current and future program leaders in support of the changing national security environment”.

-Colonel (Ret) Ray Jones, U.S. Army, Professor of Practice

SEEDLING: ASTROBATICS: a new way to fly the NASA "Astrobee" Space Robot on the International Space Station



Professor Marcello Romano leads a research team of six NPS graduate students and two postdoctoral associates in exploring new ways to fly an autonomous space robot. The project, ASTROBATICS, provides NPS students with a unique graduate-education experience and puts NPS at the worldwide forefront of space robotics research, together with peers such as Stanford and MIT. This research will contribute to the capability of humanity to explore and utilize space resources in earth's orbit and beyond.

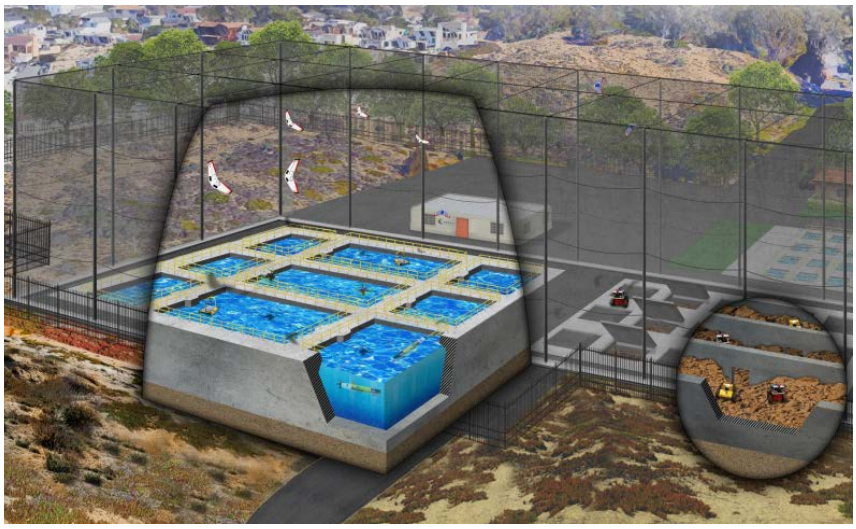
"Astrobee" is a NASA space robot onboard the International Space Station. It flies autonomously within the station and assists astronauts in everyday tasks. It is equipped with a small robotic arm which allows it to grasp handrails typically used by astronauts. The central idea of Prof. Romano's project is to "teach" Astrobee" to perform "astrobatic" maneuvers, i.e. to use its robotic arm to hop from one handrail to another, similar to the way astronauts move in zero gravity. This type of maneuver could offer a disruptive new method of flying space robots which is cheaper and more efficient.

ASTROBATICS flight experiments are currently being prepared through computer simulations and laboratory experiments at both NPS and the NASA Ames Research Center. They will be conducted in 2021 from the NPS Spacecraft Robotics Lab in direct communication with the astronauts on the International Space Station.

-Dr. Marcello Romano, Professor of Mechanical and Aerospace Engineering, Director Spacecraft Robotics Laboratory

PRIORITY PROJECT: SLAMR Facility

The Sea Land Air Military Research Initiative (SLAMR), led by Professor Ray Buettner, continues working to scale up operations in late 2020. SLAMR will be the nation's only facility that allows researchers to experiment with robotics in multi-domain environments, specifically, sea, land, air, space and cyberspace. The NPSAAF has been a foundational source of funding for the facility since its inception.



The Initial Operational Test (IOT) identified research that can be completed in tanks as they currently exist, and also identified how to make the tanks more functional for additional research and education activities. It is expected that NPS students and faculty from multiple schools will use the facility regularly for both coursework and sponsored research.

At SLAMR, private industry, academia and government organizations will collaborate to tackle the toughest defense challenges. It will be a regular part of field experimentation efforts on a quarterly basis. When fully operational, the facility will support NPS education and research in solving the challenges of national security missions. Additionally, the facility will be available for industry and academic partners. SLAMR will enable the rapid exploration of emerging commercial technologies related to AI robotics and machine learning. These technologies can be developed with military capabilities and used to intellectually prepare students for operating in a world where human-machine teaming is ubiquitous. SLAMR offers NPS students and faculty this vital facility with resources that set the U.S. ahead of potential peer competitors.

"I tell my students, in every battlefield, you will be using and/or facing nonhuman warriors. SLAMR will allow us to be at the forefront of adapting to that change."

-Dr. Ray Buettner, Associate Professor of Professor of Information Sciences

STUDENT RESEARCH

Captain Benjamin Herbold, USMC

"My research focuses on designing a Cognitive Assistant and the application of automation and AI to enhance the capabilities of decision-makers in the United States Marine Corps Fire Support Coordination environment."

Major Trisha Wyman, USA

"Since the birth of our nation, innovation and information strategy have been our strength in defending our way of life. Today and tomorrow should be no different."

Lieutenant Commander Brodie Wells, USN

"The use of ML and artificial intelligence will speed up analysis, which will provide needed surface characteristics to improve models of ocean/ice/atmosphere interaction."

Lieutenant Commander Michael Millar, USN

"This research contributes to NPS goals of supporting cyber, AI, and autonomy priorities by covering the overarching strategies that address all, and particularly posturing for unpredictable and uncertain changes inherent within each area of study."

Student Research Profile: Captain Benjamin Herbold

Captain Ben Herbold is currently completing the Information Warfare Systems Engineering curriculum at the Naval Postgraduate School in Monterey, California.

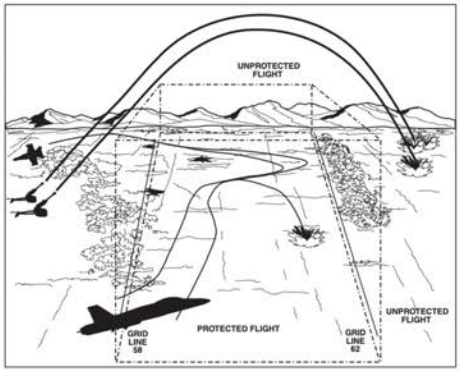
Fire Support Coordination Cognitive Assistant for the Marine Air Ground Task Force

Naval Postgraduate School

Background

- **Fire Support Coordination** is the planning and executing of fires so that targets are adequately covered by a suitable weapon or group of weapons. (JP 1-02)
- Historically, this has been a largely manual process.
- Proliferation of advanced technologies, increased operations in the littorals, and vast volumes of relevant data seek to overwhelm the cognitive abilities of Marines in Fire Support Coordination Roles.
- In future conflict, a cognitive assistant (CA) will be required to reduce the cognitive load on decision makers integrating and deconflicting fires within the battlespace.

Fire Support (dvidshub.net)



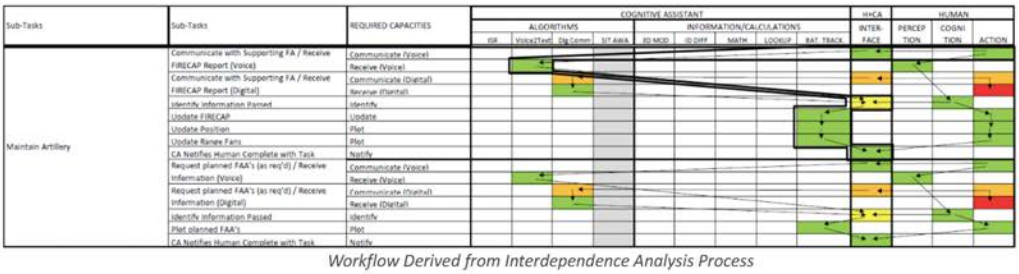
Combined Artillery-Aircraft Attack (MCTP 3-10F)

Fire Support Coordination

- Codified in doctrine and tactics, techniques, and procedures.
- Largely based on the geometrical properties of ballistics to determine where a munition will travel during its employment, and what its effects will be on target.
- Proficiency developed through resident courses and countless hours of simulated/live-fire training.
- Expertise, both the *art* and *science*, remains within the minds of Fire Support Coordination Personnel.

Interdependence Analysis

- Develop by Dr. Matt Johnson (USN, Ret) of the Florida Institute for Human & Machine Cognition.
- Develop a Human-Machine Team that embodies principles of effective teamwork: coordination of activity, cooperation amongst participants, and collaboration (Johnson, et al., 2014)
- Conduct Functional Task Analysis of Fire Support Coordination
- Develop workflows to demonstrate the actions/interactions between decision-maker and CA.



Workflow Derived from Interdependence Analysis Process

Student Research Profile: Major Trisha Wyman

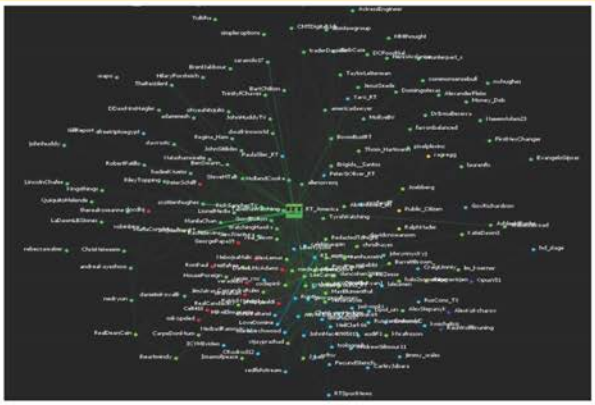
Major Wyman recently completed the Master of Science in Information Strategy and Political Warfare, at the Naval Postgraduate School in Monterey, California.

Social Media and Strategic Nuclear Weapons: The Russian Case

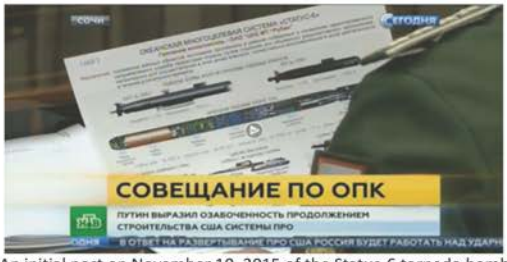
Naval Postgraduate School

Background

- The recent suspension of the intermediate-range Nuclear Forces Treaty, Russia's development of new strategic weapons, and increased media communications between the United States and Russia are reminiscent of the early 1980s "War Scare" and provide a framework for understanding Russia's methods today.
- The U.S. 2016 elections meddling case provides evidence of Russian gerrymandered online social networking and orchestration of political rallies and protest.
- Russia, since before 2015, has been actively using social media to display its strategic nuclear weapons.



@RT_America Ego Network ORA Visualization



An initial post on November 10, 2015 of the Status-6 torpedo bomb

Research design

- The research is conducted with qualitative and quantitative methods, with primary and secondary research, historical background, media and social network analysis, and application to information strategy.
- Qualitative review of Russian Twitter nodes, RT_com, RT_America, SputnikInt, and TASSagency_en, and related media webpages.
- Quantitative analysis using ORA Netscenes for SNA of 3,587 nodes pulled by the CORE Lab during July-September 2019 and restricted to Twitter posts dated between January 25, 2019 through June 1, 2019.
- Analysis was conducted to determine centralization and centrality measures within the overall network and for individual ego networks of the four Russian media accounts.

Results

- Russia is attempting to influence the American public discourse and is using an active long-term media strategy to complement and support its nuclear policy objectives. However, the discourse is mostly reactive and ranges from positive and negative discourse about Russia's strategic nuclear weapons. This research does not find that Russian media is successfully influencing and persuading U.S. audiences to believe Russian content. However, the discourse does present opportunity for political action and change in U.S. policy.
- The lack of Internet and online advertising regulations potentially enables deliberate targeting of audiences on the topic of nuclear weapons, specifically to garner support for the Russian government's narrative.
- Content, media outlets, political figures, and advertising companies of India are all prominently linked to the Russian media Twitter online social network.

A tweet from PM Modi reaffirming his support for President Putin

Advertisement for the Status-6 Nuclear Weapon

Next Steps

- Further research beyond exploratory and initial topographic social network analysis would provide hypothesis testing and further understanding of influence networks and efforts.
- Further research in the context of additional strategic nuclear weapons, including content generated by the Russian media about U.S. weapons, would enable a better understanding of influence efforts.

Student Research Profile: Lieutenant Commander Michael Millar

Lieutenant Commander Millar is currently attending the Naval Postgraduate School in Monterey CA to obtain a Cyber Systems and Operations Master's Degree.

Industry Informs DoD Strategies to Anticipate Uncertain and Unpredictable Future Cyberspace Change

Naval Postgraduate School

Background

- Private and Public sector cyberspace is interconnected; The DoD increasingly assesses strategic and militarized competition to extend to public sector cyberspace
- Public sector cyberspace strategies continue to evolve as roles, responsibilities, and resources are increasingly understood and allocated
- National, DoD, and USCYBERCOM strategies and policies desire collaboration and integration of industry partners
- Many cyberspace security and technology organizations have been successfully strategizing and practicing innovation for decades to maintain a competitive edge in an unpredictable cyberspace environment.

Unpredictable-Cyberspace-Change Strategy

- Can the DoD and USCYBERCOM learn from industry experience to build better and more robust multi-stakeholder strategies that anticipate the uncertainty of future cyberspace conditions?

Research design

- Examine a cross-sectional sample of industry organizations -- including Fortune 500 cybersecurity organizations, technology organizations, non-cybersecurity technology organizations, and smaller organizations -- that may contribute diverse lessons that enable strategic planning to adeptly anticipate unpredictable cyberspace change
- Categorize: General Organization/Specific Suborganization, Implementation, Measures of Effectiveness/Performance, Organization's Self-Evaluation
- Comparative analysis of strategies to determine applicability or adaptability to the DoD

Anticipated Results

- Categorization and percentage of organizations that utilize cyberspace strategy that anticipates unpredictable and uncertain cyberspace change
- Evaluation of applicability, adaptability, and translation of private sector strategic development techniques to the DoD
- Recommendations for adaptation and adoption of researched strategies to the DoD
- Template for potential future studies to include more organizations and/or more deeply study organizations found to have applicable strategies for the DoD

Student Research Profile: Lieutenant Commander Brodie Wells

Lieutenant Commander Wells is pursuing a Master of Science (Meteorology and Oceanography) degree at the Naval Postgraduate School, Monterey.

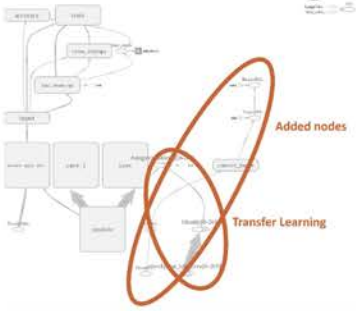
Application of Machine Learning to Understand the Operational Environment

Naval Postgraduate School

Industry Breakthrough

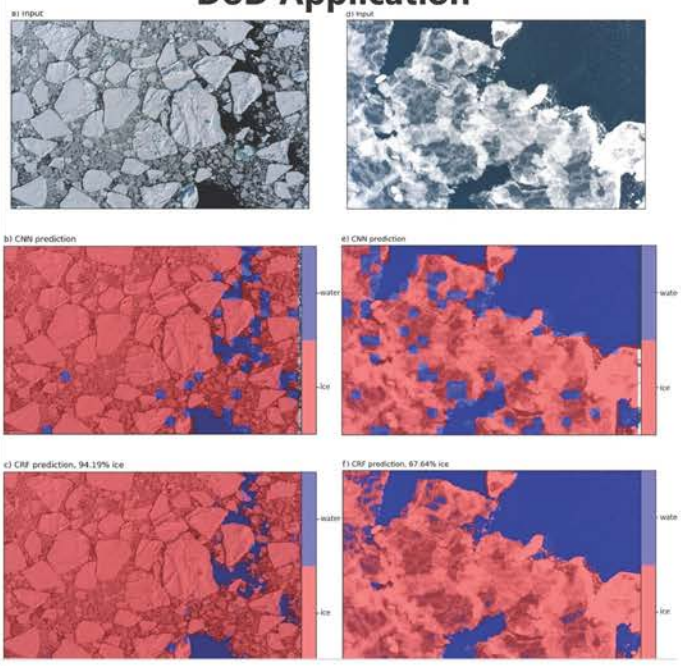
- Industry Machine Learning techniques like those used for self driving cars are a nascent technology creating opportunities (image: Waleed Abdulla, Mask RCNN)

Transfer Learning



- By utilizing models that have been trained and developed by industry and academia, adding labels to models is low cost

DoD Application

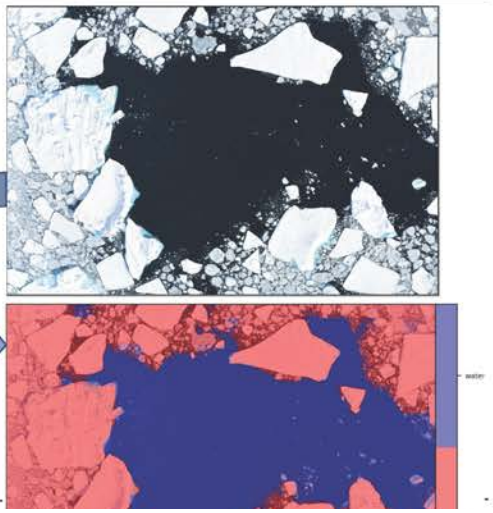


- Vast majority of collected oceanographic data goes unused
- Analysis of environmental conditions such as ice, kelp, rock concentration, and placement can be enhanced by Deep Convolutional Neural Networks (DCNNs)
- By automating manual imagery processing, analysts could focus more time towards interpreting results in support of decision makers

Research

- Seven flights over nine days were flown over the Irminger current, measuring atmospheric variables and surface temperature.
- In order to study heat fluxes into and out of the ocean within the marginal ice zone, ice concentration must be known for all measurements. Over 72,000 high resolution pictures of the surface were taken.

60.49% Ice



Application

- Safety of navigation, including around ice, rocky shorelines, and other hazardous areas
- Improved modelling

LOOKING FORWARD

In the upcoming year, the NPSAAF will expand support for strategic research initiatives. We will continue to support a robust Seed program to help faculty get their research off the ground. The Seed program incentivizes faculty to look five to ten years ahead of the DoD, and take risks on projects outside normal research funding streams. Funds will be allocated through the Seedling program to move some select Seeds through a prototyping phase. The goal of both the Seed and the Seedling is to help a faculty member secure long-term funding from a topic sponsor and ultimately make a positive impact on national defense.

The greatest growth in the coming years will be in the area of strategic initiatives. Just as we took the first steps with the Sea, Land, Air Military Research (SLAMR) Initiative, we anticipate providing an even greater "margin of excellence" to NPS in the next few years. The Department of Navy committed approximately $130 million to NPS to refurbish parts of the campus and recapitalize the lab infrastructure over the next five years. As a foundation, we have the opportunity to leverage this investment by creating tailored facilities for collaborative, interdisciplinary research focused on the most challenging defense problems. The development of an innovation center will create new opportunities for corporate engagement, the co-development of intellectual property, and outreach to the broader innovation ecosystem. We are focused on strategic initiatives that enhance NPS as the DoD's premier research university.

WAYS TO SUPPORT

How do you unlock the potential of the Naval Postgraduate School?

Individual and Foundation Opportunities

Defense Innovation Fund-The Defense Innovation Fund (DIF) supports early-stage research and development projects at NPS that focus on improving national security, increasing war-fighting capabilities, and addressing military inefficiencies, primarily through our Seed Program.

Alumni Association-With a searchable online directory and regional alumni events, the alumni association gives students the resources they need to foster both professional and personal relationships and to capitalize on the value of their graduate degree.

Student and Faculty Support-NPS's many students come to Monterey straight from overseas tours in combat areas, where they had little to no time with their families. The foundation offers a variety of recreational clubs to help families take advantage of their time together and to help students enjoy the hours away from the high-stress, demanding duty of serving our country. We also support students and faculty activities by recognizing the most high-achieving NPS students and faculty members through funded quarterly awards that honor and celebrate their achievements.

Planned Giving-You can make a planned gift to the NPS Foundation by naming it as a beneficiary in your last will and testament, life insurance policy, retirement plan, or charitable trust.

Corporate Partnership Opportunities

The *"Margin of Excellence"-*NPS has a proven track record of accomplishment in Cyber, AI, and Autonomy. External support will provide the crucial "margin of excellence" to continue to make NPS great.

Funded Chairs-A funded chair can play a significant role by gathering faculty and students from across the campus to work on critical issues confronting our nation and providing the impetus for interdisciplinary projects.

Industry Chairs-This expert, as a "Visiting Distinguished Professor," would bring their expertise into the classroom, while gaining an invaluable perspective on the challenges and opportunities of supporting our national defense.

Post-Doctoral Researchers-Post-doctoral researchers represent the latest thinking in the field. A continuing rotation of such researchers ensures the prevalence of the research, as well as its relevance to national defense.

Research fund to enhance interdisciplinary research-The research fund would support the education of the students at NPS by expanding NPS's collaborative cutting-edge industry relationships. It would also allow for collaborative conversations, research, and education in support of the national defense strategy.

Labs and Collaboration Spaces-Interdisciplinary spaces, including purpose-built labs to support collaborative projects, require external support to make them state of the art.

NPS ALUMNI ASSOCIATION & FOUNDATION

01/01/19 - 12/31/19

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Thank you to the Naval Postgraduate School Public Affairs Office for providing photos for this report.

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