

NSWCPD Internships & Capstones Overview

8/23/2023

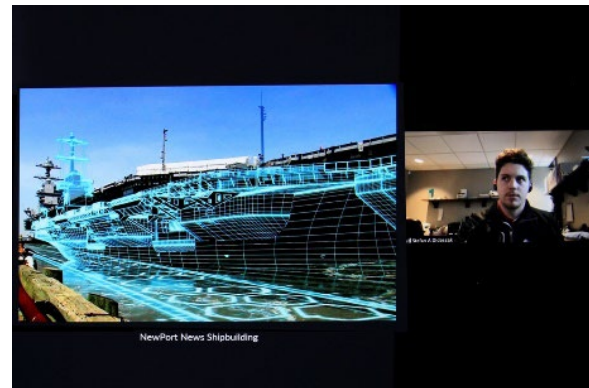
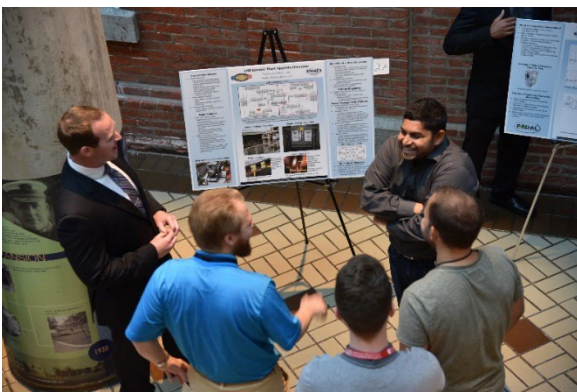
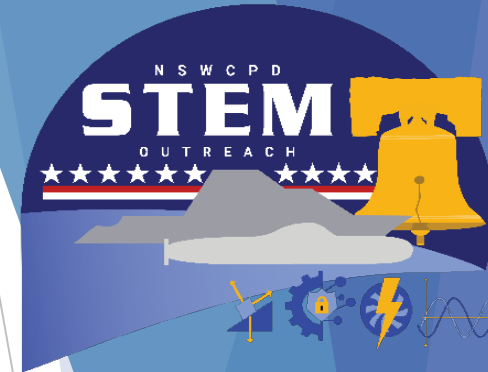
Tristan Wolfe

NSWCPD STEM Outreach Program Manager



Methods

- ❖ Summer Internships
- ❖ Short-term school year projects
- ❖ Long-term capstone projects
- ❖ Co-ops
- ❖ Scholarships
- ❖ Undergraduate / Graduate research



Intern Project Examples

- Modeling & Simulation Support / MBSE
- Testing & Evaluation Support
- Work Package Development
- Test Site Support
- Computer Programming Support
- Hardware System Upgrades
- Research & Development Support
- Control System Upgrades
- Cybersecurity, DevSecOps, & Ethical Hacking
- Engineering System Design
- Engineering Analysis & Data Analytics
- and much more...

Introduction

- Air Conditioning and Refrigeration (AC&R) systems are vital for maintaining ideal thermal conditions onboard naval vessels

Heat is transferred from the ship's interior to the sea water through the heat exchangers.

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AC&R is used for:

- Filtration of contaminants
- Crew comfort
- Maintaining air quality

LCS AC Plant Configuration is as follows:

- Adriatic Marine
 - LCS 3-15 odd (Freedom Class)
- Johnson Controls Navy Systems
 - LCS 4-34 even (Independence Class)

Problem

- Condensers on board LCS are degrading significantly faster than expected, particularly the Adriatic Marine units
- Determining causes of condenser failures via failure analysis
- Maintenance for LCS are on average once a year, significantly lower than other ships

Analysis and Prevention of Condenser Corrosion on Littoral Combat Ships (LCS)

Sirawit Shimpalee, 411
Mentor: Nuri Bracey, 411
Condenser Condition

Condenser Tubesheet

Corroded Coils

Internal View of Tubesheet Corrosion

Internal View Corrosion

OARS Data for Cleanings

MIP	5142/034	Y
MRC	F4UL	Y

Count of MRC Column Labels

Count of MRC	Column Labels	2018	2020	2021
Row Labels				
LCS 0001		3	4	

Objectives

- Research existing and potential methods of cleaning condenser and preventing damage and determine if those methods can be applied to LCS
- Review and compile maintenance data on LCS to determine sources of failure in condenser operation

Planned Activities

- For cleaning methods research:
 - Investigate cleaning methods for land based and marine condensers
 - Determine existing preventative

Problem

- The lack of control power redundancy increases the risk of loss of power to control and machinery equipment in the event of electrical failure.

Purpose

- To improve the existing control power design through the addition of a rectifier which enables a cross connection between the two systems.
- To provide redundant sources of control power that are available in a dark ship capable of starting a generator to restore ships power.
- To verify proper operation of the Rectifier and existing UPS when in parallel, to test what diode protection is needed between the units, and see how the devices react as each unit is cycled off and on

Shipboard UPS and Rectifier Parallel Operation Test

Deesha Patel, Code 446
Mentor: Joseph Everly and Joseph Amato, Code 446

Figure 1: Existing Control Power Circuit

Legend:
- 400 VAC
- 115 VAC
- 24 VDC

Test and Results

- Recorded the output current and voltages from the Rectifier and the UPS.
- Documented the outcomes through the usage of a data logger and multi-meters.
- Removed the four diodes.
- Tested with different load bank values.
- Conducted an endurance test.
- Results:
 - The endurance showed the machinery was able to function individually and maintain a stable temperature for span of two weeks.
 - The parallel test proved that the load bank was always given power through either the UPS or Rectifier.

Figure 4: Set up of LCS SCOD 24VDC UPS and Rectifier Parallel Operation test.

Abstract

- The GC-150 Main Reduction Gear (MRG) Dehumidifier Controller was updated to solve the several issues that the old version had:
 - Digitizing the unit control and operation
 - All-in-one controller for unit operation and relative humidity digital display
 - Removes the high failure rate analog hygrometer
 - Minor change that can be implemented across all ships for commonality
 - Tested on DDG 111 and LSD 52
 - Modernizing a 40 year old design

LSD 52, USS Pearl Harbor
https://www.navsea.mil/Portals/0/USN_Pearl_Harbor_16345022629.jpg

What is the MRG Dehumidifier?

- Device that removes humidity from the main reduction gear while the ship is pier side and the gear is not in use.
- Cycle time can vary depending on how long the ship is docked.
- Dehumidifier turns on if relative humidity is above certain level and unit operates to dry inlet air through a desiccant wheel.

Main Reduction Gear (MRG) Dehumidifier

Krishna Mahajan, Code 418
Brittany McQuaig & Keith Grimes, Code 418

GC-150 Dehumidifier

Dehumidifier Manual Controller

Dehumidifier New Digital Controller

Dehumidifier Air Flow Diagram

FIGURE 1-2 AIR FLOW DIAGRAM

Distribution A: Approved for public release; distribution unlimited.

Testing

- Prototype set up on DDG 111 and LSD 52.
- ISEA provided log sheet and test plan to the ships to document dehumidifier operating data
- Reviewed test data from prototype installation
- Reviewed white paper recommendations and Ship Change Documents (SCDs) for combatants and amphibies

DDG 111, USS Spruance
USS Spruance (DDG 111) (JANUARY 2015)

Technical Manual Update

- Logistic updates are required to reflect changes to new dehumidifier controller
- Reviewed existing tech manual and provided redlines for necessary changes
- Updated parts list for APL development and inclusion in tech manual
- Ensured that all figures and diagrams reflected the updated digital controller.

Navy Application

- Tests that different power structures are able to synchronize.
- Single point of failure vs. redundant sources of control power that are available in a dark ship
- Prevent a dark ship event from occurring in the future.

Links

► Internships

- [Naval Research Enterprise Internship Program \(NREIP\)](#)
- [Science and Engineering Apprenticeship Program \(SEAP\)](#)
- [Veterans to Energy Careers \(VTEC\)](#)
- [National Security Innovation Network \(NSIN\) X-Force](#)
- [DoD College Acquisition Internship Program \(DCAIP\)](#)
- [DoD Cyber Scholarship Program \(DoD CySP\) - DoD Cyber Exchange](#)
- [Pathways](#)



Closes Nov 1

Closes Feb 10



Closes Oct 11



► Scholarships / Fellowships

- [Science, Mathematics, and Research for Transformation \(SMART\)](#)
- [National Defense Science and Engineering Graduate Fellowship Program \(NDSEG\)](#)

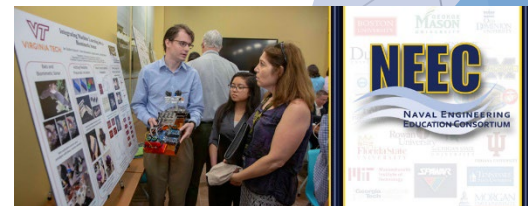
Closes Dec 1



► Capstones / Research / Projects

- [National Security Innovation Network \(NSIN\) Capstone](#)
- [Naval Engineering Education Consortium \(NEEC\)](#)

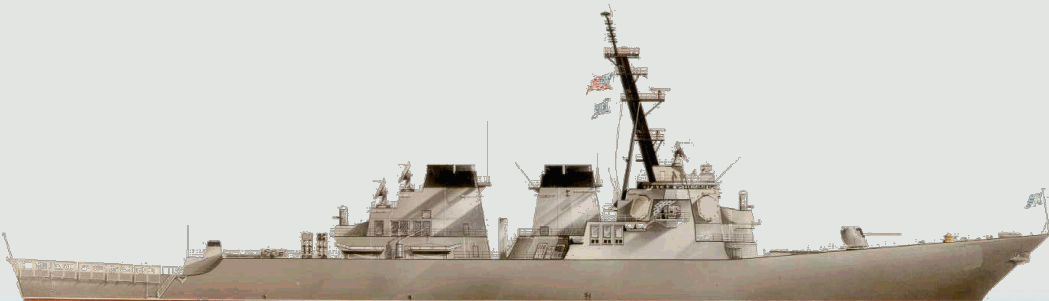
Closes Oct 31



► Capstones, co-ops, and other summer hire opportunities: Please contact us directly!

QUESTIONS

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Sample Summer Intern Projects

HFC 134a high global warming potential replacement refrigerant: Intern assists with the identification of low global warming potential refrigerants including testing AC chiller components with drop-in replacements, AC plant test site installation, and start-up testing.

Propulsion shafting alignment training and requirements development: Intern assists the propulsion shafting team in supporting the research and testing of advanced bearing materials to develop Stribeck curves for different paired materials. Stribeck curves help predict bearing wear and service life. The intern also assists in developing shafting alignment standards and products to support the in-service engineering agents in updating the training class materials and Fleet standards.

Salinity monitoring system testing: Intern assists in aspects of mechanical, electrical, and control systems testing related to control panels and other equipment supporting salinity monitoring. Activities include computer programming and cybersecurity as well as hands-on testing & evaluation.

Research & development in superconductivity: Intern assists in testing & evaluation activities related to studying the magnetic effects on pneumatic motor operations as well as studying current state of high-temperature superconducting wire performance and cost.

Machinery plant control and monitoring systems: Intern assists in new software design and development for shipboard machinery plant control and monitoring systems. Intern uses a combination of virtual machine, java script, visual basic, Arduino, and C programming languages and develops a better understanding of requirements testing.

