



# **Building A Robust Workforce in Electric Power Engineering**

**CAPT Lynn J. Petersen USN (Ret)**

**Mission Capable, Persistent and Survivable**

**Naval Platforms**

**Office of Naval Research**

**National Science Foundation**

***16 March 2023***



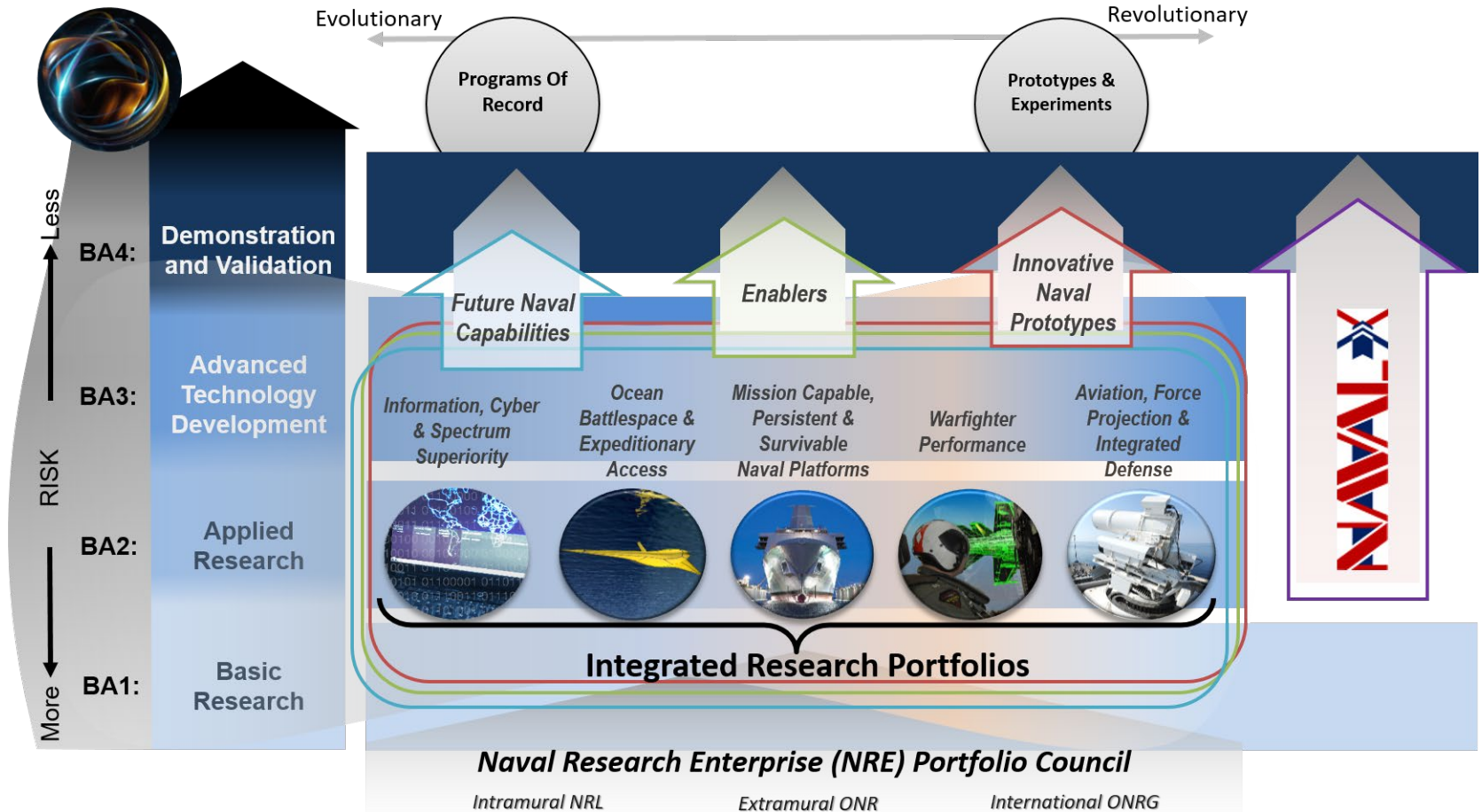
# Outline

## Office of Naval Research

- Portfolio
- Sea Warfare & Weapons
- Power and Energy Focus Area
- Power Electronic Power Distribution System
- S&T Objectives: Electric Energy Education
- STEM Initiatives (SEAP, NREIP, & SMART)
- VTEC
- Naval Power Curriculum
- Summary



# The Portfolio – ONR Departments





# Sea Warfare & Weapons

## AT A GLANCE

Research on concepts, systems and component technologies that improve the performance and survivability of Navy and Marine Corps platforms in an increasingly distributed yet interconnected force.



## WHY IS THIS IMPORTANT

- Threats to the fleet/force are increasing in number, range, precision and effectiveness.
- Sustainable operations in increasingly diverse environments require affordable, modular survivable and rapidly upgradeable platforms.
- Maritime superiority requires enduring, self-sustaining platforms able to deter/defeat aggression through overwhelming capability.



# Sea Warfare & Weapons

***Develop and deliver knowledge, talent, and technologies that enable superior warfighting and energy capabilities for Navy and Marine Corps forces, platforms, and undersea weaponry.***



***Manufacturing Focus Area*** develops technologies that acquisition programs need to make the design, fabrication, construction, repair, and sustainment of naval platforms more affordable. This FA also supports manufacturing S&T that accelerates the delivery of capabilities to the fleet and force. Advanced manufacturing technologies include additive manufacturing, repair and sustainment technologies, and coupling computational tools from design to sustainment.

***Materials Focus Area*** is materials science and engineering to enhance the performance, affordability, survivability, and reliability of the future and legacy Navy and Marine Corps systems and platforms. The focus area investments support enduring and future Navy materials needs.

***Naval Engineering Focus Area*** addresses the design, fabrication, integration, and operation of ground and sea naval warfare platforms, sensors, weapons, networks, and countermeasures to maximize their operational availability and effectiveness.

***Power & Energy Focus Area*** enables increasingly efficient, reliable, resilient, and abundant energy for Navy and Marine Corps infrastructure, platforms, systems, and equipment. This FA seeks to optimize power and energy density, energy efficiency, service life, reliability, low maintenance operation, safety, and cost.

***Undersea Systems, Payloads, & Weapons Focus Area*** addresses innovative affordable, persistent, and stealthy undersea systems that leverage the asymmetric US Navy advantage afforded by subsurface operations.





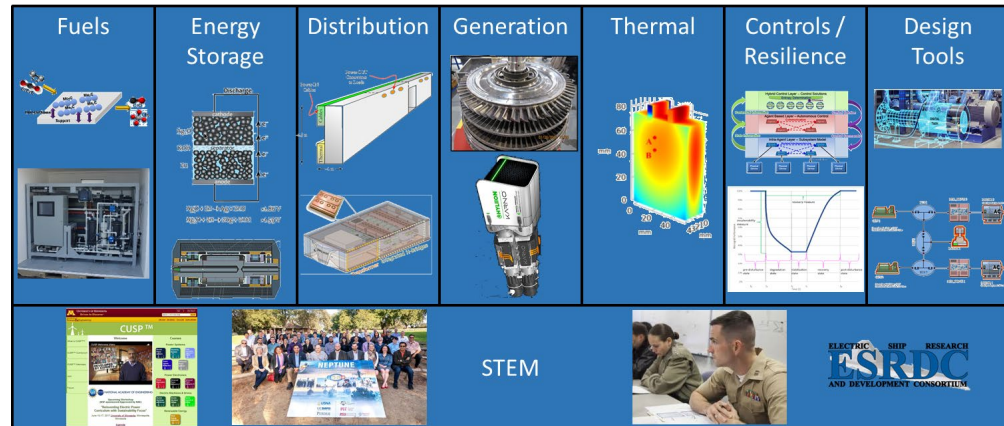
# Research Areas

## Power and Energy Focus Area

### P&E Focus Area Taxonomy

#### Research Areas:

- Advanced naval platform and expeditionary power generation, distribution, and management
- Alternative and novel naval power generation systems
- Power electronics and electromechanical machinery
- Energy storage
- Energy resilience
- Air-independent propulsion
- Alternative fuels
- Heat transfer and thermal management
- Materials
- Climate resilience and clean energy





# Navy Power Electronic Building Blocks & Power Electronics Power Distribution System (PEPDS)

### Development of SiC-Based PEBB 1000 (2014-2017)

R. Burgos, D. Boroyevich, J. Wang, and I. Cvetkovic

This work was supported by ONR Grant N00014-16-1-2956

- Designed for operation under the harsh d/v/dt environment. EMI containment strategy implemented in the gate drivers, power supplies, and digital control
- Features high-bandwidth current sensors integrated in the gate driver for extremely fast protection and peak-current mode control
- Designed for the switching cycle control that enables dc-link capacitor voltage balancing within one switching cycle

**SiC Module 1.7 kV, 300 A**

**Gate-Driver with a High-Bandwidth Current Sensor**

**1000 V nominal DC voltage**  
**100 A nominal current**  
**100 kHz switching freq.**  
**Efficiency 98%**  
**Weight 26 lb**

Range > 800 A  
 Error < 1%  
 BW > 1 MHz  
 d/dt > 50 A/ns

**Fault Current cleared in 1 μs!**

Thermal Interface, Power Terminals, Control Interface

### Development of the PEBB 6000 Using Gen3 10 kV, 240 A SiC MOSFET Modules in Full-Bridge Configuration

R. Burgos, D. Boroyevich, I. Cvetkovic, and D. Dong

This work was supported by ONR Grant N00014-16-1-2956

Using Wolfspeed XHV-6 10 kV 240 A SiC MOSFET modules

**PEBB 6000 LRU**

2 x Half-bridge converter

**Full-bridge structure Full-Bridge PEBB 6000 Power density = 23.3 kW/l**

**Objectives**

- Electro-thermal design optimization of PEBB 6000 rated at 6 kV, dc, 1 MW, 240 A, targeting 10 MW/m<sup>3</sup>, η = 99 %, and PDIV = 30 kV

**Targets Achieved:**

- Partial discharge inception voltage (PDIV) of 30 kV
- Power density of 15 MW/m<sup>3</sup>, η = 99.4 % (full-bridge) stack including wireless power transfer and d power supplies

## PEPDS is an Integrated Power and Energy Power Distribution System Challenge

- Integrated Power, Propulsion, Protection, Filtering, Storage, and Control
- Distribution Converters provide protection, filtering, and (with Energy Magazines) storage
- Distribution Converters create an interface for every load
  - No single interface standard for all loads.
  - AC or DC, Frequency, Voltage, Power, etc. are tailored to meet individual load requirements.
- Common Interface Solutions for All Loads – high commonality
- Integrated Electrical, Thermal, and Mechanical Control

**Least Replaceable Unit, Most Common Denominator**  
**-- Key To Enabling PEPDS**

### Navy Integrated Power Electronics Building Block (Navy IPEBB) (2019-2023)

C. DiMarino, R. Burgos, D. Boroyevich, I. Cvetkovic, R. Raju (Fast Watt, LLC)

This work was supported by ONR Grant N00014-16-1-2956

- Objective:** To design a high-density, integrated PEBB with galvanic isolation and high manufacturability.
- Tasks:**
  - Employ multi-physics finite element analysis to design high-density, efficient, and reliable Navy IPEBB
  - Evaluate state-of-the-art substrate materials
  - Prototype and test H-bridge with 1.7 kV SiC MOSFETs
  - Prototype and test 500 kHz, 250 kW transformer with 20 kV isolation

**Navy IPEBB Target Specifications**

Parameter	Target Value
Voltage	1 kV dc
Power	250 kW
Switching Frequency	500 kHz
Power Density	12 kW/l
Weight	35 lbs
Isolation Voltage	20 kV

**Navy IPEBB Schematic a**

Fig. 1: High-efficiency bidirectional DC-DC (DCAC) IPEBB

Fig. 2: Rendering of the IPEBB multi-layer substrate prototype, and current dimensions and weight.

### Navy Integrated Power and Energy Corridor (NiPEC)

This work was supported by ONR Grant N00014-16-1-2956

**Example Power Corridor**

**Designing algorithm**

- Cable allocation algorithm
- Thermal simulation of multiple cables, conduits and terminations
- Opt. size and location of energy storage

**Single Bulkhead Sample: Side View**



## S&T Objectives: Develop Courses and Laboratories for Electric Energy Education

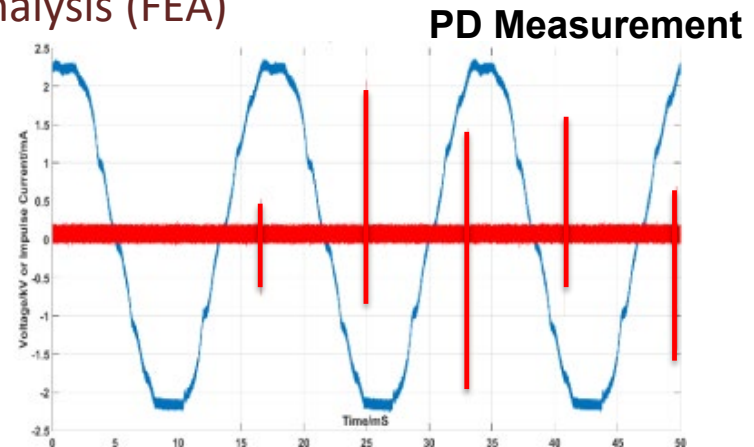
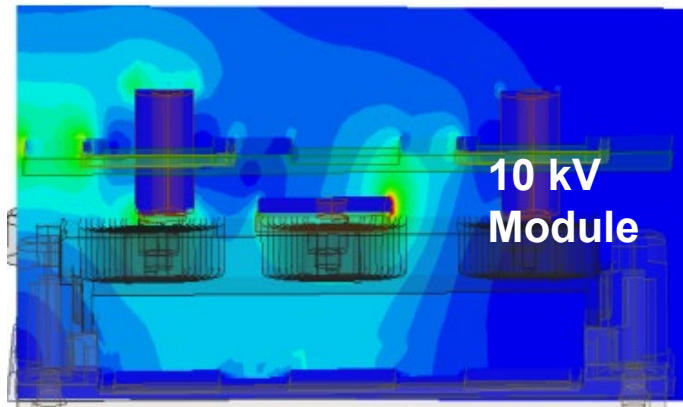
- A better-trained supply of U.S. graduates in STEM to tackle various research challenges in the Navy
- Adding flexibility and safety to ensure that they will be useable in a variety of future Navy courses and learning needs
  - Do so by enabling all universities to provide a first-rate education and educate students in large numbers
  - Two Fold Objective: 1) Incentivize US Citizen Students to Pursue Power and Energy BS, MS and PhD Degrees and 2) Equip our Naval Engineering Enterprise with the KSAs needed to stay current and ahead of emerging technologies





# Key Challenges

- Heightened EMI emissions due to high switching frequency, fast  $dv/dt$ , and large parasitic capacitances to ground
  - Mitigation: use impedance-based EMI channeling technique
- Design of high-voltage insulation strategy capable of withstanding high electric fields under fast PWM conditions
  - Mitigation: proper selection of materials, partial discharge (PD) measurements, finite element analysis (FEA)



Curriculum Development completed in Sustainable Education in EMI, Common Mode Differential Mode theoretically speaking and in practice, through an ONR Grant, N000141812601, Dr. Andy Lemmon, University of Alabama, and a second in Creepage and Clearance standards development, ONR Grants N000141812547, Dr. Rob Cuzner, University of Wisconsin, Milwaukee; N000141812623, Dr. Lukas Graber, Georgia Tech, and N000141612956, Dr. Michael Steurer, Florida State University. In the near future, sustainable education in machine and drive insulation

Approved, DCN# 543-271-23



# ONR Science Technology Engineering and Mathematics (STEM) Initiatives

Approved, DCN#436177-21

The image is a promotional graphic for two programs. On the left, under the heading "SEAP SCIENCE AND ENGINEERING APPRENTICESHIP PROGRAM", there is a photo of two young people looking at a laptop. On the right, under the heading "NREIP NAVAL RESEARCH ENTERPRISE INTERNSHIP PROGRAM", there is a photo of a young man working with a microscope. The ONR logo is in the top right corner. At the bottom, a dark blue box contains the names and titles of the program managers: Reginald G. Williams, PhD, Program Manager, and Kristen Mitchell, PhD, Senior Systems Analyst.

**SEAP**  
SCIENCE AND  
ENGINEERING  
APPRENTICESHIP  
PROGRAM

**NREIP**  
NAVAL RESEARCH  
ENTERPRISE  
INTERNSHIP  
PROGRAM

**Reginald G. Williams, PhD**  
Program Manager

**Kristen Mitchell, PhD**  
Senior Systems Analyst

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Science,  
Mathematics, and  
Research for  
Transformation  
(SMART) Scholarship  
for-Service  
Program





# SEAP: Science and Engineering Apprenticeship Program

Approved, DCN#4361772

**SEAP**  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

+ SEAP is an 8-week apprenticeship program designed to provide opportunities for **high school students** to participate in research under the guidance of a research mentor at a participating Navy laboratory.

DISTRIBUTION STATEMENT A. Approved for public release. Distribution unlimited.

Approved, DCN#4361772

+ HOW IT WORKS

1 Choose your labs

2 Apply by the Deadline

3 Receive Lab Decisions

4 Accept Your Placement

5 Embark on Your Next Adventure!

SEAP  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

**03**

DISTRIBUTION STATEMENT A. Approved for public release. Distribution unlimited.

Approved, DCN#4361772

+ ELIGIBILITY

- U.S. citizen (permanent resident alien status considered at some labs)
- High school students who have completed at least the 9th grade and graduating seniors
- Typically, must be 16 years of age or older
- 15 years of age at some labs (see website for details)

SEAP  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

DISTRIBUTION STATEMENT A. Approved for public release. Distribution unlimited.



Approved, DCN#4361772

+ STIPEND

- \$4,000 for 1<sup>st</sup> year students
- \$4,500 for returning students

SEAP  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

+ SELECTION

Selection based upon academic achievement, personal statements, recommendations, and career and research interests.

**05**

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# NREIP: Naval Research Enterprise Internship Program

Approved, DCN#436177-21



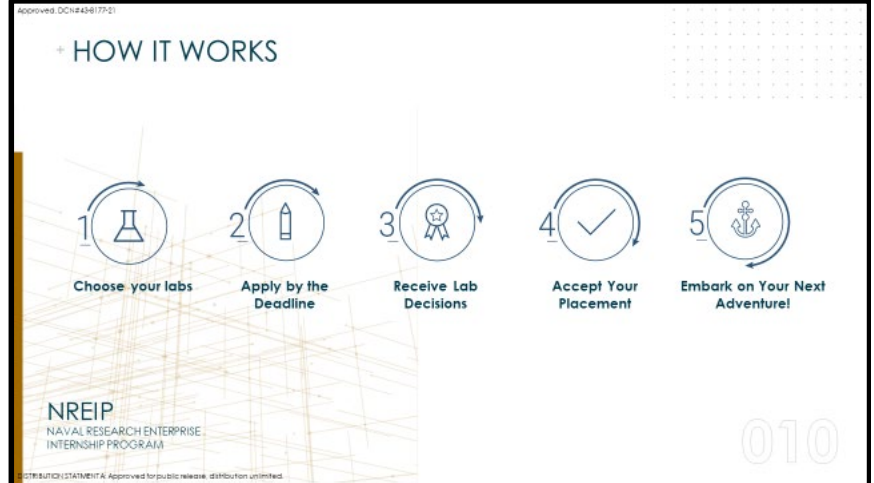
**NREIP**  
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

+ NREIP is a 10-week internship program designed to provide opportunities for **undergraduate** and **graduate** students to participate in research under the guidance of a research mentor at a participating Navy laboratory

DISTRIBUTION STATEMENT A. Approved for public release; distribution unlimited.

Approved, DCN#436177-21

## + HOW IT WORKS



- 1 Choose your labs
- 2 Apply by the Deadline
- 3 Receive Lab Decisions
- 4 Accept Your Placement
- 5 Embark on Your Next Adventure!

**NREIP**  
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

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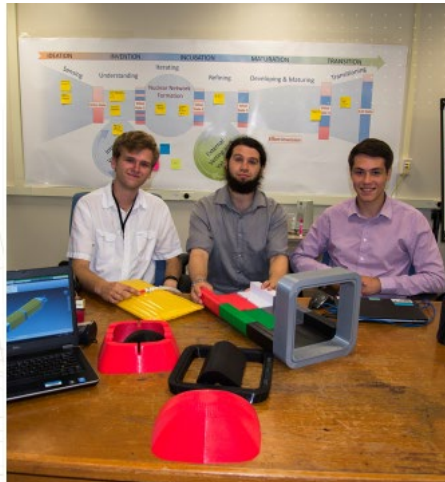
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## + ELIGIBILITY

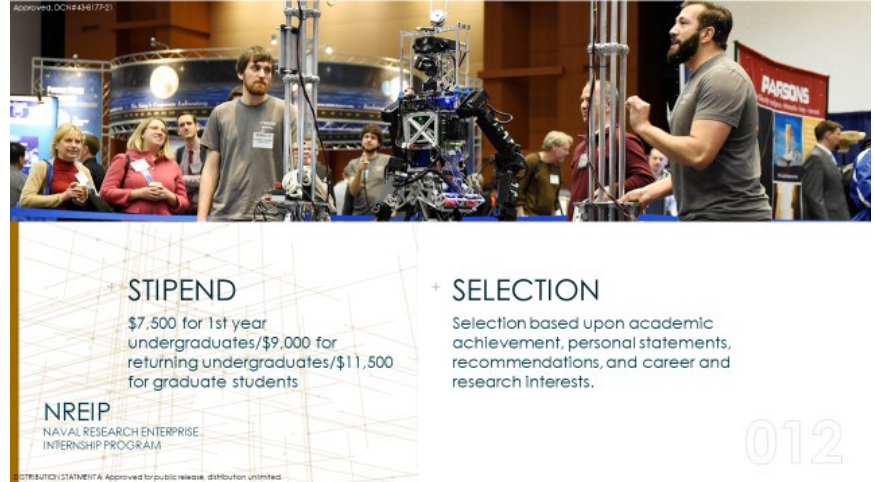
- U.S. citizen (permanent resident alien status considered at some labs)
- Sophomore - Senior and Graduate students enrolled at an accredited college or university
- All majors relevant to the research interests of the laboratories (see website)
- Eligible to be granted a SECRET security clearance (see website)

**NREIP**  
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

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## + STIPEND

\$7,500 for 1st year undergraduates/\$9,000 for returning undergraduates/\$11,500 for graduate students

## + SELECTION

Selection based upon academic achievement, personal statements, recommendations, and career and research interests.

**NREIP**  
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

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# SMART: Science, Mathematics, and Research for Transformation (SMART) Scholarship for-Service Program

### Eligibility

- U.S. Citizen
- 18 Years or Older
- 3.0 Minimum GPA
- Degree in STEM
- 1 Year Minimum Award  
5 Year Maximum Award
- Obtain/Maintain Security Clearance

### Eligibility Requirements & Scholar Benefits

### Benefits

- Full Tuition
- Annual Stipend
- Book and Health Allowance
- Experienced Mentor
- Summer Internships\*
- Employment at a DoD lab or agency\*

## SMART Scholarship 21 STEM Disciplines

- Aeronautical and Astronautical Engineering
- Biomedical Engineering
- Biosciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Cognitive, Neural, and Behavioral Sciences
- Computer and Computational Sciences/Engineering
- Electrical Engineering
- Environmental Sciences

- Geosciences
- Industrial and Systems Engineering
- Information Sciences
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Naval Architecture and Ocean Engineering
- Nuclear Engineering
- Oceanography
- Operations Research
- Physics

Emerging disciplines are added regularly!

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## DoD SMART Scholarship Facilities

Historically, SMART scholars have been placed at 200+ DoD sponsoring facilities, laboratories, and agencies.  
100+ DoD sponsoring facilities actively select SMART Scholars each year.

Laboratory Sites

**68**

Medical Facilities

**4**

Army Corps of Engineer Sites

**49**

Test & Evaluation Center Sites

**58**

Intelligence Community Sites

**15**

Other Mission Support Sites

**33**

\* Many SFs have multiple missions

## SMART Timeline Application and Scholar Cycle

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Application Cycle	Application Period					Evaluation	Selection	Awards	Site Visit			
Scholar Cycle	Academic Pursuit (Phase 1)											
									Internships			

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# VTEC

Morgan Olsen | US Coast Guard | BS Electrical Engineering



## Student Veterans Working on NREL

FAMU-FSU  
College of Engineering

CAPS student veterans Dallas Zimmer and Matthew Pickles working on NREL project



02/25/23

Kyle Giddes | US Navy | BS Mechanical Engineering

My name is Kyle Giddes. I served for five years in the Navy from 2014 to 2019. During my time in the Navy, I had the privilege of serving the White House Military Office while stationed at Camp David. I realized while stationed there that I wanted to return to school and further my education. After transferring to Naval Mobile Construction Battalion 133, I earned two warfare devices and deployed twice. Upon completing my contract, I separated under honorable conditions and currently receive 80% disability. My terminal leave began immediately upon returning to the states from my last deployment, and I enrolled in a local community college.

I spent two years at Mississippi Gulf Coast Community College (MGCCC) and earned my Associate of Arts and Sciences while maintaining a 3.95/4.00 GPA. Once I'd graduated there, I was ready to use my GI Bill and apply to various colleges, though Florida State University stood out to me because of the research being done here. At the time, I believed I wanted to major in physics & materials, but after completing a semester, I decided my true passion lay in engineering.

When Dr. Steurer reached out to recruit me to intern at the Center for Advanced Power Systems, I leapt at the chance. I had no idea an initiative like VTEC (Veterans to Energy Careers) was available to me, but I was not going to let it pass me by. Though I could not immediately capitalize on the opportunity due to medical reasons, I was eager to prove myself. As soon as I was healthy, I began working at CAPS in April 2022 and resumed school in the fall as a Mechanical Engineering major.

When I graduate in the spring of 2025, I will be much more prepared than I otherwise would have been. Words cannot express my gratitude to VTEC and the Office of Naval Research for this fantastic opportunity to capitalize on my service and further my studies.

Respectfully,  
Kyle Giddes  
[Kg21d@fsu.edu](mailto:Kg21d@fsu.edu)

My name is Morgan Olsen and am a participating veteran who is employed by both Veterans to Energy Careers (VTEC) and FSU's Center for Advanced Power Systems (CAPS). I would like to tell you about myself and my experience with VTEC:

I was active duty in the US Coast Guard from 2008 to 2020, when my career was cut short due to injuries incurred while on active duty. At the time of my departure, I was rated as a First-Class Electrician's Mate, earned an AAS in Electrical Engineering Technology, and completed an 8,000-hour apprenticeship in the trade Electrician (Ship and Boat) from the US Department of Labor's United States Military Apprenticeship Program. Up until this point, Plan A was to retire with the US Coast Guard at 20+ years as a Chief Warrant Officer but knowing that life does not always go as expected, I had to reevaluate my previous plan. It was overwhelming to say the least but I had to make do with my circumstances. Once learning of my imminent medical separation, I began considering what Plan B would look like. Most of all, I needed to discover who I was if I was no longer a Coast Guardswoman. As simple as this may sound, at the time, it was a heavy burden to bear.

**VTEC also understands that other opportunities arise.** I was granted a leave of absence when I was awarded the Office of Naval Research Naval Research Enterprise Internship Program (NREIP) opportunity over the summer of 2022. Because of VTEC's flexibility, I gained valuable insight and experience with autonomous underwater systems working at the Littoral Mine Countermeasures Warfare Center at the Naval Surface Warfare Center in Panama City, FL. During the NREIP internship, VTEC even kept in touch and ensured I was getting the most out of the experience. Most importantly, VTEC has helped me answer the question, "Who am I, if I am not in the Coast Guard?" Well thanks to VTEC, I am Morgan L. Olsen. I always was. I am a journeyman level marine electrician pursuing a bachelors in electrical engineering, and serve as a student Research Assistant at Florida State University's Center for Advanced Power Systems in Tallahassee, FL. I have a bright and exciting future in naval power generation and embody the dedicated work ethic and persistence necessary to succeed in whatever venture I may find myself. I will be applying to graduate school next year and plan to pursue a Masters or PhD in electrical engineering. Oh, ... and I just so happen to be a veteran of the United States Coast Guard.

Thank you, VTEC!

Respectfully,

Morgan Olsen

[Mlo20x@fsu.edu](mailto:Mlo20x@fsu.edu)



# Naval Postgraduate School

## Naval Power Curriculum Working Group Meeting

### What we set out to do:

The naval power curriculum working group meeting was arranged to build a team who could detail the root needs for power curriculum within the navy and supporting organizations. The purpose of the meeting was to formalize the requirements and develop an understanding of what materials are already available to potential students, and those which will need to be developed. In addition, the group was intended to develop a list of tasks and objectives for further development, as well as a list of potential resources to leverage going forward.

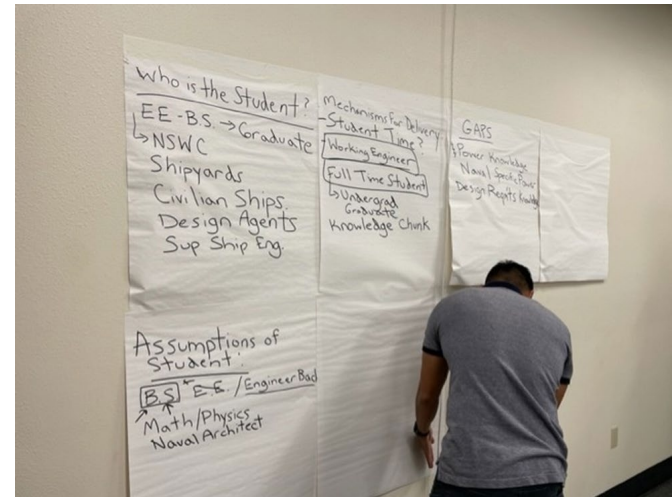
### Key Takeaways:

**Professional education:** A key assumption is that development of lessons is geared toward Professional Education vice accredited courses. Developers could use certificates or badges to allow a student to show knowledge gained, but the primary purpose of the lessons is professional education. This ensures stakeholders can create their own desired education tracks for their employees.

**Target students:** The entire Naval enterprise including academia, warfare centers, national lab research centers, shipyards/shipbuilders, etc.

**Student knowledge level:** The assumption is that the lessons will be geared toward a student with a base level of knowledge at the engineering and supporting sciences bachelor's degree level (or equivalent).

**Instructor taught:** Lessons are taught by an instructor through various methods (synchronous, asynchronous, in person, etc.) with all needed materials contained within the lessons, such as video, tests, etc. (canned courses).



### The Way Ahead:

- Create student learning objectives (SLO's) for all knowledge elements
- Consolidate and understand KSA's from stakeholder organizations (NAVSEA, shipyards, etc.)
- Take inventory of existing course offerings
- Develop a reference list of SME's from stakeholder organizations by topic areas
- Consolidate lessons learned from similar past efforts to understand potential pitfalls
- Identify potential instructors (coalition of the willing)
- Pursue funding options based on lessons/courses with development potential



# The Most Important Resource: People

## Objective / Goal

- Revive and Enhance Education - Prepare next generation of Navy electrical & power engineers
- Meet increasing demands in power-related fields in the Navy and elsewhere
- Educate naval officers to maintain, operate, & sustain naval power systems

## Summary of Effort

- Develop 19 courses in Electric Power & Energy Systems
- Disseminate widely by offering course materials free online to all U.S. universities for classroom and distance learning

## Major Participants

- Ned Mohan – University of Minnesota
- Consortium of Universities for Sustainable Power (CUSP) – 235 universities participating as of October 2022 (ref:<http://cusp.umn.edu/cusp-members.php>)



## Recent Accomplishments

- 19 courses completed
- Adopted by USNA and Naval Postgraduate School for core and distance learning curriculum
- Over 450 faculty members are using the learning curriculum

## Key Milestones / Projected Transition

- **Near:** Publication of all 19 courses complete; Additional courses Master's Program (TTU) commenced in FY19
- **Mid/Far:** Educate/Train Navy and Industry Power Engineering Workforce with emerging technologies



# Summary

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- Power Electronic Power Distribution System
- S&T Objectives: Electric Energy Education
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Work With Us... Together we can Build a Robust Workforce  
in Electric Power Engineering for the United States





Questions?



Approved, DCN# 543-271-23



# BACK-UPS



# SEAP: Science and Engineering Apprenticeship Program

Approved, DCN#43817721

## + DISCIPLINES

- Aeronautics
- Algebra
- Anatomy
- Applied Mathematics
- Astronomy
- Behavioral Science
- Biology
- Business
- Calculus
- Chemistry
- Computer Science
- Earth Science
- Economics
- Engineering
- Environmental Science
- Geology
- Geometry
- Government
- History
- Management/Leadership
- Marine Biology
- Mathematics
- Mechanics
- Medicine/Health
- Meteorology
- Oceanography
- Organizational Development
- Physical Science
- Physics
- Physiology
- Programming
- Psychology
- Public Policy
- Robotics
- Social Sciences
- Sociology
- Statistics and Probability

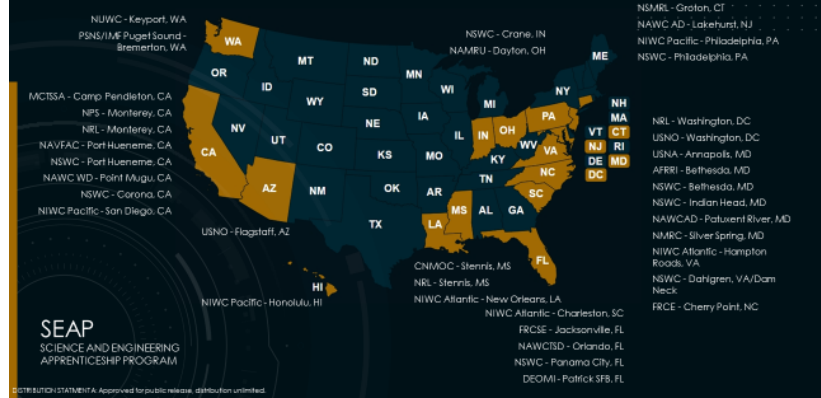
**SEAP**  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

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Approved, DCN#43817721

## + SEAP LAB LOCATIONS



Approved, DCN#43817721

APPLICATIONS OPEN  
**AUGUST 1, 2022**

APPLICATIONS CLOSES  
**NOVEMBER 1, 2022**

GO TO  
[NAVALSTEMINTERNS.US/SEAP/](https://NAVALSTEMINTERNS.US/SEAP/)

GET IN TOUCH  
[SEAP@SaxmanOne.com](mailto:SEAP@SaxmanOne.com)

**SEAP**  
SCIENCE AND ENGINEERING  
APPRENTICESHIP PROGRAM

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**Note: These Dates are for 2023,  
Please go to the website to  
Obtain the 2024 Application  
Information**

Approved, DCN# 543-271-23



# NREIP: Naval Research Enterprise Internship Program

Approved, DCN#436177-21

## + DISCIPLINES

- Aerodynamics
- Aeronautical Engineering
- Aeronautics
- Aerospace Engineering
- Applied Engineering
- Applied Mathematics
- Archaeology
- Artificial Intelligence
- Astronomy
- Behavioral Science
- Bioengineering
- Biology
- Biosciences Chemical
- Business
- Engineering
- Chemistry
- Civil Engineering
- Computer Engineering
- Computer Science
- Cryptology
- Cybersecurity
- Data Science
- Electrical Engineering
- Electronics Engineering
- Engineering
- Environmental Science
- Forensics
- Geo Science
- Geology
- Geosciences
- History
- Industrial Engineering
- Information Sciences
- Instructional Systems
- Technology
- Lasers/Optics
- Machine Learning
- Management/Leadership
- Marine Biology
- Marine Engineering
- Material Sciences
- Mechanical Engineering
- Mechanics
- Medical Science
- Medicine/Health
- Meteorology
- Natural Language Processing
- Naval Architecture
- Naval Engineering
- Neuroscience
- Oceanography
- Organizational Development
- Photonics
- Physics
- Physiology
- Programming
- Propulsion Technology
- Psychology
- Public Policy
- Radiology
- Robotics
- Social Sciences
- Software Engineering
- Statistics
- Systems Engineering
- Telecommunications
- Toxicology

### NREIP

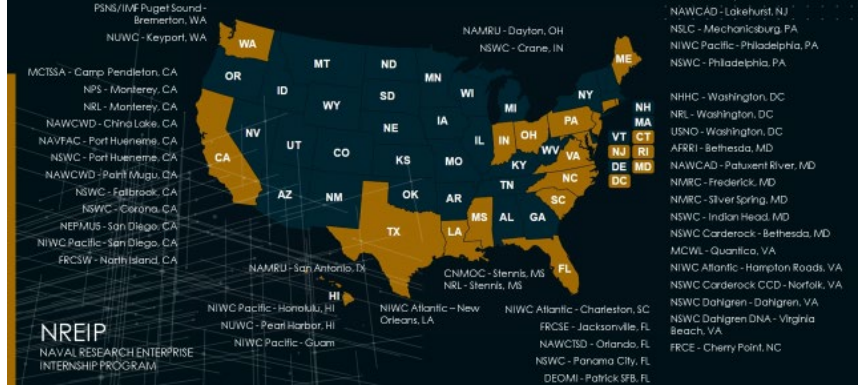
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

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Approved, DCN#436177-21

## + NREIP LAB LOCATIONS



Approved, DCN#436177-21

APPLICATIONS OPEN  
AUGUST 1, 2022

APPLICATIONS CLOSES  
NOVEMBER 1, 2022

GO TO  
[NAVALSTEMINTERNS.US/NREIP/](https://NAVALSTEMINTERNS.US/NREIP/)

GET IN TOUCH  
[NREIP@SaxmanOne.com](mailto:NREIP@SaxmanOne.com)

NREIP  
NAVAL RESEARCH ENTERPRISE  
INTERNSHIP PROGRAM

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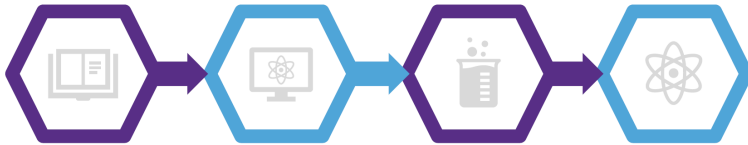
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# SMART: Science, Mathematics, and Research for Transformation (SMART) Scholarship for-Service Program

## SMART Scholarship Lifecycle

SMART  
SCIENCE, MATHEMATICS,  
AND RESEARCH FOR  
TRANSFORMATION  
PART OF THE NATIONAL  
DEFENSE EDUCATION PROGRAM



### Phase 0 Awards

- ✓ Orientation
- ✓ Site Visits
- ✓ Background Checks

2022 Cohort data on next slide

### Phase 1 Academic Pursuit

- ✓ Full time coursework
- ✓ Summer Internships
- ✓ Clearance initiated

1,119\*  
Scholars in Phase 1

### Phase 2 Service Commitment

- ✓ Graduation
- ✓ Transition to full-time employment

644\*  
Scholars in Phase 2

### Phase 3 Retained

- ✓ Service commitment complete
- ✓ Option to stay with the DoD

1,970\*  
Scholars in Phase 3

\*Data as of October 2022

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## Connect with us! SMART Scholarship

Thank you for your support of the program!



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DoD SMART Scholarship



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Reach out to your  
CL [smartcl@smartscholarship.org](mailto:smartcl@smartscholarship.org)

The SMART Selection is open  
February 1 – March 15

[www.smartscholarship.org](http://www.smartscholarship.org)

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# SMART Brochure

## What is the DoD SMART Scholarship-for-Service Program?

The Science, Mathematics, and Research for Transformation (SMART) Scholarship-for-Service Program, funded by the Department of Defense (DoD), is a combined educational and workforce development opportunity for science, technology, engineering, and mathematics (STEM) students.

SMART offers scholarships for undergraduate, master's, and doctoral students currently pursuing a degree in one of the 21 STEM disciplines. SMART scholars receive full tuition, annual stipends, and employment with the DoD after graduation.

SMART provides the research leaders of tomorrow with not only an education, but a career.



**Brandy Redic, BS**  
SMART Scholar

Naval Surface Warfare Center - Port Hueneme Division

“ Before being a part of the SMART Program, I had no idea what I would want to do with my degree once I graduated. The SMART Program has not only fueled my motivation to graduate faster, but it has also helped me figure out a 5-year-plan that has me looking forward to what is to come once I graduate. ”

## SMART Disciplines

- Aeronautical and Astronautical Engineering
- Biomedical Engineering
- Biosciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Cognitive, Neural, and Behavioral Sciences
- Computer and Computational Sciences and Computer Engineering
- Electrical Engineering
- Environmental Sciences
- Geosciences
- Industrial and Systems Engineering
- Information Sciences
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Naval Architecture and Ocean Engineering
- Nuclear Engineering
- Oceanography
- Operations Research
- Physics



# SMART SCHOLARSHIP

*Defense Created by Scientists and Engineers*



Department of Defense  
SMART Scholarship-for-Service Program



@SMART\_DoD



SMART Scholarship



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DoD SMART Scholarship



SMART.DoD.Scholarship





# SMART Brochure

## Become the next SMART scholar!



APPLICATION IS OPEN  
AUGUST-DECEMBER

### Scholar Highlight



**Warren Kadoya, Ph.D.**  
*SMART Scholar*



“Without the SMART Scholarship, I would most likely never have pursued a Ph.D. after completing my master’s. The support

of the scholarship allowed me to focus my attention on the demands of graduate school without added financial stress.”

#### Award Details

**University**

University of Arizona

**STEM Discipline**

Biosciences

**Sponsoring Facility**

U.S. Army Engineer Research, Development Center – CRREL

**SMART Successes**

Ambassador, SEED Grant Recipient

Visit our website for more scholar highlights!

### SMART Scholar Benefits



Full Tuition



Annual Stipend  
\$25,000–\$38,000



Book and Health Allowance



Summer Internships



Experienced Mentor



DoD Employment

### Eligibility and Program Requirements

- U.S. citizenship
- 18 years or older
- Pursuing a degree in, or closely related to, one of the SMART STEM disciplines
- Obtain and maintain a security clearance
- Be enrolled in a U.S. accredited college or university
- Minimum 3.0 cumulative GPA
- Complete at least one summer internship (multi-year scholars only)
- Minimum 1 year of degree funding
- Accept full-time employment with the DoD, post graduation