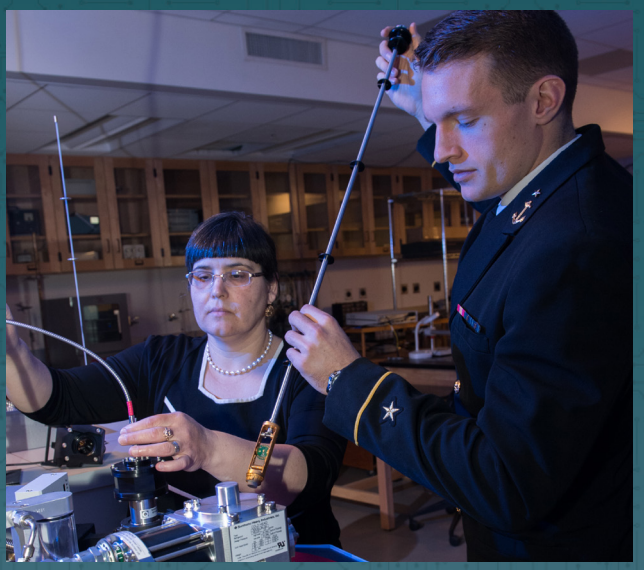


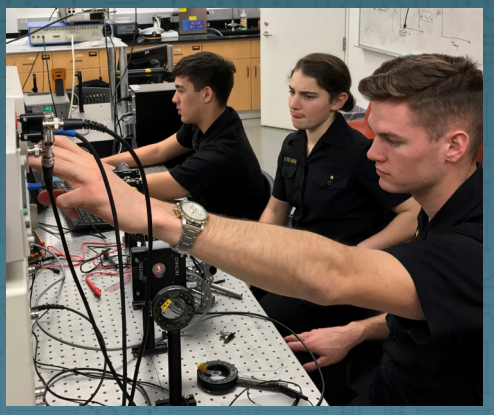


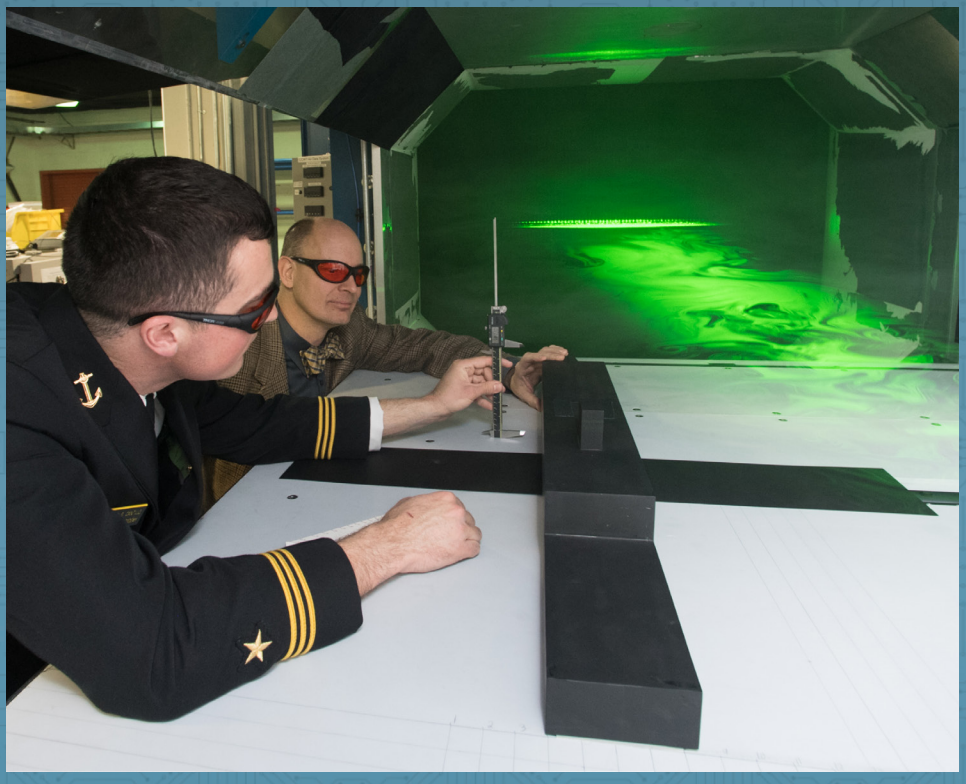


United States
Naval Academy

Senior Capstone Projects

April 25, 2018







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Welcome!



Welcome to the United States Naval Academy's sixth Annual Capstone Day. Thanks for taking time to join us as we present an academy-wide showcase of senior projects here in Annapolis.

Capstone projects provide students with valuable real-world experience that will help them in their future careers, as military officers and later in private industry. At this year's Capstone Day you will see the culmination of the year's academic efforts of our Midshipmen. Today, we have nearly 250 projects representing math, science, engineering, humanities, and the social sciences.

In the morning, seniors will present projects in parallel sessions throughout Rickover, Michelson, Chauvenet, Nimitz, and Sampson Halls. You are encouraged to browse the program and to move from room to room according to your interest. In the afternoon, the same students will reconvene for a poster session in Alumni Hall. I encourage you to take time to engage students in discussions about their work, and please make sure to congratulate them on their impressive accomplishments in the short time that is their senior year.

I thank you for coming to the Naval Academy and hope you enjoy the day!

Dr. Andrew T. Phillips
Academic Dean and Provost

Schedule of Events

0730 – 0830	Registration/Welcome	Alumni Hall
0830 - 0840	Academic Dean's Opening Remarks	Alumni Hall
0855 – 1145	Capstone Presentations	Rickover, Chauvenet, Michelson, Sampson, Nimitz Halls
1200 – 1300	Buffet Luncheon	Alumni Hall
1300 – 1315	Superintendent's Remarks	Alumni Hall
1330 – 1530	Poster Session	Alumni Hall

Shuttle Bus Schedule

0730 – 0900	Continuous Two-way shuttle, between Stadium and USNA
0930 – 1330	Stadium → USNA (on the half hour)
1000 – 1330	USNA → Stadium (on the hour)
1400 – 1600	Continuous Two-way shuttle, between USNA and Stadium

Note: All shuttles will pick up and drop off at the front entrance to Alumni Hall. (See page 4 for location on map)

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- **Mathematics & Sciences** 25-31
- **Humanities & Social Sciences** 31-32

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Alumni Hall Poster Map 43

Academic Major Codes

USNA Capstone Day 2018 represents the culmination of student's efforts in all three Academic Divisions and can be broken down into the following major efforts. Over 290 posters will be on display during the poster session and over 170 project presentations will be given. The following major codes are used in schedules and project descriptions throughout the brochure:

E&W: Division of Engineering and Weapons

EAS:	**Aerospace Engineering (Aero)**
EASA:	**Aerospace Engineering (Astro)**
ECE:	**Computer Engineering**
EEE:	**Electrical Engineering**
EGE:	**General Engineering**
ENR:	**Nuclear Engineering**
EME:	**Mechanical Engineering**
ENM:	**Naval Architecture & Marine Engineering**
ENA:	**Naval Engineering***
EOE:	**Ocean Engineering**
ESE:	**Systems Engineering***
WSE:	**Weapons & Systems Engineering**

M&S: Division of Mathematics and Science

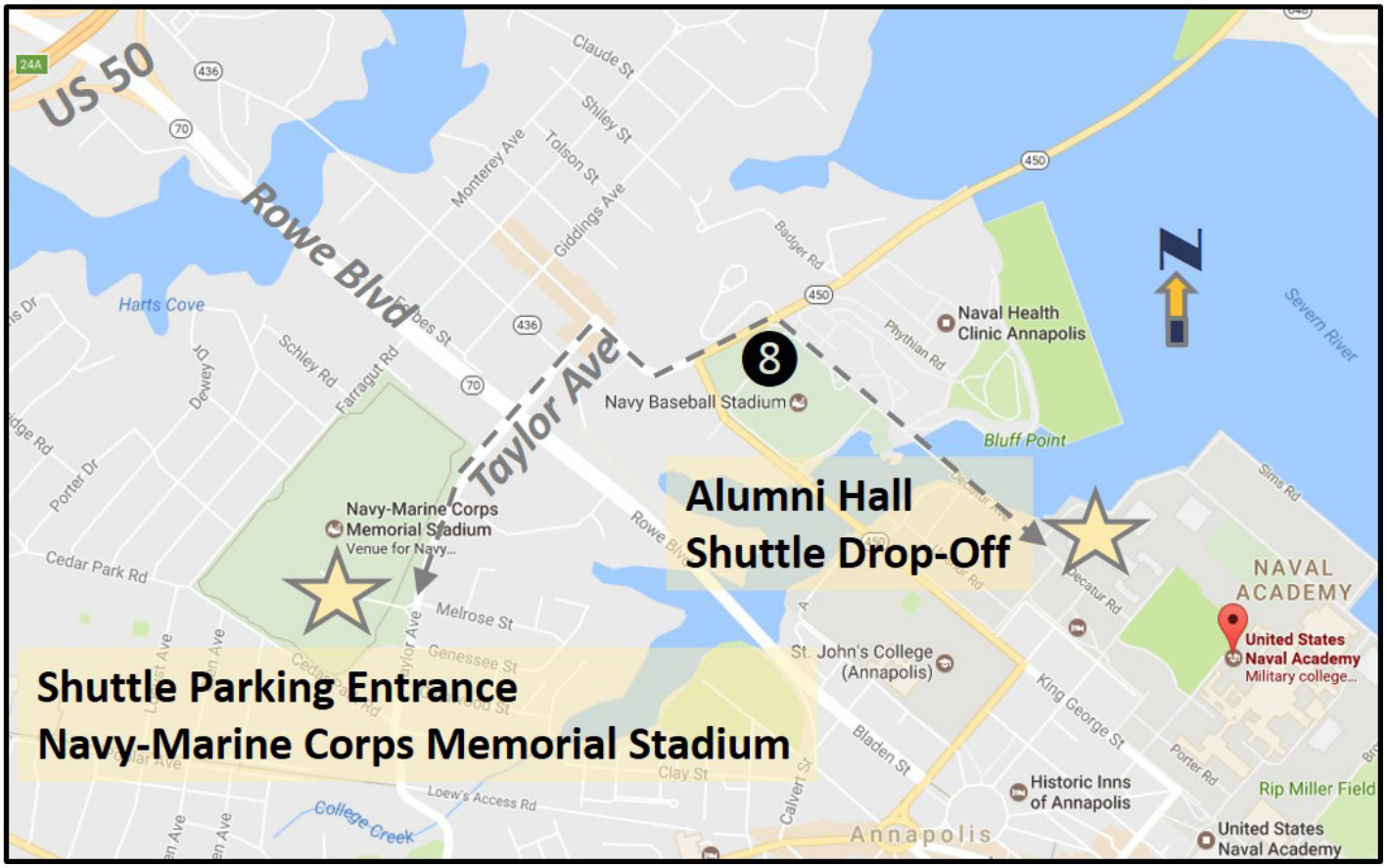
SCH:	**Chemistry**
SCS:	**Computer Science**
SCY:	**Cyber Operations**
SGS:	**General Science**
SIT:	**Information Technology**
SMA:	**Mathematics***
SMO:	**Operations Research**
SMP:	**Applied Mathematics***
SOC:	**Oceanography***
SPA:	**Applied Physics**
SPAA:	**Astrophysics**
SPH:	**Physics**
SQE:	**Quantitative Economics**

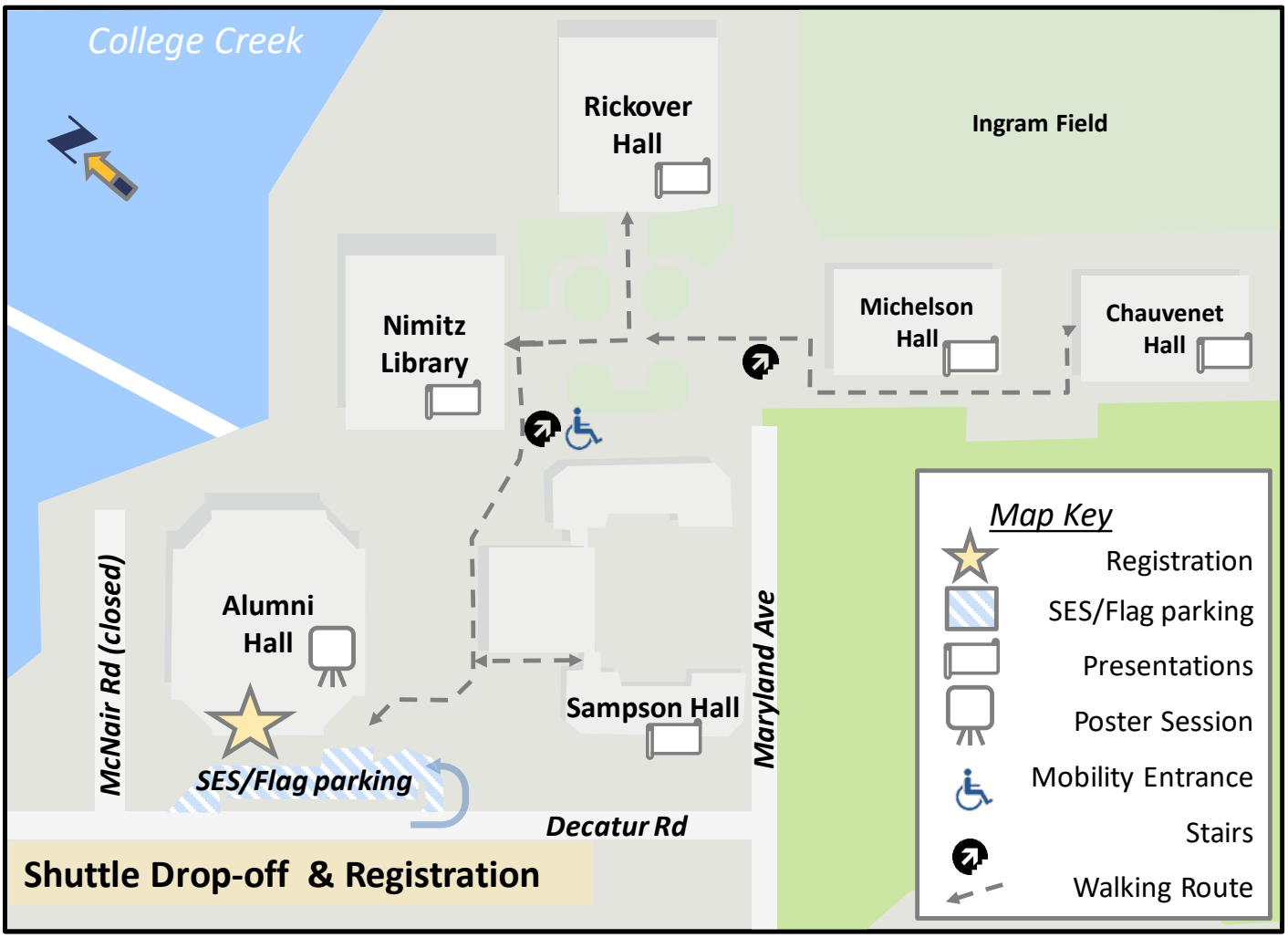
HUM/SS: Division of Humanities & Social Sciences

FQE:	**Economics***
HEG:	**English***
HHS:	**History***
FLA:	**Arabic**
FLC:	**Chinese**
FPS:	**Political Science***

* denotes Honors program available for the major. Honors students are indicated with an "H" following their respective major code.



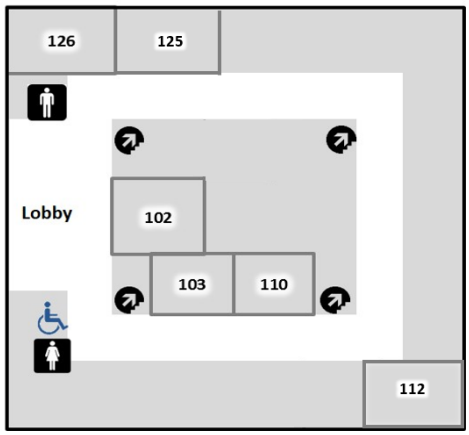

US 50
Rowe Blvd
Taylor Ave
Navy Baseball Stadium
Naval Health Clinic Annapolis
Alumni Hall
Shuttle Drop-Off
Navy-Marine Corps Memorial Stadium
Venue for Navy...
Shuttle Parking Entrance
Navy-Marine Corps Memorial Stadium
St. John's College (Annapolis)
NAVAL ACADEMY
United States Naval Academy
Military college...
Historic Inns of Annapolis
Annapolis
Bluff Point
Harts Cove
College Creek
Severn River
Rip Miller Field


College Creek
Rickover Hall
Ingram Field
Nimitz Library
Michelson Hall
Chauvenet Hall
Alumni Hall
Sampson Hall
McNair Rd (closed)
Maryland Ave
SES/Flag parking
Decatur Rd
Shuttle Drop-off & Registration
Map Key
Registration
SES/Flag parking
Presentations
Poster Session
Mobility Entrance
Stairs
Walking Route

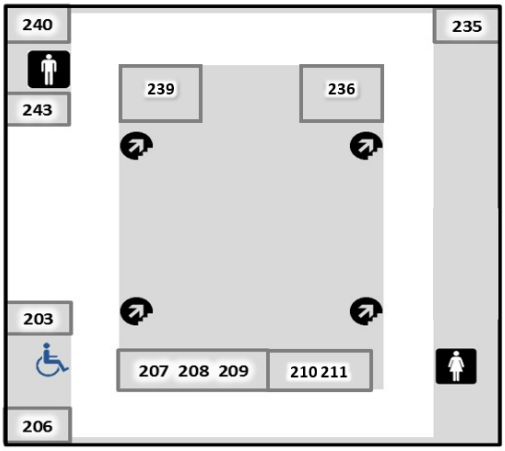
Rickover Hall

Morning Presentations (0855 - 1145)

Rickover 1st Deck



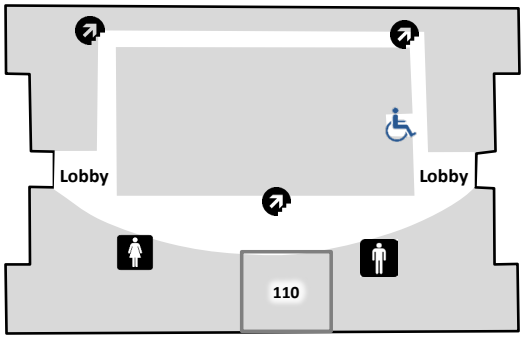
Rickover 2nd Deck



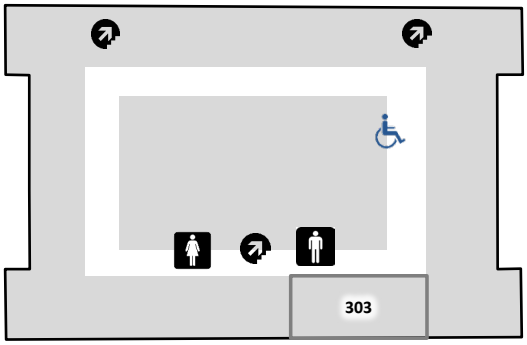
Michelson Hall

Morning Presentations (0855 - 1145)

Michelson 1st Deck



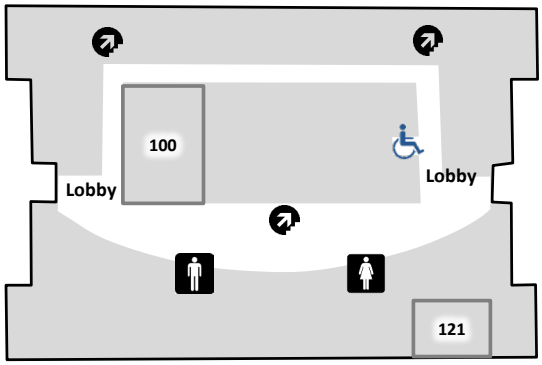
Michelson 3rd Deck



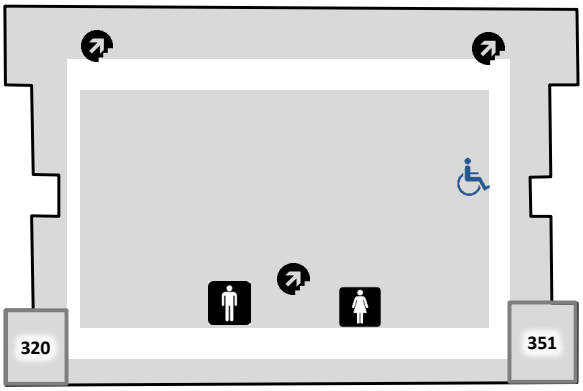
Chauvenet Hall

Morning Presentations (0755 - 1145)

Chauvenet 1st Deck



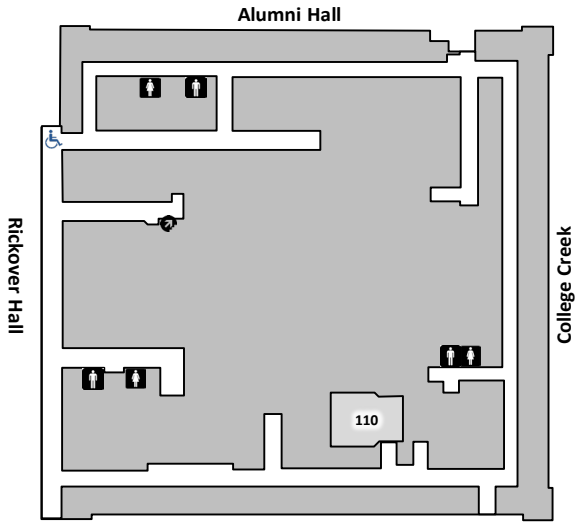
Chauvenet 3rd Deck



Nimitz Hall

Morning Presentations (0855 - 1145)

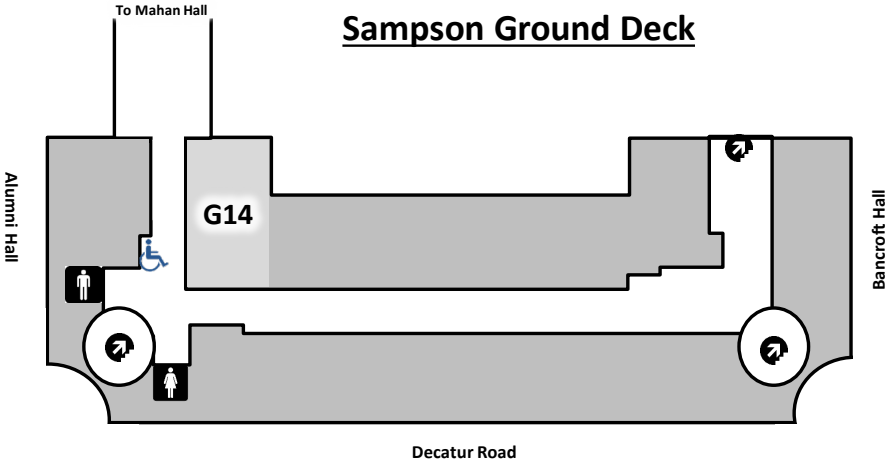
Nimitz Hall Ground Deck



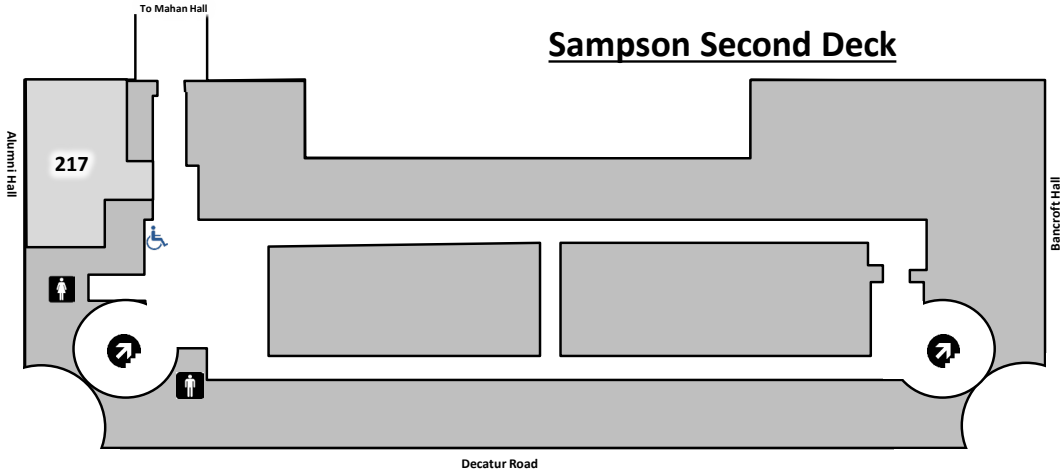
Sampson Hall

Morning Presentations (0900 - 1145)

Sampson Ground Deck



Sampson Second Deck



Rickover Presentation Schedule - Morning 0855 - 1145

	AERO	ASTRO	MECHE/ NUCE	SAE Project	MECHE/ NAOE	NUCE	NAOE	NAOE	NAOE
Room	Ri-102	Ri-112	Ri-110	Ri-203	Ri-206	Ri-235	Ri-103	Ri-125	Ri-126
0855	Navy Rockets NASA Student Launch Competition		Neutron Source Strength Calibration System (Bucket Boys)	SAE: Leadership	Dynamic Submarine Model	Joint Effort – Radiological Protection for a Martian Explorer	Heavy Ice-Breaker Team	Tsunami Stoppers	Help for Haiti via Aquaculture
0925	SQUID Sea Search VTOL UAS	USNA CubeSat: PSAT-1U Design and Lab Application	Neutron Source Strength Calibration System (NCAA)	SAE: Vehicle Dynamics	Travel Surfboard (Hang 5)	M.A.R.S. – Radiological Protection for a Martian Explorer	Arctic Expedition Sailing Yacht	Rapidly Deployable Expeditionary Breakwater System	Haitian Aquaculture System
0955	NARWHAL Artic Crevasse Detection UAS	USNA CubeSat: TugSat (USNA-18)	Retrofit All-Terrain Vehicle to Reduce Noise for Improved Stealth (Blindside)	SAE: Frame	Quadcopter Capsule for Release from a UUV	Optimization on Reactor Shielding for Spacecraft	R/V James Cameron, NOAA Research Vessel	Living Shoreline Solution for Hwy 98, Apalachicola, FL	Mussel Farming within Boundaries of the MMPA
1025	SPI-BIRD Field-Repairable UAS	Navy Satellite Tracking and Roaming (NSTAR) Mobile Ground Station	AFRL 2018 University Design Challenge	SAE: Powertrain	Underwater Robotic Arm for Inspection and Maintenance of Naval Vessels	Deployable Small Modular Reactor (Nuclear Option)	Paddlewheel Riverboat	Improving Coastal Facilities at Discovery Bay Marine Lab	Model Surfboard Test Facility and Wave Demo
1055	ARAGOG Gyrocopter Payload Delivery UAS	NSTAR Mobile User Application	Corrosion Identification and Characterization Robot Competition	SAE: Systems	Additive Manufacturing of Shipboard Components (PL-ABLE)	Persistent Monitoring of Nuclear Waste	Wynter Coastal Container Ship	Offshore Wind Farm Design	Ventura Artificial Submerged Reef
1125			Autonomous Military Vehicle Conversion Kit (Free Wheelin)	SAE: Aerodynamics	Travel Surfboard (TSA)	Nuclear Plant to Power a Direct Air Carbon Capture Facility	APEX, Coastal Defense Submarine	*Ocean Engineering Capstone Project Review w/ Evaluation Panel*	*Ocean Engineering Capstone Project Review w/ Evaluation Panel*

Rickover Presentation Schedule - Morning 0855 - 1145

	MECHE WSE	WSE	WSE	WSE	WSE	WSE	ECE	ECE	ECE
Room	Ri-207	Ri-208	Ri-209	Ri-210	Ri-211	Ri-236	Ri-239	Ri-240	Ri-243
0855	Adaptive Technology Lifting Device for a Disabled Patient – Rick-Over-Haul	Capability Based Swarming of ASVs with Vehicle Dynamics	Matrix Completion with LiDAR	Student Unmanned Aerial Systems	Autonomous Control of Monocopter	Drone Identification and Tracking	Rapid Detection and Localization of High Energy Laser Strike Using the Electrical Response of Carbon-Nanotube Sheet as a Sensor	IED Triggering Device	Analysis of Orbital Angular Momentum
0925	Exercise Tricycle for Person with Special Needs (Design for Desmond)	Rifle Accuracy Degradation	Bio-Inspired Gliding/ Walking Robot	Autonomous Landing of a Fixed Winged Aircraft on a Moving Platform Using Optic Flow Sensing	Distributed System for Drone Swarm Control	Replacing Lookouts with Computer Vision	Calibration and Testing of Distributed Fiber Optic Sensors	Swarm Target Defense Lab	LiFi – Next Generation WiFi
0955	Low Cost Residential Power System for Ile-a-Vache, Haiti	Robot Football I	Assessment of Open-Loop Characteristics of Various Fiber-Reinforced Actuators	Optical Flow in Determining Obstacle Avoidance and Path Identification	iPhone-based Autopilot	Acoustic Localization of UAVs	Automatic Fire Classification Using the Visual and IR Spectrum	The Valets: USNA Smart Parking System	Biomimetic Microbots
1025	Sustainable Farm Power for Ile-a-Vache, Haiti	Robot Football II	Simulation of Muscle Co-contraction Guided by Feedback	Exploration of the Effects of Multiple Wavelength Laser Beams Propagating Underwater	Android-based Autopilot	Boeing Tri-Service Academy Counter UAS Competition: "Britomartis"	Instrumented Sports Helmet		Semi-conductor Deterioration and Characterization of Laser Radiation Damage
1055	Improved Cinderblock Press for Ile-a-Vache, Haiti	Automated Early Detection of Lung Cancer	Ulnar Collateral Ligament Robotic Rehabilitation	RHIB Drop in Autonomy Kit	Flexible Shape-Adapting Autonomous Underwater Vehicle	Project MidKnight Drone Denial System	Enabling Wireless Communication and Object Tracking in a Multi-Agent Swarm		
1125	Smart-Energy Control System	Automatic Film Developer	Diabetic Treatment of a Virtual Patient	Sailboat Ship Control Systems	Intelligent Chaff	Persistent Target Detection and Tracking by an Autonomous Swarm			

Chauvenet Presentation Schedule - Morning 0755 - 1355

	Applied Mathematics	Operations Research	Operations Research, Cyber, Applied Mathematics	Physics
Room	Ch-121	Ch-320	Ch-351	Ch-100
0755	Manufacturing in an Uncertain Environment (SMP)		0755-0810 Predicting the Performance of the Naval Academy Women's Basketball Team 0810-0825 An Integer Programming Based Approach to Final Exam Scheduling at USNA 0825-0840 Daily Flight Schedule Optimization for the Powered Flight Program	
0820				
0855	Terrorist Operations in the Information Environment (SMO)	The Mission is Munitions: Analysis of Munitions Assembly Operations at Navy Munitions Command Mayport (SMO)	Vulnerability Assessment on Navigation Information System (SCY)	Infrared Microlensing Analysis of the Gravitationally Lensed Quasar Q0957+561 Investigation of Copper's Unoccupied Bands Experiments in Nonlinear Acoustic Landmine Detection Thermal Conductivity of Novel Dielectric Materials Analysis of Modeling of Electron-Phonon Coupling Using Time Domain Thermoreflectance Measurements Determining the Mass of Stars in Binary Systems The Ion-Trapping Property of Graphene and Use of Hybrid Cells in Liquid Crystal Displays
0920	Ocean Deployment of Radio Repeater Balloon Network (SMO)		Network Vulnerability Map (SCY)	
0955	Operation Unified Assistance (SMO)		How to Search for Your Parked Car (SMP)	
1020	HOSUB Applications for Integrated Swimmer-UUV Technologies (SMO)		Uncertainty in an Arms Race (SMP)	
1055	UAV Perimeter Patrol (SMO)	USMC Reserves Incentive Program Data Analysis (SMO)	1055-1110: Predicting Food Demand in King Hall 1110-1125: Improving Laundry Delivery Operations at the Naval Academy 1125-1140: Optimizing Shell Collection Routes for the Oyster Recovery Partnership	
1120	Analyzing Efficient Use of Resources (SMP)	Project NEXT: Experimental Matching through Stable Allocation (SMO)		

Michelson Presentation Schedule - Morning 0855 - 1200

	Chemistry								Computer Science
Room	After short presentations in MI-110 at 0855, 0955, and 1055, presenters will move to smaller breakout rooms.								Mi-303
0855	Microwave-assisted Copper-catalyzed Amidation of Aryl Halides via Concurrent Tendem Catalysis	Using In Vitro Selection to Change the Ligand Specificity of a Riboswitch from Guanine to Hypoxanthine	Quantifying the Impact of the Addition of Low Cetane Compounds on the Properties of Jet Fuel	Synthesis of Chlorfumaron Itrile: A Di-cyanocetylene Equivalent Useful for Tetra-azaporphyrin Synthesis	Crystallo-graphic Studies of Staphylococcal Nuclease Bariants with Internal Polar Substitutions	Determining the Effect of Surfaces on Islet Amyloid Polypeptide and Prion Peptide Aggregation	Developing an Isolation Strategy for New Antibiotics		
0955	Electrochemical Studies of L-Histidine Interactions	Analysis of Inks using Capillary Electrophoresis and Direct Analysis Mass Spectrometry Techniques	Quantifying the Properties of Hydrocarbon Mixtures Containing Compounds with Low Cetane Numbers to Assess Their Impact on Diesel Combustion	Developing an Isolation Strategy for New Antibiotics	The Synthesis and Characterization of Historical Pigments	Effects of Red Oak Foliar Tannins on the Growth, Mortality and Development of Gypsy Moth Larvae	Red Oak Foliar Tannins, Separation and Identification	Synthesis and Superlattice Films of Semi-conducting Nanocrystals	
1055	Novel Metal-Organic Frameworks (MOFs) for the Destruction of Chemical Warfare Agents	Synthesis and Superlattice Films of Semiconducting Nanocrystals	HIV-1 RNA-Protein Interactions	Determination of Heavy Metal Uptake in Agar-Grown Plants by X-Ray Fluorescence (XRF)	Effects of Red Oak Foliar Tannins on the Growth, Mortality and Development of Gypsy Moth Larvae	Analysis of Inks using Capillary Electrophoresis and Direct Analysis Mass Spectrometry Techniques	Structural Characterization of Endotoxin from Psychrophiles	Analysis of Lipstick using Micellar Electrokinetic Capillary Chromatography	Phone Number Extraction to Prevent Human Sex Trafficking
1120									Human Cognition In Attacking Privacy Zones-Strava

Sampson Morning Presentation Schedule - Morning 0855 - 1145

	English		
Room	Sa-217	Students will participate in a panel discussion moderated by faculty.	
0900	Phallic Whimsy: The Veneration of Masculine Identity in Wes Anderson's Early Films	Journey to the West in Contemporary Media	
1015	*Jacob Gorres*	This session will be a group discussion with students in a capstone English course about blackface, yellowface, and redface in American literature and culture. From noble savage narratives in the eighteenth and early-nineteenth centuries, to "Uncle Tom" characters in the late-nineteenth and early-twentieth centuries, to "model minority" stories in the twentieth and twenty-first centuries, white-authored depictions of stereotyped minority characters haunt the American literary canon. Each student has an end-of-term project that identifies and analyzes blackface, yellowface, or redface in a novel, film, play, or in media culture; that engages with major theoretical interventions about race and ethnicity in America; that suggests a legacy of these practices in contemporary American culture; and that, ultimately, proposes "solutions" to the problem of these depictions.	
1025	*Noah Pounds*		
1035	*Cory Provence*		
1045	*Ryan Santos*		
1055	*Wesley Stewart*		
1105	*Daniel Stitt*		
1115	*Miguel LaPorte*		
1125	*Michael Martin*		
1135	*Yennifer Posada*		
1145	*Natalie Wender*		

	History		
Room	Sa-G14	Students will participate in a panel discussion moderated by faculty.	
0900	Plebe Summer Never Ends: The Origins of Summer Indoctrination at the United States Naval Academy	Force in the Far East: Royal Navy Gunboat Operations on the China Station, 1860-1870	'The Subject of So Much Importance:' The Freedman's Bureau's Education Mission in South Carolina, 1865-1870

Nimitz Morning Presentation Schedule - Morning 0855 - 1145

	Political Science				
Room	Ni-G110	Students will participate in a panel discussion based on research concentration.			
0855	**American Government**	Pressing Matters: A Rhetorical Analysis of Presidential News Conferences During Periods of War	Morally Opposed: Evidence for Differing Conservative and Liberal Moral Considerations	Less Separate, Still Unequal: Persisting Racial Disparity in Schools, the Power Structure that Allows It, and How Redistricting Fails to Fix It	
0955	**Comparative Politics**	Huntington and Hybrid Democracy: The Absence of Third Wave Democratization Factors as Forces for Illiberal Democracy	The Lying Game: An Analytic Comparison of Authoritarian vs. Democratic Strategic Communication	Disaster and Democracy: A Look into Natural Disasters' Impact on Democratization	
1055	**International Relations**	The Most Interesting of Alliances: Why does the U.S.-Saudi Arabian Alliance Exist?	The United States' Influence in Shaping Iran's Decision to Develop a Nuclear Weapon	Colonial Exploitation: A Paired Cases Analysis of Extractive and Inclusive Institutions Triggered by Resources	Preventing Nuclear Proliferation by Human Capital: Systemic Public Policy Analysis

Trident Scholars

Since 1963, the Trident Scholar Program has provided an opportunity for a select group of midshipmen to engage in intensive research or scholarly activities during their 1/C year. Each scholar devotes 9-12 credit hours to their research project and are guided by Naval Academy faculty mentors. Research posters are on display in the lobby of Alumni Hall.

Evaluation of Non-Oxide Fuel for Fission-based Nuclear Reactors on Spacecraft

Dakota Allen (ENR)

The purpose of this project is to research uranium based non-oxide fuels for use in a nuclear reactor intended for space. This project will evaluate the reactor's criticality and power over a 15 year lifetime. This is done using MCNP and measuring the change in neutron population within the core to test its stability. The reactor will also be tested at 100, 150, and 200% power, determined by how the reactor will be affected by thermal expansion to test if it can survive changes of temperature.

Assessment of Genomic Screening in Large, Asymptomatic Populations with Applications to the Military

Joseph Brough (SCH)

To determine the feasibility of genetic screening in the military to identify possible genetic diseases through the use of large genomic databases, models that relate genetic information to disease, cost-benefit analyses, and assessing current attitudes towards genetic screening in the military.

Human Aided Reinforcement Learning in Complex Environments

Carter Burn (SCS)

With the increased desire for machines to autonomously accomplish tasks, reinforcement learning algorithms have become very popular in order to solve tasks through a trial-and-error process. To aide in the process of learning, and to learn the task quicker and correctly, a human expert can be added to the system to guide an agent in solving the task. This project seeks to employ a human expert to assist an agent in learning a better solution to a task at a faster rate.

Experimental Transient Gust Response of a Representative Ship Airwake

Chris Cantillo (EAS)

This research aimed to analyze the effects of transient wind gusts on shipboard flight operations using a Particle Image Velocimetry suite in a Closed-Circuit wind tunnel. A programmable linear actuator was used to simulate a measurable gust and turbulence patters were compared with existing research in the field for a Standard Frigate Shape 2 representative model.

Exploring the propagation of MJO through the Maritime Continent

Casey Densmore (SOCH)

The Madden-Julian Oscillation (MJO) is a circulation of zonal winds and convective (thunderstorm) anomalies that propagates eastward around the equator every 30-60 days. While passing from Indonesia to the Phillipines (the Maritime Continent), MJO predictability is significantly inhibited. This Trident project categorized successful and unsuccessful MJO events from 1980-2015, and contrasted background atmospheric conditions and modes of interannual variability for each of these cases.

Magnetotransport Properties of Shallow Quantum Well Structures for Spintronic Applications

Benjamin Dunphy (SPH)

This project studies the various semiconducting and spin-orbit of heterostructures developed at NRL. These results will be used to evaluate these structures for use in a Spin Field Effect Transistor.

Persistent Target Detection and Tracking by an Autonomous Swarm

John Gainer (WSE)

This project uses tools from multi-agent control theory and nonlinear estimation to detect and track multiple targets in a bounded area search environment with a group of limited endurance autonomous vehicles. The proposed work will extend existing solutions for persistent multivehicle operations by 1) creating search paths for autonomous vehicles with limited endurance, 2) accounting for recharge requirements, and 3) developing a decision making model to coordinate and assign operational modes.

A Microlensing Analysis of the Central Engine in the Lensed Quasar WFI J2033-4723

Gregory Hyer (SPH)

We have analyzed the microlensing variability in the lightcurves of the gravitationally lensed quasar WFI J2033-4723 to measure the size of its continuum source using optical monitoring data from the SMARTS and EULER telescopes.

Stability of Nonlinear Swarms, on Flat and Curved Surfaces

Carl Kolon (SMAH)

Swarms of idealized agents have been studied, both in attempts to understand natural phenomena and as a method to control systems of UAVs. This Trident project examines a class of gradient models for a swarm of agents, in an attempt to prove aspects of their limit behavior and generalize the models to Riemannian manifolds.

Prediction of Regional Voting Outcomes Using Heterogeneous Collective Regression

David Liedtka (SCS & SIT)

Can exploiting links in relational data lead to greater accuracy in predicting elections as they unfold in real-time? For a set of Swiss voting data, we look at national political party recommendations, voting histories, and demographic region information and take advantage of different regression techniques to predict election outcomes. This project demonstrates the viability of using machine learning to analyze timely relational data.

Creating a Fast SMT Solver for the Theory of Real Non-Linear Constraints

Fernando Vale-Enriquez (SCS)

Satisfiability Modulo Theory (SMT) Solvers for the theory of real non-linear constraints have a wide variety of real world applications, but remain too slow for many practical uses. The aim of this project is to improve solvers for this theory by incorporating a fast but partial theory solver. We based our partial theory solver off of existing algorithms for fast satisfiability detection, which we augmented for use in the SMT framework.

Increasing Power in Navy and Marine Corps Engines with Partially Premixed Combustion

Michael Walker (EME)

Once the soot limit is reached in a conventional diesel engine, further fuel increases will not result in more engine power since both the time for combustion (engine RPM) and oxygen are limited. Partially Premixed Combustion (PPC) allows for better mixing of the air and fuel by delivering additional fuel through the air intake system, allowing for increased power opportunities. This project sought to characterize achievable power gains in several Navy engines and the AM General HMMWV engine.

Innovations to Increase the Power of State-of-the-Art Graph-Theoretic Two-Sample Statistical Tests

Michael Wallace (SMOH)

Classical two-sample statistical tests are often subject to severe shortcomings in high dimensions. With the rise of "big data", recent developments in the area of nonparametric statistics and graph-theoretic tests offer novel solutions to these types of problems. This project seeks to extend existing methods and achieve new and improved results.



Morning Presentation Project Descriptions

AERO
(Rickover Room 102)

Navy Rockets: NASA Student Launch Competition 0855

Zachary Lewis (EASA), Ryan Mariano (EASA), Jose Medina (ESE), Tyler Davidson (ESE), Mike Morales (EASA), Andrew Gomez (EASA), Rhett Nowotny (EME), Zachary Moore (EME), Sam Siprelle (EASA), Joseph Mullen (EASA), Ryan Kenyon (EASA)

Purpose: Navy Rockets is a senior design team that competes in the NASA University Student Launch. The competition will take place in April of 2018 in Huntsville, Alabama with the goal of launching a rocket to an apogee of 5280 ft AGL, performing a successful recovery, and upon landing deploy an autonomous rover from inside the rocket. Navy Rockets will also reach out to encourage the study of science and engineering through programs run by organizations such as AIAA and STEM.



SQUID Super Quick Unmanned Intelligent Design 0925

Matthew Baugh (EAS), Sean Cardenas (EAS), Daniel Dwyer (EAS), Finn Ludwig (EAS), William Olsen (EAS), Tyler Russell (EAS), Erik Sabelstrom (EAS), Lauren Trotter (EAS)

Purpose: Project is to design, build and operate an unmanned aircraft system to conduct search at in a maritime environment. The UAS is capable of vertical launch and recovery from a small ship and transition to wing-borne flight for long range. The aircraft will record imagery over a 600 square kilometer search range.

NARWHAL Arctic Crevasse Detection UAS 0955

Dillon Cooley (EAS), Philip Daniels (EAS), Nikolas Fagen (EAS), Paige Furlong (EAS), Charles Linder (EAS), Grant Robertson (EAS), Paul Vogeler (EAS), Carter Wilkerson (EAS)

Purpose: Project is to design, build and operate an unmanned aircraft system to facilitate route planning across dangerous glacial terrain in the Arctic environment. The UAS will carry a ground-penetrating radar to detect dangerous crevasses hidden below thin layers of snow and ice. Radar data is used to map ground resupply routes across glaciers. The electric aircraft utilizes carbon nanotube technology and advanced insulation to enable operation in -40 degree temperatures.

SPI-BIRD Squad Portable Immediate Basic Intelligence and Reconnaissance Drone 1025

Thaddeus Brown (EAS), Erin Evans (EAS), Marieme Gueye (EAS), Caleb Ingram (EAS), James Madigan (EAS), Christopher Monte (EAS), Juan Suarez (EAS)

Purpose: Project is to design, build and operate a low-cost field-repairable unmanned aircraft system. The primary mission of the aircraft is to provide intelligence, surveillance and reconnaissance in support of a Marine infantry squad. If damaged during operations, the aircraft can be quickly repaired using materials commonly available in the field environment. The entire UAS will cost less than $1000.

ARAGOG Small Cargo Delivery Gyrocopter UAS 1055

Christopher Cantillo (EAS), Thomas Davey (EAS), Benjamin Machen (EAS), Ryan Savitt (EAS), Grant Thornton (EAS), Abigail White (EAS)

Purpose: Project is to design and build an unmanned aircraft system (UAS) that explores the potential of gyrocopter technology to improve UAS ship to shore payload delivery capability. The electric-powered aircraft utilizes a rotary-wing in autorotation to facilitate very slow flight and confined area landings.

ASTRO
(Rickover Room 112)

USNA CubeSat: PSAT-1U Design and Lab Application 0925

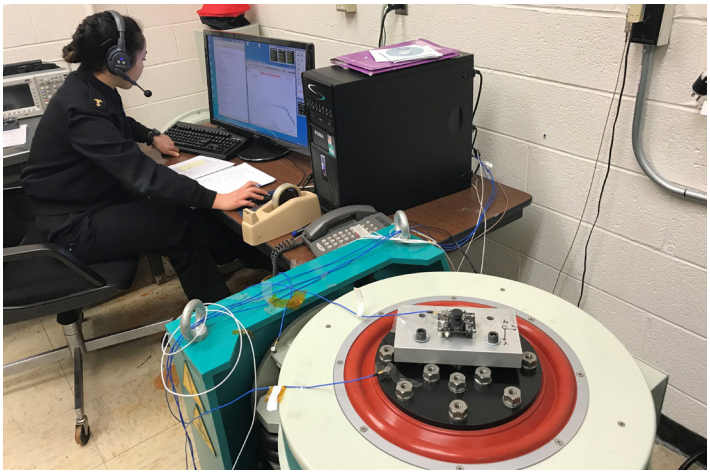
Christopher Johnson (EASA), Jonathan Meier (EASA), Andrew Chen (EASA)

Purpose: PSAT1U is a 1U CubeSat educational satellite built to expand on the launch opportunities and mission capabilities of previous Midshipmen-built 1.5U satellites. The design will reduce total cost through innovative engineering solutions without sacrificing overall performance and capabilities. PSAT1U will provide an engineering model for future Midshipman use as well as a standard design to be replicated by other academic institutions and their various payloads.

TugSat (USNA-18) 0955

Nicholas Bakulinski (EASA), Eryn Culton (EASA), Flor Landi (EASA), Cody Hyland (EASA), Aidan Switzer (EASA), Adrienne Wang (EASA), Matt Scoggins (EASA), Andrew Maus (ESE), Dylan Jensen (ECE)

Purpose: TugSat is a small satellite project which will demonstrate docking between two 3U CubeSat class satellites while in orbit. This satellite will utilize electric propulsion and an extendable boom to demonstrate necessary technologies and capabilities required to provide on orbit tethering and maneuvering in future USNA satellite missions. This satellite also utilizes computer vision to generate vectors required for docking operations.



Navy Satellite Tracking and Roaming Ground Station 1025

Rob Thyberg (EASA), Gunnar Hough (EASA), K Parriott (EASA), Mac Glassford (EASA), Dan Fulton (EASA), Ben Hynes (EASA)

Purpose: Team N*STAR is designing, configuring, and building a for the USNA Aerospace Department to replace the existing satellite ground station in Rickover Hall. The mobile command center will be outfitted with the capability to communicate with and command USNA satellites over amateur and Federal frequencies independent from external power and networks.



NSTAR Mobile User Application 1055

Edward Decker (SCS), Daniel Lloyd (SCS)

Purpose: The purpose of this project is to build a mobile application for the NSTAR Ground Station to serve as an alert system and platform for telemetry access. The application will serve to provide individualized user access with custom telemetry limits, notification settings and the ability to view different day's telemetry. NSTAR Mobile will run on the Android operating system and be developed in Android Studio.

MECHE/NUCE
(Rickover Room 110)

Neutron Source Strength Calibration System 0855

Cameron Allen (ENR), William Gomperts (ENR), Andrew Grothmann (ENR), Brian Tobie (ENR)

Purpose: The objective of this project is to design and build an inexpensive, accurate detection system to measure the strength of sealed neutron sources. The end goals of the project are to create detailed plans and bill of materials for a full-scale prototype of the system, Monte Carlo Neutral Particle (MCNP) code to simulate expected results for each neutron source type, and experimental results for proof-of-concept and model validation.



Neutron Source Strength Characterization System 0925

Adrienne Easter (ENR), Jennifer Hedgecoth (ENR), Eunbi Rha (ENR), Kristine Rojo (ENR)

Purpose: The objective of this project is to design and build an inexpensive, accurate detection system to measure the strength of sealed neutron sources. The end goals of the project are to create detailed plans and bill of materials for a full-scale prototype of the system, Monte Carlo Neutral Particle (MCNP) code to simulate expected results for each neutron source type, and experimental results for proof-of-concept and model validation.



Polaris MRZR-D4 Sound Mitigation **0955**

Rayce Blair (EME), Gabriel Collison (EME),
Garrett Southerland (EME), Robert Monroe (EGE),
Daniel Lindauer (EME)

Purpose: The Polaris MRZR-D4 is a modular light all-terrain vehicle used by Navy Special Warfare operators. The MRZR must meet very different specifications to be used in military operations. The MRZR-D4 is too loud for stealth operations. The operators would like modifications to be made to the vehicle that would render the MRZR quieter, and make the vehicle harder to detect aurally.



AFRL Design Challenge: Deorbiting Space Debris **1025**

Matthew Hundt (EME), Margaret Ruud (EME),
Thomas Imhoff (EME), Stefano Pineda (EME), Patrick Riley (EME)

Purpose: The AFRL Design Challenge tasked groups with designing a device capable of deorbiting space debris. Various teams compete at the Army National Guard Training Site on Arnold AFB, TN. Simulated orbital debris is placed within range of the devices, and the teams must use their devices to attach to the debris and deploy a flag representative of a large drag device. This challenge is intended to help develop new ideas to combat increasing pollution in low earth orbit.



Corrosion Identification and Chracterization Robot **1055**

Mathew Crispell (EME), Cameron Duffy (EME),
Brian Long (EME), Samuel Valley (EME), Patrick Moore (EME),
Zoe Sobeck (ESE)

Purpose: Design and build an unmanned system capable of maneuvering within an enclosed structure and locating, identifying, and mapping corroded areas and other corrosion related damage sites within the structure for the NACE University Student Design and Applied Solutions Competition.

Autonomous Vehicle Conversion Kit **1125**

Hank Forsythe (EME), Sean Kelly (EME), Chris Palladino (EME),
Jackson Cotney (ESE), Michael Crandell (ESE),
Austin Hague (ESE), Chad Lewellyn (ESE),
Marina Muenster (ESE)

Purpose: Development of a man-portable system which enables the conversion of a wide-variety of vehicles to autonomous operation.

SAE PROJECT
(Rickover Room 203)

Formula SAE Racecar

Ben Anderson (EME), Cory Buckwell (EME), Eli Carlson (EME),
Zach Ferraguti (WSE), Aaron Fletcher (EGE),
Patrick Forchhammer (EAS), Connor Harris (EAS),
Austin Krusz (EME), Ryan Limjoco (WSE), Charles Lohmann (EAS),
Ben Longacre (EGE), Christian Martin (EME),
Kelli McQuiston (WSE), Nate Tran (EME), Michael Walker (EME),
Dalton Wolfe (WSE), Thomas Lai (EME)

Purpose: Build a race car. In this project, students from several majors design, build, test and race a high performance racecar. Highlights include program management, vehicle dynamics, advanced materials processing, aerodynamics, systems engineering and principles of propulsion. Part of The Society of Automotive Engineers' intercollegiate competition featuring student-designed and built open-wheeled racecars from 130 universities around the world.

MECHE/NAOE
(Rickover Room 206)

Dynamic Submarine Model **0855**

Harrison Yosten (EME), Josh Laflam (EME),
Kyle Mathes-Orr (EME), Michael Palaski (EME),
Channing Martin (EME)

Purpose: NAVSEA is interested in further characterizing the dynamic behavior of a submarine during an emergency main ballast tank (EMBT) blow. The capability to perform small scale experiments for EMBT blow maneuvers is not currently in the Navy's portfolio and there is interest in gathering additional data to improve simulations and current fleet guidance.

Travel Surfboard - Hang 5 **0925**

Alan Rogers (EOE), Bennitt Hermsen (EOE), Samuel Ledesma (EOE), Matthew Ledger (EOE), Patrick Long (EOE)

Purpose: Design and build a travel surfboard that is capable of fitting inside luggage which can be checked on all major airlines, without oversized baggage fees, and that provides surfing performance comparable to a traditional board.

Quadcopter Capsule for Release from a UUV - The Dirty Boyz **0955**

Gerard Mirville (EGE), Jacob Crippes (EOE), Thomas Lambert (EOE), Matthew Majors (EGE)

Purpose: Design, build, and test a capsule that can be carried and released underwater by a UUV and that travels on its own to the surface. The capsule must carry a waterproof quadcopter, open automatically once it reaches the surface, and be stable enough to release the quadcopter in sea state 3. The project must be completed by April 2018 within a budget of $2,000.

Underwater Robotic Arm for Inspection and Maintenance of Naval Vessels **1025**

Quinnton Marshall (EOE), Gregory McKnight (EOE), Christina Roberts (EOE), Samuel Shaunak (EME), Shaun Shiotani (ESE), Elliott Speirs (EOE)

Purpose: Design and build a prototype of a 4+ DOF robotic payload delivery arm to augment existing and future capability needs of Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility.

Additive Manufacturing: 3D Printing of Shipboard Components **1055**

Evan Akins (EME), Justin Artis (EME), Sam Haber (EME), Joe Reed (EME)

Purpose: The Navy maintains a strategic interest in the integrity and availability its shipboard components. The objective of PL-Able's design project is to demonstrate the ability to successfully reverse engineer a ball valve, a complex and dynamic shipboard component prone to failure, and reprint it using polymeric additive manufacturing techniques. The design will also include additional considerations that would allow the valve to be printed in metal using powder bed fusion additive manufacturing.



Travel Surfboard - The TSA (Travel Sufboard Association) **1125**

Ryan Kierce (EOE), Emma Chesire (EME), Aaron Fowler (EME), Eric Garmoe (EOE), Mark Glaeser (EME)

Purpose: Design and build a travel surfboard that is capable of fitting inside luggage which can be checked on all major airlines, without oversized baggage fees, and that provides surfing performance comparable to a traditional board.

NUCE
(Rickover Room 235)

Joint Effort - Radiological Protection for a Martian Explorer **0855**

Dakota Allen (ENR), Duncan Brown (ENR), Quinn Dircks (ENR), Eric Hess (ENR), Zach Scholz (ENR)

Purpose: The main objective of this project is to provide radiation protection in the form of a suit to astronauts, for survival on Mars. This objective was narrowed down over the course of the project to focusing on an individual joint, which still needs the radiation protection, however cannot have excessive amounts of shielding.



Radiological Protection for a Martian Explorer - MARS **0925**

Michael Thomas (EGE), Nick Taglialavore (EME), Nick Costa (ENR), Stephen Campo (ENR), Ryan Mansfield (ENR), Josh Ten-Eyck (ENR)

Purpose: Current space suits, designed for a zero gravity environment, are extremely heavy and provide very poor maneuverability for the astronauts inside. The design of this suit must be of a material light enough and maneuverable enough for an astronaut to conduct several experiments on the surface of Mars. The goal of this project is to design and test a small square of material that would best protect a human from radiation in a Martian environment.

Optimization of Shielding for a Nuclear Powered Spacecraft **0955**

Austin Armand (EGE), David Christie (ENR), Brianna Kaufmann (ENR), James Lagos-Antonakos (ENR), Zach Schaidle (EME), Nick Stovall-Kurtz (EME)

Purpose: This project designs and optimizes radiation shielding for a nuclear powered spacecraft on a round-trip interplanetary mission to Mars. The shielding is evaluated on the basis of shielding capability per unit mass; sources of radiation include cosmic radiation and an on-board nuclear reactor for electrical power.

The Nuclear Option: Deployable Small Modular Reactor **1025**

Beau Cisneros (ENR), Paul Jackson (ENR), Matthew Sensenig (ENR), Zach Skirpan (ENR)

Purpose: The Nuclear Option presents a 10 MW small modular reactor capable of being deployed in a remote outpost or as a disaster response in under 5 days. It requires minimal set up and installation, and is operated by a small crew and is designed to run for up to 2 years.

Persistent Monitoring of Nuclear Waste **1055**

Blake Guidice (ENR), Josh Hanna (ENR), Sean Park (ENR), Jordan Richardson (ENR), Jake Fernandes (ESE)

Purpose: The objective of this project is to test a system of acoustic sensors that can be installed on dry casks that are used to store spent fuel from nuclear reactors. The purpose of the sensors are to monitor the stainless steel canister for stress corrosion cracking by passively listening for acoustic signatures associated with cracking. This project will perform physical tests with off-the-shelf acoustic sensors on samples of steel (SS316L).



Nuclear Plant to Power a Direct Air Carbon Capture Facility **1125**

Steven Hamasian (EGE), Julian Martinez (ENR), Tucker Massie (ENR), Ellis Moore (ENR)

Purpose: Climate change may be mitigated by reducing the carbon dioxide levels in the atmosphere. While many have called for reductions in man-made carbon dioxide emissions, significant challenges exist. Point-capture technology has achieved some degree of success over the past decade. The objective of this project is to create a comprehensive report for our customer, Carbon Engineering, that analyzes the viability of nuclear power as a practical energy source to power a carbon capture facility.

NAOE
(Rickover Room 103)

Polar Ice Breaker **0855**

Ryan Iverson (ENM), Jake Ruby (ENM), Peter Hodapp (ENM), Noe Lovera (ENM)

Purpose: Next generation Ice Breaker capable of year round polar operations.

Oceanographic Research Sailing Vessel (Arctic) **0925**

Theodore Papenthien (ENM), Ryan Pinch (ENM), Austin Rhodes (ENM), Patrick Rice (ENM)

Purpose: This vessel is designed to transport and remain on station for small research teams and expeditions to the arctic in the summer and fall for periods lasting up to eight weeks.

R/V James Cameron **0955**

Gabe Gaspar (ENM), Karl Flynn (ENM), Hawkeye Griffin (ENM), Kevin Freedman (ENM)

Purpose: The mission of the research vessel is to conduct sea floor mapping and other oceanographic research in the blue-water regions outside of the arctic and antarctic circles. Our team has designed a platform to fill this mission statement as well as demonstrate knowledge learned throughout our time in the major.

Mississippi River Paddle Wheel Cruise Ship **1025**

Arthur Hines (ENM) Jessica Robinson (ENM), Cori Sullivan (ENM), Camille Tiemann (ENM)

Purpose: This project is a design for a 200+ passenger river cruise ship which will transport patrons from New Orleans to Minneapolis and back. This ship will be propelled by a functioning paddle wheel and will make multiple stops along the Mississippi river such as Memphis and Saint Louis.

Wynter Cargo Ship **1055**

Thomas Monaghan (ENM), Collin Berenguer (ENM), Lynette Sivells (ENM), Robert Mannier (ENM)

Purpose: LO-RO LNG Container ship whose purpose it is to travel marine coastal highways along the eastern coast of the United States.

Submarine Design **1125**

Preston Custer (ENM), JP Morrison (ENM), Jackson Parrish (ENM), Thomas Sarant (ENM)

Purpose: The mission of the APEX Class SSN is to provide a middleweight solution to threats posed by the proliferation of advanced foreign AIP and SSN platforms.

NAOE
(Rickover Room 125)

Tsunami Stoppers **0855**

Spencer Cobb (EOE), Jordan Graff (EOE), Anna Haschert (EOE), Ajan Sahman (EOE), Michelle Tran (EOE), Zachary Vaughn (EOE)

Purpose: Design a multi-use tsunami shelter, capable of vertical evacuation, for the town of Lincoln City, Oregon.

Rapidly Deployable Expeditionary Breakwater System **0925**

Andrew Craft (EOE), John Garza (EOE), Alexander Hassen (EOE), Daniel Noh (EOE)

Purpose: Expeditionary forces are limited in ability to provide material ashore in highly developed sea. The U.S. Army Corps of Engineers wants to determine whether use of Conex boxes might make for a viable breakwater option. The goal is to develop a floating solution for up to 35' water depth, as well as a submerged solution for 12-20 feet water depth. Creating 1:20 plexiglass models, the design team has tested and evaluated several different variations of floating, submerged, and hybrid systems.

A Living Shoreline Solution for the Franklin County School Section of Highway 98 in Apalachicola, FL **0955**

Connor Bailey (EOE), Rachel Fortner (EOE), Sara Jenkins (EOEH), Sean Trent (EOE), Christine Walker (EOE)

Purpose: The project goal is to determine a feasible living shoreline alternative appropriate for implementation along Franklin County School's section of Highway 98. The proposed solution provides the beach front with an aesthetically pleasing shoreline that will mitigate erosion associated with a 50-year storm event while promoting wildlife and oyster recruitment. To effect this effort, tidal activity, storm frequency and magnitude, water level history, and native flora and fauna were investigated.

Coastal Facility Improvements at Discovery Bay Marine Lab **1025**

Alex Cowsert (EOE), Miranda Kosmides (EOEH), Liz Pittman (EOEH), Sarah Reilly (EOE), Brittany Webb-Martin (EOE)

Purpose: Improve the current coastal facilities at the University of West Indies Discovery Bay Marine Lab in Jamaica. The docks must be able to accommodate at least a 32' boat as well as withstand tropical storms and hurricanes, while taking into consideration limited funding. The team collected field survey data used to create a bathymetric chart of the lab. The deliverable is a conceptual engineering design for the construction of an improved harbor.

Offshore Wind Farm Design **1055**

Javarri Beachum (EOE), Drew Parks (EME), David Perez (EME), Jacob Wolff (EOE)

Purpose: The project goal is to design an offshore wind farm which provides 20% of the city of Myrtle Beach's residential power consumption. This long-term solution will focus on providing cost competitive electricity via renewable energy to Myrtle Beach and the surrounding area. The design effort includes selection among design alternatives, a structural analysis, power assessment and an economic evaluation.

NAOE
(Rickover Room 126)

Help for Haiti Aquaculture Farm **0855**

Jared Castillo (EME), Richard Elmore (ESE), Trent Hori (EOE), Joshua Martin (EOE)

Purpose: Help for Haiti is a capstone project focused on developing a sustainable fish farm for the people of Ile-a-Vache. The goal is to provide an extra sustainable food source for the citizens of the island capable of feeding approximately 50 families with the possibility of becoming a source of income.

Haitian Aquaculture System **0925**

Andrew Chang (EOE), Jared Downing (EME), Michelle Katz (EME), Steven Swiatek (EGE)

Purpose: Develop an economical aquaculture system for the island of Ile-a-Vache in Haiti. The system will be implemented in a littoral area of a local bay on the island in order to support feeding the local populace.



Mussel Farming within the Boundaries of the Marine Mammal Protection Act **0955**

Alexandra Hoiles (EOE), Shelby McCool (EOE), Natalie Sava (EOE), Jennifer Smith (EOE), Matthew Vandenboomen (EOE)

Purpose: The purpose of this project is to design and build a deep water longline mussel farm within the boundaries of the Marine Mammal Protection Act. The longline mussel design and anchoring system will be designed to withstand typical meteorological patterns and conditions in the Gulf of Maine, break apart upon impact of the North Atlantic Right Whale, and decrease the probability of the Right Whale's entanglement in the longline and other mussel farming equipment.

Model Surfboard Test Facility and Wave Demonstrator **1025**

John Linenger (EOE), Patrick McMahan (EOE), Matthew Mila (EOE), Margaret Phillips (EOE), Suzanne Toms (EOE)

Purpose: The purpose is to create a surfable wave by varying the bathymetry under the water. A model surfboard will be placed on the water in order to "ride" the wave.

Ventura Artificial Submerged Reef **1055**

Griffin Hinkley (EOE), Thomas Moynahan (EOE), Robert Patrician (EOE), William Rittenhouse (EOE), Nicholas Street (EOE)

Purpose: In partnership with the U.S. Army Corps of Engineers, this team aims to restore desirable beach conditions at Oil Piers Beach in Ventura, CA by implementing an artificial reef. Through the analysis of natural conditions and local wave behavior, the team designed and tested a model of the proposed reef in the USNA Coastal Laboratory. The primary purpose of the reef is to reduce beach erosion. The secondary purpose is to produce a more predictable and desirable surf climate for recreational use.

MECHE/WSE
(Rickover Room 207)

Adaptive Technology Lifting Device for a Disabled Patient - Rick Over-Haul **0855**

Jinhong Park (EME), Austin Dumas (EME), Nathan Knueven (EME), Keven Yeh (EME)

Purpose: The primary objective of this project is to design and create a mobile lift device capable of transferring a disabled patient, Desmond, from his wheelchair to his exercise bike while providing maximum comfort and safety to Desmond and ease of use to the operator. Secondary objectives include the operator of the device being able to utilize the device for all other transportation purposes involving Desmond as well. The machine will be operated from a home environment.

Design For Desmond **0925**

John Britt (EME), Jonathan Castaneda (EME), Ricardo Rosario-Hoover (ESE), Randy Sosa (ESE), Carson Taff (EME)

Purpose: To design a tricycle adapted to the needs of our client, a low-tone quadriplegic teenage. The bike will provide him with be used for therapeutic recreation and strengthening.

Low-Cost Residential-Scale Power Generation System **0955**

Andrew Bergman (EME), Hugh Ehrensbeck (EME), Andrew Julius (EME), Norbert Buba'A (EEE), Gary Watson (EEE)

Purpose: Design and build a power generation prototype from cheap locally or readily-available materials.

Sustainable Farm Power **1025**

Aidan Ball (EME), Colin Ball (EME), Francisco Figueroa (EME), Ace Padilla (EME), Nikolaus Schaeffer (EME), Kathryn Wesdyk (EME), Logan Dyer (ESE)

Purpose: Convert Resources Available from Agriculture to Cooking Fuel for a Farm on the Island of Ile-a-Vache, Haiti.

Improved Cinderblock Press for Ile-a-Vache, Haiti **1055**

Sam Davis (EME), Luke Dodds (EME), Connor McNerney (EME), Blake Stanford (EME), Taylor Yohe (EME)

Purpose: The goal of this project is to design and develop a cinderblock production device or system for the inhabitants of Ile-a-Vache, Haiti, that reduces the required labor to make bricks, improves production rate, and improves brick quality. The device must be human-powered and portable.



Smart-Energy Control System **1125**

Diana Vazquez (EEE & ECE), Thomas Stone (WSE)

Purpose: Design a smart-energy control system that senses the energy-controlled states within a given room, and determines the necessary courses of action to minimize energy costs. Energy-controlled states are measurable and physical attributes e.g. lighting and temperature, which can be manipulated using electrical power. The smart-energy control system must determine how to minimize the energy used in manipulating energy-controlled states without changing the infrastructure of the given room.

WSE
(Rickover Room 208)

Capability Based Swarming of ASVs with Vehicle Dynamics **0855**

Eric Dewitte (ESE), James Winnefeld (ESE)

Purpose: In 2015, USNA Trident Scholar Tang Gabriel developed a hybrid controller based on a novel capability concept for control of a swarm of heterogeneous USVs and UUVs for asset protection was developed. In our proposed work, we extend upon the work of Gabriel to: 1) include vehicle dynamics within the control law and 2) provide experimental verification of the proposed concept on scale vehicles.

Rifle Accuracy Degradation **0925**

Sam Butler (ESE), Matthew Crider (ESE), Joe Cacciatore (ESE), Connor Gillette (ESE), Chase Ross (ESE)

Purpose: We are studying the effects on rifle accuracy as a rifle is fired repeatedly without cleaning the barrel. The military, particularly ground forces, stress the importance of keeping a clean barrel. We are analyzing the degradation of accuracy to see if such frequent cleaning is necessary.



USNA Robot Football Team **0955**

Abbey Taylor (WSE), Casey Cowan (WSE), Dennis Riley (EME), Steven Ewald (EME), Francisco Perry (WSE), Jackson Baker (WSE), Matthew Tumelty (WSE), Nathan Tidwell (WSE), Miles Oakley (EEE)

Purpose: The USNA Robot Football Team designs, construct and competes remotely-operated and autonomous robots in the annual robotic football competition hosted by the University of Notre Dame each spring. The competition includes both 11-on-11, full-scale American football games played between teams of robots and an NFL Combine-inspired event during which robots complete feats of strength and agility for a score.

Automated Early Detection of Lung Cancer **1055**

Jack Timberlake (WSE)

Purpose: This project aims to use an artificial neural network to automatically detect lung cancer in a CT scan that is 4-8 pixels in diameter.

Automatic Film Developer **1125**

Marcelo Norcini (ESE)

Purpose: A machine that automatically develops photographic film based on input from the user on process, chemicals, and development times at appropriate chemical temperatures.

WSE
(Rickover Room 209)

Matrix Completion with LiDAR **0855**

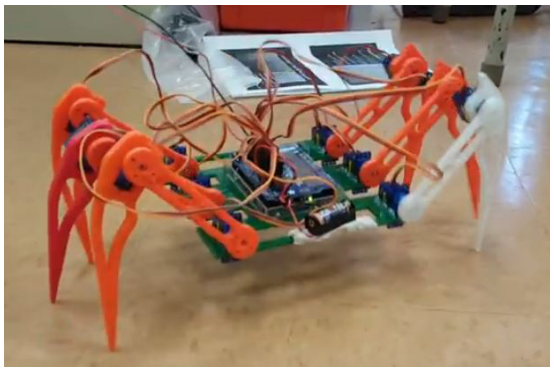
Jack McGillick (WSEH)

Purpose: My project attempts to complete occlusions from LiDAR data by applying the Robust Component Principle Analysis method of matrix completion. In theory, this matrix completion algorithm should fill in spots of missing data when applied to these matrices.

Bio-Inspired Gliding/Walking Robot **0925**

Isabelle Babb (WSE), Angela Deniega (WSE), Daniel Iskandar (WSE), Emily Peterson (WSE)

Purpose: To research animal movement, specifically that of sugar gliders and flying lizards, in order to inspire, design, and create a self-stabilizing aerial robot. This system will be capable of gliding, aerial maneuvering, navigation, and landing safely on the ground. In the future additions will be made to capabilities such as walking and heavy load carry.



Assessment of Open-Loop Characteristics of Various Fiber-Reinforced Actuators **0955**

Kevin McNeela (ESEH)

Purpose: The field of soft robotics involves flexible vs. rigid materials. This research focuses on implementation of a soft robotic fiber-reinforced actuator as a proof-of-concept thumb exoskeleton device, as well as control through a linear controller.

Simulation of Muscle Co-Contraction Guided by Feedback **1025**

Anne Fisher (ESEH)

Purpose: This research investigates a closed-loop co-contracting muscle system though simulation to theoretically provide proof of concept that closed loop control would decrease error and increase performance of Electrical Muscle Stimulation.

Ulnar Collateral Ligament Robotic Rehabilitation **1055**

Connor Linnartz (ESE), Carter Prescott (EME)

Purpose: To design and create a robotic exoskeleton brace that aids in the recovery of the strength and range of motion of patients with ulnar collateral ligament injuries. The design will implement a feedback control system utilizing sensors and actuators to assist rotational movement for physical therapy routines.

Diabetic Treatment of a Virtual Patient **1125**

Austin Schober (ESEH), Baylen Smith (ESEH)

Purpose: The goal of this project is to produce a control algorithm using Model Predictive Control to determine the amount of treatment to be applied to the patient in order to maintain healthy blood glucose levels. The patient is represented by the Cobelli model that can predict the response of a diabetic patient to the ingestion of a meal and to treatments such as insulin, sensitizing agents, secretagogues, and exercise.

WSE
(Rickover Room 210)

Student Unmanned Aerial Systems 0855

Thomas Moore (ESE), Shenandoah Daigle (ESE), John Bolton (ESE), Simeon Brewster (ESE)

Purpose: Outfitting a remote control airplane to operate autonomously and conduct image analysis in order to identify, classify and locate targets all without user input. Develop a dropping mechanism that is capable of releasing a payload(8 oz water bottle) on a designated location with the best accuracy possible.



Autonomous Landing of a Fixed Winged Aircraft on a Moving Platform Using Optic Flow Sensing 0925

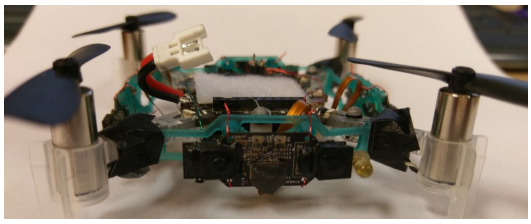
Matthew Sims (ESEH)

Purpose: We are developing a system using a camera as the main sensor that guides a fixed winged aircraft to land on a platform with the main sensor being a camera. The camera will be using optic flow sensing to keep it on the proper glide slope for approach. The main method of testing is simulation using a robot arm to model the controllers reaction to deviations from the glide path.

Optical Flow in Determining Obstacle Avoidance and Path Identification 0955

Timothy Naski (ESEH)

Purpose: Use of the Optical Flow vision system to determine obstacles and navigate throughout an environment. Use of small micro air systems which have the ability to compute and navigate within an unknown environment.



Exploration of the Effects of Multiple Wavelength Laser Beams Propagating Underwater 1025

Mike Kelly (ESEH)

Purpose: Laser beams experience distortion when propagating through turbulent media, such as water. This project seeks to explore if intensity fluctuation can be minimized through the use of a multiple wavelength beam in comparison to a normal Gaussian beam. To do this, a large test bed emulator was created to mimic certain specified underwater environments. The lasers were propagated through these environments and the change in intensity fluctuation was recorded.

RHIB Drop-In-Autonomy Kit 1055

Jack Thoene (ESE), Zack Davis (ESE), Michael Coleman (ESE), Andres Rodriguez (ESE)

Purpose: In conjunction with NAVSEA (Combatant Craft Division), create a drop-in autonomy kit for a 7m RHIB or other small motorboat of opportunity.

Sailbot Ship Control Systems 1125

Eric Stoermer (ESE), Gabe Lackey (ESE), Louise Zhou (ESE)

Purpose: This project is completing the construction and programming of a ship control system for a sailing vessel (NAOE Sailbot Hull 13) capable of sailing across the Atlantic Ocean autonomously with pre-programmed waypoints.

WSE
(Rickover Room 211)

Autonomous Control of Monocopter 0855

Parker Novakovic (ESEH)

Purpose: Project entails building a prototype Monocopter aerial vehicle capable of autonomous flight. It will be experimentally validated based off of concepts of control derived and simulated in MATLAB.

Distributed System for Drone Swarm Control 0925

Ebrahim Alteneiji (WSE), Connor Dittmar (WSE), Jesus Escudero (WSE), Charles Garcia (WSE), Feodor Orlov (WSE)

Purpose: Single drone autonomous control is a solved problem. The challenge lies in integrating multiple air platforms for cooperative behavior. This project shall demonstrate a distributed control system for drone swarms capable of flocking behaviors and navigation without individual control over any one platform.

iPhone Based Auto-Pilot 0955

James Winnefeld (ESE), Eric DeWitte (ESE)

Purpose: Using IOS application to pull core data from an iPhone to send to peripheral devices for automated control.

Android Based Autopilot 1025

Malick Ba (ESE), Taygan Grundy (ESE)

Purpose: We are coding an android application that is capable of displaying the phone's accelerator, magnetometer, GPS, speed over ground, gyroscope, and time data. It will also be capable of sending this data wirelessly to a computer. The hope that is, in the future, a team will be able to use this information in order to create a controller that is capable of remote controlling an RC water/land vehicle.

Flexible, Shape-Adapting Autonomous Underwater Vehicle 1055

Thomas Guinan (ESEH)

Purpose: This research focuses on the development of a controller for a flexible, bio-inspired, shape-adapting autonomous underwater vehicle in simulation.

Intelligent Chaff 1125

Joseph Rensvold (ESEH)

Purpose: W are developing a decentralized control law for a swarm of unmanned gliders with minimal sensing and communication ability. The swarm of gliders will be used to replace chaff, which is a radar countermeasure comprised of small strips of aluminum. The swarm of gliders will be able to stay in the air longer, maintain a more effective distribution, and propagate in a controlled direction. These capabilities will provide an order of magnitude increase in effectiveness over traditional chaff.

WSE
(Rickover Room 236)

Drone Identification and Tracking 0855

Chandler Vercher (WSE)

Purpose: This project aims to explore the most efficient and accurate methods of using classifiers and/or artificial neural networks to train a computer with an attached camera to identify a drone and track it in real time.

Replacing Lookouts with Computer Vision 0925

Michael Bush (ESE), Chris Hill (ESE)

Purpose: This project aims to isolate moving targets on the water using computer vision. The biggest challenge in this task is to stabilize the system to account for the motion of the ship the camera is on. This is done through digital stabilization as well as a system that adjusts the camera to motion using an Inertial Measurement Unit.

Acoustic Localization of UAVs 0955

Carly Donner (ESEH)

Purpose: The project aims to locate UAVs using a microphone array and time difference of arrival methods. The project also includes finding the acoustic characteristics of the tested drones and determining which characteristics can be used to identify them and distinguish them from other sounds.

Boeing Tri-Service Academy Counter UAS Competition: "Britomartis" 1025

Keely Chan (WSE), Quinn Harrison (WSE), Princeton Luong (WSE), Alex Redlon (WSE)

Purpose: Design a system capable of providing situational awareness and counter UAS capabilities sufficient to defend a small detached forward operating location assuming 2030 technology and fielding.



Project MidKnight: Drone Denial System 1055

Stephen Roberts (ESE), Gabriel Weigelt (ESE)

Purpose: Project MidKnight is a precision controlled autonomous turret system that will use an agnostic weapon mount in order to provide a kinetic defensive capability against small Unmanned Aerial Systems. A moment-matching based algorithm will receive input of the UAS' position and velocity to create a pattern of shots that allow for a high hit percentage. Project MidKnight began by simulating drone flights, bullet ballistics and shot patterns in MATLAB to demonstrate the increased probability of hit by using a moment-matching algorithm to create a pattern of shots to be fired at the UAS. Once proof of concept was attained, Project MidKnight focused on designing and implementing a mechanical trigger system to fire a stock M4A1 rifle to achieve a high precision in firing timing.



Persistent Target Detection and Tracking by an Autonomous Swarm 1125

John Gainer (WSE)

Purpose: This project uses tools from multi-agent control theory and nonlinear estimation to detect and track multiple targets in a bounded area search environment with a group of limited endurance autonomous vehicles. The proposed work will extend existing solutions for persistent multivehicle operations by 1) creating search paths for autonomous vehicles with limited endurance, 2) accounting for recharge requirements, and 3) developing a decision making model to coordinate and assign operational modes.

ECE
(Rickover Room 239)

Rapid Detection and Localization of High Energy Laser Strikes Using the Electrical Response of Carbon-Nanotube Sheet as a Sensor 0855

Andrew Sumida (EEE)

Purpose: Investigate carbon-nanotube (CNT) material as a sensor for detecting and identifying the location of a high energy radiation strike.

Calibration and Testing of Distributed Fiber Optic Sensors for Detection of High Energy Radiation **0925**

Mathew Kautzman (EEE)

Purpose: Development of technologies to detect high-energy laser (HEL) strikes on aircraft are of increasing interest due to recent advances in HEL weapons. By embedding sensors into a composite, counter-directed energy weapons (CDEW) technology can be incorporated during the aircraft manufacturing process. This research specifically focuses on the high temperature calibration and testing of embedded distributed optical fiber sensors to detect high energy radiation.

Automatic Fire Classification Using the Visual and IR Spectrum **0955**

Armando Rivera (EEE)

Purpose: This research focuses on the implementation of Neural Networks to classify different types of fire. Our end goal is to create a system that can detect, locate, and classify fires. The system uses both an IR and RGB camera in order to classify the type of fire in the image. The output of this system will display two streams of video with the fire outlined.

Instrumented Sports Helmet **1025**

Timothy Smith (EEE), Tyler Haigh (EME), Dexter McGriff (EEE), MaryKate Wetzel (WSE)

Purpose: To design and build a prototype instrumented football helmet that senses physical contact and environmental conditions for in-game health monitoring and assessment.

Enabling Wireless Communication and Object Tracking in a Multi-Agent Swarm **1055**

Adam Pressel (ECE)

Purpose: This project is intended to enable the real world validation of various pursuit control laws in a multi agent robotic network. To that end, position and orientation data from an OptiTrack motion capture system is streamed to a host client which publishes it to a network of TurtleBot mobile robots. This project is part of an ongoing effort to develop the infrastructure of the Mobile Agents & Networks (MANET) Lab to enable future research, coursework, and experimentation.

ECE
(Rickover Room 240)

IED Triggering Device **0855**

Dan Dukleth (ECE), Joshua Story (ECE), Eashwar Thenpattinam (ECE), Jaime Villalva Ligo (EEE)

Purpose: To remotely actuate a command signal using existing wireless network infrastructure maximizing the probability of successful trigger. We create three different designs to transmit and receive a 4G LTE signal in order to trigger a simulated IED device.

Swarm Target Defense Lab **0925**

Christian Montgomery (ECE)

Purpose: Build a test environment for analyzing autonomous control theories for the USNA Mobile Agent and Network Lab. This project aims at creating a robust interface for students with little programming or ROS experience to be able to orchestrate four Turtle Bots autonomously.

The Valets **0955**

Jalan Darby (ECE), Mariza Guerrero (ECE), Aaron Seals (ECE)

Purpose: Design and build a system that counts vacant parking spots for Midshipmen, faculty, and staff in a desired parking lot. The goal for the product is to help a customer go directly to a destination and cut out the traveling and surveying of fully occupied parking lots, which through testing can triple or quadruple ones travel time.

ECE
(Rickover Room 243)

Analysis of Orbital Angular Momentum Laser Beams for Applications in Underwater Communication **0855**

Joseph Brugger (EEE)

Purpose: Underwater communications present a challenge in the US Naval Undersea Community. During underwater operations, command and control requires effective communication on both a tactical (short-range) and strategic (long-range) level. One approach to address this issue would be the use of an optical beam to transmit underwater. This paper evaluates the use of an Orbital Angular Momentum (OAM) beam and their effectiveness in underwater transmissions as compared to a Gaussian beam.

LiFi - The Next Generation WiFi **0925**

Gardy Lebon (ECE), Josh Gray (ECE), Jon Boccarossa (EEE & ECE), Nate Arellano (EEE), Kendrick Nafus (EEE)

Purpose: LiFi is a high speed bidirectional alternative to WiFi data communication using the light spectrum. It has the potential to reach unprecedented speeds and will be the future of data transmission for the increasing demand in the evolving world today. Our project focus is to make a working prototype in the visible light spectrum. The final product should have a bidirectional connection to a computer with access to the internet at 10Mbps.

Biomimetic Microrobots **0955**

Benjamin Carpenter (EEE), Peter Huang (EEE)

Purpose: At the micro level, particles behave differently in fluids than on the macro scale. Bacteria have adapted methods of motility at these scales, and this project attempts to model a synthetic microrobot, controlled by magnets, on bacterial swimming methods.

Semiconductor Deterioration and Characterization of Laser Radiation Damage **1025**

Maeve Broeg (EEE)

Purpose: Metal-oxide Semiconductor Field Transistors (MOSFETs) function as a switch controlled by voltage applied to the gate. A heat gun is used to emulate a High Energy Laser attack on 2N7000 MOSFETs in low power applications and IRF540 MOSFETs in high power applications. K type thermocouples and processing circuits were used to investigate the effect that laser radiation could have on the required voltage to activate the switch.

APPLIED MATHEMATICS
(Chauvenet Room 121)

Manufacturing in an Uncertain Environment **0755**

Lacey Kelley (SMP), Gabi Faria (SMP), Alex Ki (SMP)

Purpose: Investigate how the demands of a product change when the environment changes. For example, demands for aircraft spare engines needed to replace failed ones at a Navy base follow a Poisson process with a certain rate per day. Upon the onset of hostilities, the rate jumps to a higher value and then tapers off exponentially. The goal is to have enough spare parts on hand to handle the demand. We will also explore randomly occurring hostilities.

Terrorist Operations in the Information Environment **0855**

Joseph Bahleda (SMO), Robert Runnells (SMO), Julie Zezeski (SMO)

Purpose: For the national defense of the country, as well as our military interests, having a comprehensive understanding of the way terrorist organizations operate in the information environment is paramount to the global war on terror and to national security. As terrorist operations in the information environment change, the resulting fluctuation in network activity will be reflected in the overall presence of terrorist organizations on social media platforms.

Ocean Deployment of Radio Repeater Balloon Network **0920**

Jane Kirkham (SMO), Danie MacPhee (SMO), Bryant Schlade (SMO)

Purpose: To establish communications across the Pacific Ocean for the Navy in the event that satellite communications were down or destroyed in some catastrophic event. Using ideas from Google's "Project Loon," we have designed autonomous balloons, carrying radio repeaters, spread out at optimal locations from San Diego to Hawaii to Yokosuka to serve as that back-up plan.

Operation Unified Assistance – 2004 Tsunami Relief Efforts **0955**

Alessandra Altruda (SMO), Joshua Brown (SMO), Darren Roach (SMO)

Purpose: Our project involves using a linear program to model a humanitarian assistance/disaster relief mission, specifically the 2004 Operation Unified Assistance. Our model deals with coordinating US Navy assets to meet the demand of needy individuals in the Aceh region of Indonesia.

HOSUB Applications for Integrated Swimmer-UUV Technologies **1020**

Catherine Delong (SMO), Bradley Kadlubowski (SMO), Tyson Stickler (SMO)

Purpose: We are exploring how to integrate the capabilities of UUV's to improve the performance of diving operations. Some areas we are exploring is how the divers could utilize the UUV's for surveillance, communications, and logistical support.

UAV Perimeter Patrol **1055**

Stephen Born (SMO), David Jones (SMO)

Purpose: Our project analyzes the effectiveness of UAVs patrolling a remote military perimeter using search and detection techniques. The effects of sweep width, searcher and target speeds, battery life, and perimeter size are all analyzed in this project along with cost-benefit analysis of how to effectively employ these UAV's.

Efficient Use of Resources **1120**

Daniela Pimentel (SMP), Andrew Jones (SMP), Joe Hansberry (SMP)

Purpose: Investigating how to optimize scarce resources under varying conditions. An example being: allocating hospital beds for emergencies versus scheduled appointments.



OPERATIONS RESEARCH
(Chauvenet Room 320)

The Mission is Munitions: Analysis of Munitions Analysis of Munitions Assembly Operations at Navy Munitions Command Mayport **0855**

Spencer Erjavec (SMO), Brent Huffines (SMO), Liz Kim (SMO), Megan Lauterer (SMO)

Purpose: Navy Munitions Command Mayport (NMC Mayport) has the responsibility of providing armament to the helicopters and ships stationed at Naval Station Mayport. In the near future, the requirement for new weapons and additional munitions demand will exceed NMC Mayport's current production capacity. NMC Mayport requested assistance in determining the best location and most cost efficient solution to assemble rockets and missiles in order to ensure the highest rate of order completion. We developed a discrete event simulation model designed to assess the impact of assembly location on order failure rate and production capacity.

USMC Reserves Incentive Programs Data Analysis 1055

Daniel Hugh (SMO), Conrey Meagher (SMO), Cole Oliver (SMO), Charles Patterson (SMO)

Purpose: Our project focused on the effectiveness and efficiency of the Marine Corps Reserve incentive programs. We analyzed data on over 33,000 Marines in the Select Marine Corps Reserves (SMCR) from Fiscal Year (FY) 2008 to FY 2015 to determine what type of Marines were receiving the incentives as well as the return on investment of the incentives. We evaluated the Marines based on provided data fields which included Marine Corps performance evaluations and marks.

OPERATIONS RESEARCH, CYBER, APPLIED MATHEMATICS
(Chauvenet Room 351)

Statistical Analysis of Navy Women's Basketball Using Multiple Linear Regression Techniques 0755

Gennaro Esposito (SMO), Hannah Fenske (SMO), Jane Moon (SMO), Matthew Vogel (SMO)

Purpose: The goal of this project is to analyze the past 40 seasons of the Navy Women's Basketball team in order to find which certain metrics correlate to a higher overall season winning percentage. Sports analytics is a rising field in statistics and is being used in all facets of collegiate competition. Our exploratory study intends to find which of the 73 specific predictors we selected are key to Navy Women's Basketball. This project uses multiple linear regression models to correlate overall winning percentage in a season with predictors such as shooting percentage, free throw percentage, rebounds, turnovers, player retention rate, and among several others. We will apply the models extracted accordingly to make predictions such as future success.

Final Exam Scheduling at the United States Naval Academy Using Mathematical Optimization 0810

Thomas Henson (SMO), Cody McWilliams (SMO), Abigail Mesaros (SMO)

Purpose: The goal of this project is to use mathematical optimization techniques to efficiently create a final exam schedule for the United States Naval Academy. Each semester, the registrar schedules roughly 4,500 students for approximately 350 classes and nearly 22,500 exams. We create an integer linear program which minimizes the overlapping of individual exams for individual students without extending the number of days designated for an exam period. We run our model using exam data provided by the Naval Academy registrar from the fall semester of academic year 2017-2018.



Daily Powered Flight Program Scheduling at the United States Naval Academy Through Mixed Integer Programming 0825

Jason Chan (SMO), Emily Horman (SMO), Eleyna Richardson (SMO)

Purpose: The Powered Flight Program (PFP) at the United States Naval Academy (USNA) is a flight training program that introduces USNA students to aviation through small training aircraft. The goal of this project is to use mathematical optimization to schedule about 60 students and 30 instructors in 1 of 5 training waves per day, in about a dozen planes available for any given training day. PFP works under many constraints dictated by USNA, the aircraft leasing company, and aviation regulations that make scheduling by hand cumbersome and time-consuming. We formulate a mixed integer program to maximize the number of students who are assigned to a plane and wave on a given training day. Our resulting outputs are valid for a single given day and aims to help the scheduling officer more quickly construct a daily flight training schedule with all parties' interests taken into consideration.

Vulnerability Assessment on Navigation Information System 0855

Justin Park (SCY), Connor Mellett (SCY), Alexi Mendolia (SCY), Chris Kay (SCY)

Purpose: At the United States Naval Academy, the Yard Patrol (YP) craft are readily available to midshipmen. Both classrooms at USNA and the YP's are outfitted with software and hardware which is either identical to, or representative of, equipment that is currently installed in the USN fleet for navigation. In this project, four midshipmen will assess the risk of cyber-attacks on the VMS 9.03 navigation software, and then provide a vulnerability assessment to Northrop Grumman for review.

Network Vulnerability Map 0920

Ethan Whitaker (SCY), Alexander Varon (SCY), Logan McFann (SCY)

Purpose: Mapware is a Python based post exploitation tool that conducts active and passive reconnaissance on a target machine or its network. The program contains a network analysis tool that creates and exports network usage reports for the cyber operator to gain situational awareness for strategic targeting purposes as well as a tool for individual file system or directory mapping. When employed Mapware provides the cyber operator with heightened situational awareness which allows for targeting or exploration of critical network nodes.

How to Search for Your Parked Car 0955

Austin Merritt (SMP), Vadim Ivanov (SMP), Amanda Murray (SMP)

Purpose: In this problem we will investigate different methods for searching. For example, in a parking lot you are trying to find your car in a very long row of identical cars. Is the best way to search to check every car in sequence? Or to randomly hop around? From here many different variations can be made.To solve this problem, we will use Markov processes, expectations, and stopping times. Navy applications could include search and recovery or search and destroy.

Uncertainty in an Arms Race 1020

Adeana Steinlauf (SMP), Stephen Miller (SMP), Talen Moores (SMP)

Purpose: In this project we will introduce randomness or uncertainty into a model of an Arms Race, where x and y are the amount of ammunition for two factions. Here uncertainty can be introduced in any parameter. We will study the fixed points of the system, how they change, and variations of our model. We will also use white noise, discrete differential equations and stopping times and apply them to the Navy.

Predicting Evening Meal Demand in King Hall 1055

Robert Coleman (SMO), Vincent Faust (SMO), Steven Gutierrez (SMO), Jaymes Yuen (SMO)

Purpose: The goal of our project is to accurately predict the food demand in King Hall for rolling tray. The King Hall staff has provided our team with evening meal data from 2016 and 2017. Using the data provided, we will use a multiple linear regression to predict the number of midshipmen that participate in rolling tray on any given night. We will compare our model's output against King Hall's records of actual attendance predictions in order to test the validity of our model. We will also validate our findings by predicting the demand of food for a future rolling tray event. These predicted findings will be compared to the actual food demand on that given meal. If successful, King Hall will not only be able reduce waste in any rolling tray event, the funds saved from these meals can be relocated to more popular events for midshipmen, such as private catering parties.

Laundry Demand and Prediction at the United States Naval Academy 1110

Audrey Brandon (SMO), Julia Collins (SMO), Kylee Daitz (SMO), Derek Duplaga (SMO)

Purpose: The goal of this project is to use regression in order to forecast how much laundry midshipmen at the United States Naval Academy will send into the Brigade Laundry Service Center. 4,500 midshipmen require the use of several uniforms on a daily basis as is dictated by their schedule and the occurrence of special events. Using data collected from the past two fiscal years overlaid with the Brigade master schedule, we determined which events would result in more laundry to be picked up and delivered for cleaning. This information would aid in the determination of scheduling and staffing at the Laundry Service Center.

Improving Oyster Recovery Partnership's Shell Collection Process by Solving Vehicle Routing Problems 1125

Hiram Carter (SMO), Ashanti Curry (SMO), Daniel Keo (SMO)

Abstract: In this work, we study a capacitated vehicle routing problem for the Oyster Recovery Partnership (ORP). The ORP is interested in doing an analysis of their collection process in order to ensure they are collecting the most possible shells to reuse in the bay. The ORP sends vehicles to pick up bushels of used oyster shells from individual restaurants; the trucks owned by the ORP have a maximum 15,000 pound payload. The goal of our project is to analyze the routes driven by the ORP staff, and offer better routes while considering the capacity of the ORP trucks. We will solve ORP's capacitated vehicle routing problem using the specialized vehicle routing library in Google Optimization Tools, in particular with its Python interface. Specifically, we will develop a series of near optimal routes using data provided by ORP in order to maximize the number of shells they can collect each day.

PHYSICS
(Chauvenet Room 100)
0855-1145

Infrared Microlensing Analysis of the Gravitationally Lensed Quasar Q0957+561

Christian Sorenson (SPH)

Purpose: Using an optimized lensing galaxy model, I create H-band infrared light curves that quantify the variations in flux of the twin images of the quasar Q0957+561. Accounting for a time delay of 417 days between the twin images, I create a time-delay corrected difference lightcurve of the Q0957 images. I then conduct Monte Carlo microlensing analysis of the time-delay corrected difference lightcurve of the Q0957 system.

Investigation of Copper's Unoccupied Bands

David Postma (SPH)

Purpose: Copper, a relevant photocathode material, is examined by way of DFT modeling and time-dependent/many-body techniques in order to explore the possibility of enhanced quantum efficiency. In the photoexcitation view, a highly excited state may have enhanced lifetime via quasiparticle modifications of the excited-state band structure. A discussion of Cu as a rugged photocathode and its applications specifically in the areas of the x-ray free electron lasers will transpire.

Experiments in Nonlinear Acoustic Landmine Detection

Francesca Browne (SPH)

Purpose: The goal of conducting research in the field of nonlinear acoustic landmine detection is to enhance understanding between the differences of the detection of layered soil versus a legitimate landmine. Through the use of data collection for two-tone frequency testes, the effects of frequencies will be plotted, and the nature of the graph produced will provide insight to the nonlinear acoustic peculiarities of landmine detection.

Thermal Conductivity of Novel Dielectric Materials

Andrew Borgdorff (SPH)

Purpose: We established the Transient Electrothermal Technique (TET) for characterizing thermal transport in novel dielectric materials. TET enables us to characterize anisotropy in thermal transport, which is associated with higher dielectric strengths. TET is preferable to bulk thermal characterization techniques becuase it has a short time scale, and is performed on a laboratory scale.

Analysis and Modeling of Electron-Phonon Coupling using Time Domain Thermoreflectance Measurements

Andrius Bernotas (SPH)

Purpose: Time Domain Thermoreflectance Measurement (TDTR) measurements are taken on simple microscopic systems and the signal is used to analyze and model heat diffusion on time and length scales relevant to current microelectronic systems. At these scales the common conception of macroscopic heat flow is not sufficient, so the Two Temperature model, with both electrons and phonons as heat carriers, is implemented. Through analyzing TDTR signals we track the temperatures of two interdependent heat carriers and attempt to model the electron phonon coupling occuring in the material.

Determining the Mass of Stars in Binary Systems

Cameron DeCoursey (SPAA)

Purpose: By calculating orbital parameters of a binary star system, I determined the masses of the constituent stars. To accomplish this, I combined my astrometric observations of these individual stars colelcted with the USNA 20" telescope at the Naval Support Activities, Annapolis (NSA) with archival images of these stars from the USNO 6th Catalogue of Orbits of Visual Binary Stars.

The Ion-Trapping Property of Graphene and Use of Hybrid Cells in Liquid Crystal Displays

Andrew Lee (ENR)

Purpose: The use of hybrid graphene-ITO liquid crystal cells can potentially reduce the electrical input necessary for information output on screens. This is possible by utilizing the ion-trapping property of graphene and the structural stacking of ITO to minimize the internal electrical resistance.

CHEMISTRY
(Michelson Room 110)

0855 Presentations

Microwave-Assisted Copper-Catalyzed Amidation of Aryl Halides via Concurrent Tendem Catalysis

Raymond Chang (SCH)

Purpose: A method for the copper-catalyzed amidation of aryl chlorides using concurrent tandem catalysis (CTC) was developed using a multifunctional copper catalyst. Aryl amides with a variety of functional groups were synthesized from primary and secondary amides in 40-85% yield. Evidence that the reaction occurred through a CTC mechanism will be presented.

Using In Vitro Selection to Change the Ligand Specificity of a Riboswitch from Guanine to Hypoxanthine

Jeremy Garcia (SCH)

Purpose: Riboswitches are RNA sequences found in a number of messenger RNAs that control gene expression by changing shape upon binding to a small molecule. We have adapted riboswitches for use as sensitive and specific sensors for use in vitro. This projects seeks to produce new sensors by changing the ligand specificity of naturally-occcuring riboswitches.

Quantifying the Impact of the Addition of Low Cetane Compounds on the Properties of Jet Fuel

Theodore Johnson (SCH)

Purpose: The use of jet fuel in emergency diesel generators on ships opens the question of differences in fuel specifications for diesel and jet fuel, specifically the cetane number, which is a measure of the combustibility of diesel and is only specified for diesel fuel. In this work, compounds with low cetane numbers were added to jet fuel to see if the resulting properties (density, viscosity, flash point, and derived cetane number) would fall outside the military specifications for jet and diesel fuel. This poster will present results of mixtures containing butylbenzene and isocetane and blends of these mixtures with petroleum-based fuel.

Synthesis of Chlorofumaronitrile: A Dicyanoacetylene Equivalent Useful for Tetraazaporphyrin Synthesis

John Korenak (SCH)

Purpose: Dicyanoacetylene, a useful synthon for soluble tetraazaporphyrins (TAPs) is difficult to make on a large scale (> 1 g) by published methods (solid-state dehydration of the diamide by P2O5). Here, we report on our efforts to synthesize chlorofumaronitrile as a substitute for dicyanoacetylene. Succinonitrile and fumaronitrile are reacted with a variety of chlorinating agents, under both ionic and free radical conditions, and the reaction products are analyzed by 1H NMR, 13C NMR and IR spectroscopy as well as mass spectrometry.

Crystallographic Studies of Staphylococcal Nuclease Variants with Internal Polar Substitutions

Resielyn Jose (SCH), Kevin Moy (SCH)

Purpose: X-ray crystallographic studies of staphylococcal nuclease variant proteins containing internal ionizable groups have identified a variety of strategies to mitigate the thermodynamically unfavorable burial of ionizable groups in the protein interior, including incorporation of internal water molecules, local unfolding, and structural rearrangements to expose the ionizable group to polar protein interactions or to solvent. Less is known about the effects of polar substitutions such as serine, threonine, and tyrosine, for which few crystal structures exist. New crystallographic structures have been produced to expand the existing database for these proteins and may contribute towards improved algorithms for protein electrostatics computational studies.

Determining the Effect of Surfaces on Islet Amyloid Polypeptide and Prion Peptide Aggregation

Ashley Schenck (SCH), Catherine Yip (SCH)

Purpose: Protein-misfolding diseases such as Type 2 diabetes and prion-related encephalopathies are recognized by forming proteinaceous fibrillar aggregate deposits classified as amyloids. We studied islet amyloid polypeptide and prion protein fragments via a colorimetric assay and atomic force microscopy (AFM) to understand how amyloidogenic aggregation/interaction varies with surface chemistries. In this study we have shown distinct amyloid-forming morphologies and aggregation kinetics for each peptide, facilitating unique peptide-lipid interactions with lipid membranes of differing chemistry.

Developing an Isolation Strategy for New Antibiotics

Zachary Hudgens (SCH), Aaron Wickard (SCH)

Purpose: Most current antibiotic compounds were isolated from terrestrial actinomycete (fungus-like) bacteria, however widespread misuse of these powerful chemicals provided a selective environment for antibiotic resistant bacteria to flourish and bacterial resistance has now been observed to every antibiotic in common use. The focus of this research is to isolate new antibiotics from airborne bacteria (the aerobiome), particularly actinomycetales like Streptomyces, which show potential to create natural antibiotics due to their shared genetic heritage with other antibiotic-producing bacteria. We are focused on identification and characterization of the compounds created by organisms detected by a deprelicating screen carried out by collaborators at ECBC (Army RDECOM) at Aberdeen Proving Ground (MD). Bacteria isolated by USNA and other institutions were shown by this screen to inhibit the growth of antibiotic-resistant pathogens such as MDR E. Coli, MRSA, and Klebsiella. We now demonstrate partial purification of antimicrobial activities secreted into liquid culture by four of the organisms isolated and screened by these collaborators.

0955 Presentations

Electrochemical Studies of L-Histidine Interactions

Dexter Clark (SCH)

Purpose: Histidine residues in proteins have been discovered to have a high affinity towards zinc ions. These two species interact and form complexes, some of which have vital roles in protein structure and function. Voltammetric experiments have been conducted to observe interactions between L-histidine and Zn(II) in various media. pH 7.4 was used to mimic bodily conditions. It was found that the glassy carbon working electrode gave the best results. Recent efforts have involved extension of this work to bismuth and glutathione.

Analysis of Inks Using Capillary Electrophoresis and Direct Analysis Mass Spectrometry Techniques

Theresa Erbach (SCH), Meghan McDonough (SCH)

Purpose: The compositional differences between various inks have been elucidated in order to aide in forensic analysis. Specifically, capillary electrophoresis (CE) buffer composition, injection and detection parameters have been optimized for ink identification in document authentication. The importance of minimal alteration to documents in these analyses is noted and methods are described that fit this criteria. Finally, CE methods are compared to ink analysis by direct sample analysis (DSA) and direct analysis in real time (DART) coupled with high resolution, high mass accuracy time of flight mass spectrometry (TOF-MS).

Quantifying the Properties of Hydrocarbon Mixtures Containing Compounds with Low Cetane Numbers to Assess Their Impact on Diesel Combustion

Sahara Graft (SCH)

Purpose: The use of jet fuel in emergency diesel generators on ships opens the question of differences in fuel specifications for diesel and jet fuel, specifically the cetane number, which is a measure of the combustibility of diesel and is only specified for diesel fuel. In this work, compounds with low cetane numbers were added to jet fuel to see if the resulting properties (density, viscosity, flash point, and derived cetane number) would fall outside the military specifications for jet and diesel fuel. This poster will present results of mixtures containing hexylbenzene and isododecane and blends of these mixtures with petroleum-based and bio-based alternative fuels.

Developing an Isolation Strategy for New Antibiotics

Zachary Hudgens (SCH), Aaron Wickard (SCH)

Purpose: Most current antibiotic compounds were isolated from terrestrial actinomycete (fungus-like) bacteria, however widespread misuse of these powerful chemicals provided a selective environment for antibiotic resistant bacteria to flourish and bacterial resistance has now been observed to every antibiotic in common use. The focus of this research is to isolate new antibiotics from airborne bacteria (the aerobiome), particularly actinomycetales like Streptomyces, which show potential to create natural antibiotics due to their shared genetic heritage with other antibiotic-producing bacteria. We are focused on identification and characterization of the compounds created by organisms detected by a deprelicating screen carried out by collaborators at ECBC (Army RDECOM) at Aberdeen Proving Ground (MD). Bacteria isolated by USNA and other institutions were shown by this screen to inhibit the growth of antibiotic-resistant pathogens such as MDR E. Coli, MRSA, and Klebsiella. We now demonstrate partial purification of antimicrobial activities secreted into liquid culture by four of the organisms isolated and screened by these collaborators.

The Synthesis and Characterization of Historical Pigments

Carly Knapp (SCH)

Purpose: Many azo-pigments are historical, that is, though once available, are no longer available commercially. Because many have not been characterized by modern analytical techniques, we synthesized a series of azo-pigments, specifically members of the pigment classed Arylide yellow (Hansa, PY49, PY98, and PY203), Diarylide yellow and orange (PY113, PY124, PO14, and PO15), and red Naphthol AS (PR11 and PR19). The pigments were characterized through Infrared and Raman spectroscopy, and Laser Desorption Ionization (LDI) Mass Spectrometry. Synthesis will be outlined in the context of the utility of these reactions for undergraduate laboratory synthesis and characterization.

Effects of Red Oak Foliar Tannins on the Growth, Mortality and Development of Gypsy Moth Larvae

Erin Kusuda (SCH), Lianne Marquez (SCH)

Purpose: Outbreaks of gypsy moth (Lymantria dispar) caterpillars can cause long term forest damage due to defoliation. The population cycles that include outbreaks occur due to interactions of the caterpillars with plant defense compounds, a virus, generalist predators, and the weather. This work focused on the effects of the plant defenses on the caterpillars.

Red Oak Foliar Tannins, Separation and Identification

Gregory Murtha (SCH), William Switzer (SCH)

Purpose: Outbreaks of gypsy moth (Lymantria dispar) caterpillars can cause long term forest damage due to defoliation. This project focuses on isolating a complex mixture of hydrolyzable tannins from powdered leaves and then carrying out chromatographic separation. Partially separated mixtures are used to identify specific tannins in the mixture by mass spectrometry.

Synthesis and Superlattice Films of Semiconducting Nanocrystals

George Peng (SCH), Charles Cuthbert (SCH)

Purpose: Semiconducting nanocrystals (NC's) are the subject of extensive research owing to their potential use in fabricating electronic and photonic materials and devices. Thin superlattice films formed by self-assembly of NC's are of particular interest because they provide a way to probe the interactions between nanocrystals in an ordered environment. This project focuses on synthesis of several types of colloidal semiconducting NC's and their use to form single- and multi-layer superlattices on liquid substrates.

1055 Presentations

Novel Metal-Organic Frameworks (MOFs) for the Destruction of Chemical Warfare Agents

Thomas Hentges (SCH), Patrick Brennan (SCH)

Purpose: This research project focused on the design, synthesis and characterization of novel materials based on metal-organic frameworks (MOFs). New compounds based on the NU-1000 structure will be created and tested for their ability to rapidly and selectively destroy chemical warfare agents.

Synthesis and Superlattice Films of Semiconducting Nanocrystals

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HIV-1 RNA-Protein Interactions

Cassandra Garfola (SCH)

Purpose: A segment of the HIV-1 genome, called the RRE, is essential for replication and, thus, an ideal target for the developemt of novel therapeutics. Interactions between the RRE RNA and its protein partner Rev were studied in vitro using electrophoretic mobility shift assays.

Determination of Heavy Metal Uptake in Agar-Grown Plants by X-Ray Fluorescence (XRF)

Elizabeth Lee (SCH)

Purpose: Metal hyperaccumulator plants can be employed to aid in environmental clean-up efforts by uptaking heavy metals such as lead and arsenic from contaminated soil or water. In this project, the amount of heavy metal uptake by plants grown in modified agar media was measured by X-Ray Fluorescence (XRF).

Effects of Red Oak Foliar Tannins on the Growth, Mortality and Development of Gypsy Moth Larvae

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Analysis of Inks Using Capillary Electrophoresis and Direct Analysis Mass Spectrometry Techniques

Theresa Erbach (SCH), Meghan McDonough (SCH)

Purpose: The compositional differences between various inks have been elucidated in order to aide in forensic analysis. Specifically, capillary electrophoresis (CE) buffer composition, injection and detection parameters have been optimized for ink identification in document authentication. The importance of minimal alteration to documents in these analyses is noted and methods are described that fit this criteria. Finally, CE methods are compared to ink analysis by direct sample analysis (DSA) and direct analysis in real time (DART) coupled with high resolution, high mass accuracy time of flight mass spectrometry (TOF-MS).

Structural Characterization of Endotoxin from Psychrophiles

Margaret Pana (SCH)

Purpose: Bacterial lipid A is an important structural component of the Gram-negative membrane, and as the hydrophobic anchor of endotoxin is also one of the most medically important toxins in Gram-negative bacterial infection. This molecule is central to both the stimulation of immunological defenses and to the physical and chemical properties of the bacterial cellular envelope. In this project we purifiy endotoxin from psychrophiles isolated from the Severn River using solvent extraction followed by chromatography purification and structure determination by MALDI-TOF MS and FAME GC-MS. We are further testing the evolutionary hypothesis - supported by previous studies with arctic bacteria - that psychrophiles will utilize shorter, more unsaturated, and more varied acyl units in endotoxin structure than related mesophiles.

Analysis of Lipstick using Micellar Electrokinetic Capillary Chromatography

Alexander Wieman (SCH), Natalia Barrow (SCH)

Purpose: Sampling and analyzing lipstick residues on surfaces is of interest to forensic chemists. Micellar Electrokinetic Capillary Chromatography (MEKC) parameters are optimized for the idendtification and quantiation of lipstick ingredients. Sampling of lipstick residues directly from surfaces into the MEKC system is also described.

COMPUTER SCIENCE
(Michelson Room 303)

Phone Number Extraction to Prevent Human Sex Trafficking 1055

Stephen Steckler (SCS)

Purpose: Solicitation websites such as Backpage and CraigsList have become den's for sex traffickers and pimps. They are able to avoid detection from police using phone number obscuring techniques. This research creates a website to share to USNA to gather data on how people obscure phone numbers, take this data and builds a machine learning algorithm, and finally, uses a web-crawler to gather phone numbers from online and create a database of un-obscured phone numbers.

Human Cognition In Attacking Privacy Zones-Strava **1120**

Dan Johnston (SCS)

Purpose: This research considers the ability of humans to detect and defeat attempts by Strava and other fitness applications to obfuscate users' home locations. A suite of tests are developed to assess an individual's ability to detect and defeat the privacy features offered by these fitness applications.

ENGLISH
(Sampson Room 217)

Phallic Whimsy: The Veneration of Masculine Identity in Wes Anderson's Early Films

Nelson Chandler (HEG)

Purpose: This project takes a critical look at three of the early films in Wes Anderson's filmography through a psychoanalytic and feminist lens. It specifically discusses the language of the films' as a method of subjugation of the feminine voices found in Anderson's fictional universes.

Journey to the West in Contemporary Media

Daniel Stitt (HEG)

Purpose: This project explores how martial arts literature like Journey to the West shaped both Modern Chinese culture and Modern American Chinese culture.

HISTORY
(Sampson Room G14)

Plebe Summer Never Ends: The Origins of Summer Indoctrination at the United States Naval Academy

Ben Barsam (HHSH)

Purpose: This project examines the 1960s transformation of plebe summer from an officer-centric model of plebe indoctrination to the midshipmen-led model that exists today. It argues that the influences of Admiral Hyman Rickover and the Vietnam War forced the Naval Academy to focus not just on officer education but also on professionalization, resulting in the establishment of plebe summer as an essential portion of the process of developing midshipmen into young leaders.

Force in the Far East: Royal Navy Gunboat Operations on the China Station, 1860-1870

Ryan Menke (HHSH)

Purpose: This project examines the role of the Royal Navy's China Station as the constant protector of British commercial interests in East Asia during the nineteenth century. It argues that British success in anti-piracy operations and the suppression of rebellious Chinese citizens was not a result of Western technological superiority but of the superior performance, discipline, and leadership of competent and devoted officers and enlisted men.

'A Subject of So Much Importance': The Freedman's Bureau's Educational Mission in South Carolina, 1865-1870

Luke Miller (HHSH)

Purpose: This project examines the Freedmen's Bureau's educational work in South Carolina during Reconstruction, specifically focusing on issues related to funding and hostility from the state's white population, and the efforts of Bureau officials, teachers, northern aid societies, and African-American communities to respond to these challenges. It argues that the diverse group of men and women involved in the Bureau's educational mission succeeded despite the many challenges they encountered and left an enduring legacy for the future of education and equality in America.

POLITICAL SCIENCE
(Nimitz Room G110)

American Government Panel 0855-0945

Pressing Matters: A Rhetorical Analysis of Presidential News Conferences during Periods of War

Kathryn L. Hughes (FPSH)

Purpose: A systematic analysis of presidential press conferences during war time to determine shifts and patterns in rhetoric and language as the war unfolds. The goal is to determine if presidents use similar approaches to persuade the public in response to similar situations. Particularly, this study aims to determine similarities in the usage of rhetorical devices across the timeline of a war to predict involvement and successes in future engagements from a president's press conferences.

Morally Opposed: Evidence for Differing Conservative and Liberal Moral Considerations

Ehren A. Johnson (FPSH)

Purpose: To further explore and possibly explain the root cause of political party polarization in the American context. Building on the past research of Hetherington & Weiler, Haidt & Graham's Moral Foundation Theory, and incorporating George Lakoff's theories of family-political moral metaphors, this study uses debate transcripts from the 2000, 2008, and 2016 Republican and Democratic primaries to search for differences in moral language between the two parties.

Less Separate, Still Unequal: Persisting Racial Disparity in Schools, the Power Structure That Allows It, and How Redistricting Fails to Fix It

Dylan R. Pennell (FPSH)

Purpose: This thesis focuses on school redistricting, a potential avenue of local education policymaking that a school district might use to alleviate racial disparity between schools; yet often, they fail to do so, or undergo the redistricting process for other expressed purposes. This thesis seeks the answer to two questions: to what extent do those involved in a school redistricting process consider racial factors such as disparity of racial representation between schools.

Comparative Politics Panel 0955-1045

Huntington and Hybrid Democracy: The Absence of Third Wave Democratization Factors as Forces for Illiberal Democracy

Bridget A. Devey (FPSH)

Purpose: Increasingly, states are emerging that exhibit signs of procedural democracy, but that lack the traditional liberal characteristics generally associated with democratic government. This paper seeks to identify why countries become stuck in this previously transitionary stage, using Turkey, Pakistan and Norway as case studies.

The Lying Game: An Analytic Comparison of Authoritarian vs. Democratic Strategic Communication

Maeve Owens (FPSH)

Purpose: In 2016, Oxford Dictionary named "post-truth" as the international Word of the Year in citing a decreasing social concern for the value of undisputed fact. Political leaders are increasingly more likely to blur the lines of reality in communication of both personal and policy matters. Through use of signaling games, I offer a theory that politicians lie differently according to regime type and the nature of information conveyed.

Disaster and Democracy: A Look Into Natural Disasters' Impact on Democratization

Garrett Snyder (FPSH)

Purpose: This study analyzes the impact of aid on the process of democratization specifically in the aftermath of a natural disaster. From 1968-2018 over 30 cases of major natural disasters resulted in death tolls of more than 5,000 within a few days. I conduct a study utilizing both quantitative analysis of country level input and two qualitative case studies to understand the relationship between foreign aid and democratization under a unique set of circumstances.

International Relations Panel 1055-1145

The Most Interesting of Alliances: Why does the U.S.-Saudi Arabian Alliance Exist?

Matthew T. Lorber (FPSH)

Purpose: 15 of the 19 hijackers on the September 11, 2001 terrorist attacks on the United States were Saudis. In 2017, the United States agreed to a $110 arms deal with Saudi Arabia. In this historical case study, I research significant aspects, to include military, culture, economy, terrorism, government, oil, and others, as to why the U.S.- Saudi partnership is where it is today, and I analyze why it was able to survive difficulties such as the oil embargo and 9/11 attacks.

The United States' Influence in Shaping Iran's Decision to Develop A Nuclear Weapon

Kamil A. Mazal (FPSH)

Purpose: This study explored and described the factors that must be taken into account when analyzing the potential development of nuclear weapons by Iran in the future, and the United States' influence in that decision. This work is largely qualitative and predictions on the future relationship between the two nations and the influence that the United States will have on Iran's nuclear future are based on historical case studies, tied in with the theory of realism.

Colonial Exploitation: A Paired Cases Analysis of Extractive and Inclusive Institutions Triggered by Resources

William D. Morgan (FPSH)

Purpose: Modern African development has generally lagged behind the rest of the world since decolonization, to the detriment of hundreds of millions of people. However, not all countries in Africa suffer equally, with vast differences in economic development across the continent. Through the use of most similar paired nation states, this thesis suggests that one possible root cause of these varied levels of modern development is the presence of exploitable natural resources at the onset of colonialism.

Preventing Nuclear Proliferation by Human Capital: Systematic Public Policy Analysis

Calvin L. Steber (FPSH)

Purpose: Nuclear weapons proliferation cannot be prevented by only containing nuclear weapons materials. Developing ideas and concepts to prevent human capital flight to countries considering nuclear weapons proliferation must be part of the solution. The programs introduced by the Department of Energy for the express purpose of preventing human capital flight from the FSS provided crucial lessons for developing a theoretical model pursuing the same goal in a hypothetical country.

Afternoon Poster Descriptions

In addition to posters from morning presentations, the following posters will also be on display in Alumni Hall.

Division of Engineering & Weapons

Evaluation of Non-Oxide Fuel for Fission-based Nuclear Reactors on Spacecraft

Dakota Allen (ENR)

Purpose: The purpose of this project is to research uranium based non-oxide fuels for use in a nuclear reactor intended for space. This project will evaluate the reactor's criticality and power over a 15 year lifetime. This is done using MCNP and measuring the change in neutron population within the core to test its stability. The reactor will also be tested at 100, 150, and 200% power, determined by how the reactor will be affected by thermal expansion to test if it can survive changes of temperature.

Experimental Transient Gust Response of a Representative Ship Airwake

Chris Cantillo (EAS)

Purpose: This research aimed to analyze the effects of transient wind gusts on shipboard flight operations using a Particle Image Velocimetry suite in a Closed-Circuit wind tunnel. A programmable linear actuator was used to simulate a measurable gust and turbulence patters were compared with existing research in the field for a Standard Frigate Shape 2 representative model.

Increasing Power in Navy and Marine Corps Engines with Partially Premixed Combustion

Michael Walker (EME)

Purpose: Once the soot limit is reached in a conventional diesel engine, further fuel increases will not result in more engine power since both the time for combustion (engine RPM) and oxygen are limited. Partially Premixed Combustion (PPC) allows for better mixing of the air and fuel by delivering additional fuel through the air intake system, allowing for increased power opportunities. This project sought to characterize achievable power gains in several Navy engines and the AM General HMMWV engine.

Division of Mathematics & Sciences

Development of Alorithms for the Detection of Bottom-Moored Obects Using Sidescan Sonar

Timothy C. Abunike (SOC)

Purpose: A simple algorithm for the automated detection of bottom moored objects from sidescan sonar was developed. The algorithm was evaluated using imagery collected over a series of simulated targets placed on the bottom of the Severn River, MD. Results will be used to aid in the development of automated methods for the detection of bottom-moored objects in coastal systems.

Support for Development of Cyber Wargame Best Practices

Catherine Adams (SCY), Jason Clark (SCY), Rahul Singh (SCY)

Purpose: The purpose of this study is to observe and study past and present common practices for wargaming, specifically in the cyber realm, and use this data to determine which practices produce the best results and the most usable data or tools. In order to identify the best practices, the midshipmen involved will research previously hosted wargames and use the results to compile a set of suggested best practices. Specifically, we have been asked by Mr. Gary Wilson of Lockheed Martin to address "how people are exploring cyber warfare through wargame-type events in both cyber-only and multi-domain situations."

Variability of Precipitable Water Vapor in the Atacama Desert, Chile

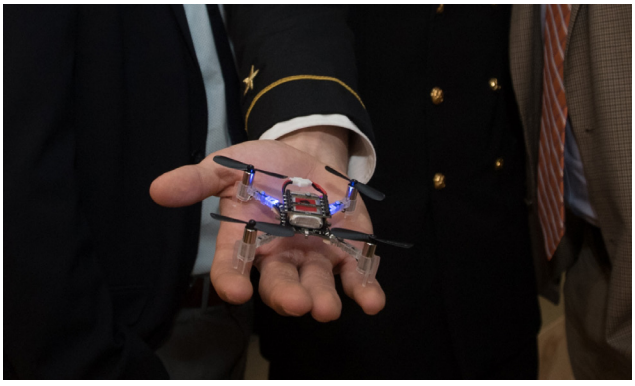
Tomas Aguilar (SOCH)

Purpose: In this project, we analyze the variability of the precipitable water vapor in various locations throughout the Atacama Desert in northern Chile. This desert is the driest in the world but its dryness varies through time and place with some amount of periodicity. We look into what drives these variations and how we may be able to predict them.

The Madden Julian Oscillation (MJO) and its Influence on Surface Wave Heights in the Pacific Ocean

Andrew Ahn (SOC), Casey Kramer (SOC)

Purpose: The aim of this project is to analyze how the intraseasonal Madden Julian Oscilation (MJO) infleunces surface wave heights over the Pacific Ocean. MJO is a significant driver of tropical and extratropical atmospheric circulation with a period of roughly 30-60 days. MJOs interaction on the upper ocean layer results in surface influence and momentum fluzes as a result of its relatively strong surface zonal winds. Surface wave models forced by these surface winds will be analyzed from a 30- year reanalysis data. The RMM index, created by Wheeler and Hendon, which captures the large-scale structure of the MJO in zonal wind and convection along the equator, is also used to determine if there is a connection between the westerly winds produced by the MJO and noticable variations in surface wave height anomalies.



Baseline Analysis of Oils, CDOM, and Optical Brighteners in Shallow Estuarine Environments: Potential Tools for Evaluating Restoration Effectiveness

Ervin Anies (SOCH)

Purpose: In the recent decades many of the local creeks and rivers have also become chemically influenced by the urbanization of local harbors and the surrounding human populous. Recent restoration projects have been enacted within the local area to see if the actions taken may actually help to revitalize the water quality and perhaps reverse some of the damage that has been committed over the years. Downstream consequences of these implemented restoration efforts must now be quantified and analyzed in order to determine legitimate effectiveness; this project attempts to analyze local water sources and the extent as to which these projects are working.

The 802.11 Project

Alpha Arines (SIT), Van Forrester (SCS), Eric Hilgendorf (SCS), Svetla Walsh (SIT)

Purpose: It is a safe assumption that most mobile users do not have an in-depth understanding of the vulnerabilities that their device could be exposed to at any given time. In order to figure out what makes their devices' vulnerable, one would need to have enough information about the device. This is what the 802.11 project will accomplish. It will look for and capture data packets from 802.11 capable devices and associate it with vulnerabilities from the National Vulnerability Database (NVD).

Assessing an Atoms First SC111 Pilot

Olivia Bair (SCH)

Purpose: In the fall semesters of 2016 and 2017, a pilot program for SC111 was undertaken. This project is examining the results of this pilot. In particular, we are interested in whether changing the order of topics in SC111 will lead to an improved understanding of the particulate level of matter and whether this knowledge is retained through the spring semester. This analysis includes conducting a variety of statistical analyses of various multiple choice instruments and comparing the results between students in the pilot and students in the conventional course. In addition, free response questions were collected from students at several points in the spring semester and a similar comparison of these questions was conducted.

Assessment of Coastal Processes Affecting Beach Morphology at Sandy Point State Park, MD

Garrett Barrios (SOC), Gage A. Butler (SOC)

Purpose: Meteorological data and current data were used to assess dynamic coastal processes occurring at Sandy Point State Park, MD. Current beach morphology was measured using field survey techniques to determine the how these coastal processes may affect beach structure. Results will be used to make recommendations for future potential coastal engineering improvements.

Easily Satisfied

J. Beal (SCS), Caleb Cimmarrusti (SCS), A Jason Harvey (SCS), Ian MacLeod (SCS)

Purpose: Create an SMT Solver which, given a real nonlinear polynomial constraint problem, leverages the SAT Solver program MiniSAT to generate a satisfying solution to the problem or return that the problem is unsatisfiable.

Midshipmen Improvised Drone Swarms

Wyatt Berg (SIT), Jacob Broz (SIT), Ian Davis (SIT), Matthew Goodpaster (SCS), Scott Mayer (SCS & SIT)

Purpose: This project primarily encompasses Robotics and Networking. We will be working with a swarm of 25 fixed wing Zephyr drones and quad-rotor Flamewheel drones. The goal of this project is to improve the user interface of the drone control system and to develop new advanced tactics to be utilized by drone swarms. We are a joint capstone with the Systems Engineering department who maintain the drones we will be flying with our software.

Detection of Malware C2 Channels using Semi-supervised Multi-label Classification Machine Learning

Daniel Bittleston (SCY), Adam Montgomery (SCY), Mitchell Swartwood (SCY)

Purpose: Signature-based detection is no longer useful or detection of malware command and control (C2) traffic due to the malleable patterns and amorphous implementations of the various mechanisms. In order to identify malicious domains, understaffed defenders must identify outliers from the endless stream of benign and normal traffic. We are focusing on the ability to detect and block malicious network traffic – specifically common malware functionalities such as command and control, downloading payloads, and file egress. Our approach revolves around using semi supervised machine learning – we will create a feedback loop that lowers workload while increasing prediction accuracy.

Surface Wind Impacts on Air-Sea Interactions and Upper-Ocean Temperature Response in Hurricane Irma

Rachel Boushon (SOCH), Casey Densmore (SOCH), Kelli Wise (SOCH)

Purpose: As part of the TROPIC 2017 research program, a group of midshipmen flew through Hurricane Irma with the USAF 53rd Weather Reconnaissance Squadron to collect surface wind speed and upper-ocean temperature observations. These observations were analyzed and compared to current numerical models to better understand hurricane impacts on air-sea interactions as well as mass transport and cooling within the ocean beneath such storms.

Historical Reconstruction of the Wave Field at the Wreck Site of the USS San Diego

Nolan Brandon (SOCH)

Purpose: Wave data collected by buoys from the National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center (NDBC) from 2008-2017 were used to interpolate and reconstruct an historic wave field at the wreck site of the USS San Diego. Major energetic storm/wave events were identified and compared to storm records to identify to identify significant episodic events over the last 100 years that had the potential to impact the wreck site. Results will be used to help assess the current state of the wreck and aid in management and preservation efforts.

Assessment of Genomic Screening in Large, Asymptomatic Populations with Applications to the Military

Joseph Brough (SCH)

Purpose: To determine the feasibility of genetic screening in the military to identify possible genetic diseases through the use of large genomic databases, models that relate genetic information to disease, cost-benefit analyses, and assessing current attitudes towards genetic screening in the military.

An Examination of Bluetooth Low Energy MAC Address Randomization in Mobile Devices, and When it Fails

Lamont Brown (SCS)

Purpose: Many devices sue random MAC address for privacy concerns in order to prevent tracking of product owners. This project focuses on Bluetooth hardware addresses, randomization techniques, and methods for defeating such randomization such that the mobile devices can be tracked despite their use of randomization. We then derandomize the MAC addresses and track the devices using the FuriousShark suite.

Blackout

Trace Brown (SCS), Kaycee Kimbrow (SCS), Tim McCown (SCS)

Purpose: We will be using a 2-D engine (GameStudio 2) in order to design a video game. We will design our own characters, create levels that integrate into a complete storyline, and include a combat system. We will not be using any "drag-and-drop" methods in the engine. Instead, we will create our own methods and mainly use the engine to keep the code organized.



Simulating Natural Rainbows: Effects of Raindrop Size, Shape, and Background

Brittney Bruns (SOCH)

Purpose: Although some features of natural rainbows (bows seen in sunlit rain or water sprays) can be explained with geometrical optics, other features require physical optics, including wave diffraction and interference. Such natural rainbow features include (1) faint supernumerary bows inside the primary and (2) changes in rainbow color distribution and angular width as functions of raindrop radius and shape. This research project analyzes how the size-dependent, vertically asymmetric flattening of falling drops can be incorporated into a physical-optics theory (Airy theory) to give realistic simulations of the corresponding colors, widths, and deviation angles of monodisperse rainbows. In addition, it examines how changes in background luminance affect natural rainbows' visibility.

The Secure Hashing Algorithm and the Breaking of SHA-1

Layton Bryant (SMA)

Purpose: My project will cover the basics of hashing and the Secure Hash Algorithm (SHA). I will also cover how SHA-1 was broken.

Los Angeles Surface Ozone and Meteorology Effects

Brittany Burg (SOC), Chialin Hu (SOC)

Purpose: Los Angeles County has a history of surface ozone. We will discover what aspects are human caused versus how the weather effects ozone at the surface.

Art Conservation Laboratory Development for Integrated Lab II

Mary Campbell (SCH)

Purpose: This project involves development of a student laboratory experiment based on the synthesis and characterization of a number of related azo pigments that are of interest for art conservation purposes. A combinatorial chemistry approach will allow each student to work on his/her own compound while using the same general approach, providing interesting and challenging individual exercises in synthesis and instrumental charaterization for each midshipman.

Validation of a Four-Component MATLAB Nutrient, Phytoplankton, Zooplankton, and Detritus (NPZD) Model for the Mesohaline Chesapeake Bay

Michael J. Cassano (SOC), Jenna Jones (SOC), Shae Timmons (SOC)

Purpose: Field data were collected from a single station in the deep channel of the mesohaline Chesapeake Bay to initialize and validate a four-component MATLAB Nutrient, Phytoplankton, Zooplankton, and Detritus (NPZD) Model. Results will be used to assess the applicability of the model in its current state and to make recommendations for model improvements for future applications to investigate plankton bloom dynamics and nutrient cycling in the Chesapeake Bay.

Estimates of Upper Ocean Heat Storage from the 1990 Polarstern Cruise and the 2016/2017 OMG Project

Emily Cecchini (SOC)

Purpose: The 2016/2017 Oceans Melting Greenland projects dropped close to 400 AXCTD sensors across the Greenland Shelf. The Polarstern cruise from 1990 dropped 20 CTD sensors in the Scoresby Sund region. Glacial ice mass loss near the marine terminus is a result of ice velocity and interactions near the air-ice-ocean boundaries. We focus on Scoresby Sund to find freezing temperature, ocean heat storage, and fresh water storage. This analysis establishes the total heat available to the base of glaciers.

Interactive Midshipmen Planner

Carson Chauvin (SCS), Luke Dalton (SCS), Julie Dejnozka (SCS), Hannah Urbaczewski (SCS)

Purpose: A webpage that allows midshipmen to plan their courses at USNA efficiently in a visually pleasing, user-friendly way. This service will be located on the CS Department's internal web server for midshipmen and faculty to use in the future. The web page would contain a traditional matrix that midshipmen are familiar with from the MIDS module, as well as an interactive planning matrix that is dynamic, usable, and effectively visualizes when courses are actually taken.

Powered Flight Website

Harold Choo (SCS), John Clancy (SIT), Jacob Pavlock (SCS), Curtis Olsen (SIT)

Purpose: The PFP website allows data for midshipmen, instructors (military or civilian), and planes to be stored into the database. People will input this data through a web browser either by a capable phone or computer. After the data has been inputted, the administrator will be look at this data to find patterns. Also, the website will be able to use this data to make a flight schedule for the next day.

Ionic Liquid Property Effects on the Natural Fiber Welding Process

Robert Chung (SCH)

Purpose: Natural Fiber Welding (NFW) is a process that utilizes ionic liquid solvents to selectively disrupt the forces holding together natural biopolymer materials allowing for the manipulation of those forces to incorporate polymers, nanoparticles, and/or other functional molecules into, or on, the natural polymer substrate. In this project, the effects of ionic liquid structure and composition on the NFW process were evaluated. Materials were characterized by methods including con-focal fluorescence, scanning electron, and atomic force microscopies, infrared and Raman spectroscopies, surface area analysis, and tensile strength testing.

Severn Blend

Connor Clavin (SCS), Fumiya DuFresne (SCS), Walker Sachner (SCS), Simic Tuan (SCS)

Purpose: Severn Blend is a web-based application that provides financial sentiment generated by feeding online posts through a machine learning classifier for investors to react to market opinions of specific stocks that release their earnings report of that day.

NSTAR Satellite Ground Station

Edward Decker (SCS), Daniel Lloyd (SCS)

Purpose: This project analyzes and converts data from USNA's orbiting satellites into a format supportive of viewing telemetry both as an individual packet as well as graphically. The project routes the real-time data to a server from which telemetry data is analyzed. The project alerts the user based on two conditions: 1) Whenever the application pulls a new telemetry packet from the server, and 2) if analysis determines that any of the telemetry is out of customizable limits.

Exploring the Propagation of MJO through the Maritime Continent

Casey Densmore (SOCH)

Purpose: The Madden-Julian Oscillation (MJO) is a circulation of zonal winds and convective (thunderstorm) anomalies that propagates eastward around the equator every 30-60 days. While passing from Indonesia to the Phillipines (the Maritime Continent), MJO predictability is significantly inhibited. This Trident project categorized successful and unsuccessful MJO events from 1980-2015, and contrasted background atmospheric conditions and modes of interannual variability for each of these cases.



An Exploration of Shor's Algorithm & Quantum Computing

Brittany Dowling (SMP)

Purpose: My project will be about Shor's Algorithm and how its use on a quantum computer will effect the future of cryptography.

Magnetotransport Properties of Shallow Quantum Well Structures for Spintronic Applications

Benjamin Dunphy (SPH)

Purpose: This project studies the various semiconducting and spin-orbit of heterostructures developed at NRL. These results will be used to evaluate these structures for use in a Spin Field Effect Transistor.

Time of Transaction vs Security of Bitcoin

Charles Eshenour (SMA)

Purpose: I will study the relationship between the security of a transaction and time to complete a transaction for Bitcoin.

Classifying Military Vessels via Satellite Imagery

Ted Fan (SCS), Jack Gasper (SCS), Aaron Joo (SCS), Daniel Seckinger (SCS), Logan Zeuner (SCS)

Purpose: The product for this capstone will be a working application that can accurately classify military vessels from satellite imagery. We will retrain Google's pre-trained Inception Model Version 3 with our own images for our ship classification program. An uploaded image is fed into our retrained Inception Model Version 3 and the best matches are outputted with their respective percentage matches.

Comparison of the Physiochemical Contours in the Lower Severn River Developed from Measurements by the EcoMapper Autonomous Underwater Vehicle (AUV)

Patrick Francis (SOC), Jesse Sharp (SOC)

Purpose: Physiochemical contours in the lower Severn River, MD were developed using data collected by an EcoMapper Autonomous Underwater Vehicle (AUV) surveys using different survey mission plans. Survey results were compared to contours created from discrete station profile data collected concurrently using a hand-held water quality monitoring probe deployed from a small boat. Results will be used to conduct sensitivity analysis to determine an optimal survey mission plan for physiochemical data collection in the Severn River and other sub-estuarine systems using an EcoMapper AUV.

Tracking Rescue Animal Vital Signs: Instrumented Dog Collar as an IoT Security Example

Jeffrey Gao (SCY), Shannon Gorman (SCY)

Purpose: This joint capstone project (with the University of Alabama) involves the refinement of an instrumented dog harness, used to track vital signs for rescue dogs and communicate the resulting data in real-time via Bluetooth to a cell phone. The USNA security validation team will conduct penetration testing to test the security of both the dog harness and cell phone app. This application will also be used as a realistic example of a class of IoT problems from a security perspective; we will develop a taxonomy of IoT sensor applications and assess the taxonomy in terms of risk, types of threat and potential countermeasures.

The Recent Cold Air Outbreak that Occurred on the East Coast and the ENSO, MJO, and NAO Influences

Hannah Godfrey (SOC), Ashleigh Keister (SOC)

Purpose: This project will anaylze the influences of ENSO, the MJO, and NAO on the recent Cold Air Outbreak (CAO) that occurred along the East Coast between December 31st and January 7th. The recent CAO will be compared to past CAOs in order to determine if there is a pattern in how frequent CAOs occur as well as if there is one weather phenomon that is the main contributor to the occurance of a CAO.

Migration to the US From Mexico and Relation to Climate Shock

Colin Hackbarth (SOC), Victoria Ramirezsolis (SOC)

Purpose: In this project, we'll study the effect of climate shock events, such as droughts and extreme heat waves, on migration in Mexico. Our particular focus is investigating whether climate shock events trigger migration from Mexico into the US. We will be using atmospheric reanalysis data and data from the Mexican Migration Project to conduct our research.

Drydock Pizza Ordering System

Phil Hanson (SIT), Charlene Kearns (SIT), Andres Lulli (SCS), Caitlyn Vernon (SCS), Andrew Wisegarve (SIT)

Purpose: This project develops an online environment capable of placing orders to Drydock to order pizza. This web-based application allows midshipmen to place orders to a pizza kitchen being installed in the Dry Dock, and notifies midshipmen at various stages of order progress. Payment methods via the Yard Card and Blackboard payment system are supported.

Development of a Simple Sediment Erodibility Map for the Lower Severn River

Kellyanne M. Hurst (SOC), Emily Ranzau (SOC)

Purpose: Sidescan sonar backscatter amplitude and bathymetry data and sediment grain size data collected from a survey in 2015 were used to determine high-resolution sediment grain-size distribution and Acoustic Doppler Current Profiler measurement were used to develop a representative current velocity field for the lower Severn River, MD. These data were compared to determine where critical shear conditions in the Severn River could be exceeded and sediments suspended from the bottom to develop a simple sediment erodibility map for the lower Severn River, MD.

A Microlensing Analysis of the Central Engine in the Lensed Quasar WFI J2033-4723

Gregory Hyer (SPH)

Purpose: We have analyzed the microlensing variability in the lightcurves of the gravitationally lensed quasar WFI J2033-4723 to measure the size of its continuum source using optical monitoring data from the SMARTS and EULER telescopes.

Magic Adj(utant)

Jenny Ingliss (SIT), Amanda Keller (SIT), Gerhard von zur Muehlen (SCS), Victoria Reyes (SIT)

Purpose: Magic Adj allows a midshipman adjutant to quickly, easily, and accurately generate a semester's watchbills for the company and manage changes to them. Magic Adj allows varying degrees of automation for this task and includes an algorithm for fairly distributing watches while also taking into account individual midshipmen preferences. Through Magic Adj, all midshipmen in a company can view watchbills, request duty swaps, and receive email alerts to their academy gmail if watches are changed.

Catch Me If You Can: A Study of Game Theory and Cryptography

Jordan Jones (SMA)

Purpose: I will be creating an original game involving strategically solving a cipher code to win. This project involves the study of game theory, its history, and military applications.

An Analysis of Russian Cyber Strategy Against the Western World

Conor Keating (SCY), William Moore (SCY), David Sessamen (SCY)

Purpose: Our project aims to analyze Russian Cyber Operations - specifically against former Clinton Campaign Chairman John Podesta - to show Russian motivations and willingness to use cyber as a form of warfare. We look to interpret previous Russian Cyber Operations to examine their growing prominence in cyber and where their former actions will lead them in future cyber operations.

Aviation Service Assignment Tracking System (ASATS)

Joseph Kim (SIT), Enock Langat (SCS), Landry Tamba (SCS & SIT), Grant Zaro (SCS)

Purpose: ASATS is a tool that facilitates aviation mentors and the aviation board with providing relevant information of each midshipman. It is a database driven web site that efficiently stores and retrieves detailed information such as ASTB scores, PFP and Aviation Cruise performances, and interviews. The system is easy to use and understand for both midshipmen and faculty and is able to accommodate administrators without experience in SQL, PHP, or Javascript.

The Tweet M.D's

Brandon Khoury (SCS), James Park (SCS), Zach Tyra (SCS), Kurt Zepeda (SCS & SIT)

Purpose: Twitter monitor that employs an established machine learning classifier. This will be used to gauge the probability of cyber attacks on different corporations. A live stream of Tweets will be utilized to provide users a real-time graphic monitor for each corporation. Each monitor will have 1. health status, 2. trending Tweets, and 3. latest related Tweets for a period of time.

Wireless Sensor Networks: Authenticated Encryption for Engergy Constrained Environments

Mi Kim (SMP)

Purpose: I will be studying authenticated encryption for energy constrained environments in Wireless Sensor Networks (WSN).

Stability of Nonlinear Swarms, on Flat and Curved Surfaces

Carl Kolon (SMAH)

Purpose: Swarms of idealized agents have been studied, both in attempts to understand natural phenomena and as a method to control systems of UAVs. This Trident project examines a class of gradient models for a swarm of agents, in an attempt to prove aspects of their limit behavior and generalize the models to Riemannian manifolds.

Structural Characterization of Human Endogenous Retroviral RNA

Benjamin Kondrup (SCH)

Purpose: Eight per cent of the human genome consists of retroviral sequences called human endogenous retroviruses (HERVs). These sequences do not make infectious virus, but the expression of their proteins has been associated with various neurological diseases and cancer. This work investigates the three-dimensional structure of a segment of an endogenous retroviral genome that is essential for the expression of HERV proteins.

Bioprospecting for New Bifuels and New Antimicrobial Compounds

Natalie Lemek (SCH)

Purpose: This project entails a survey and genetic idetification of bacteria growing in the Severn River at various times of the year, establishing seasonal (temperature) variations in psychrophilic and mesophilic populations. The psychrophiles are of particular interest for instrumental characterizations because of the adaptations of their outer membranes, which consist of lipids related to agonists or antagonists of the human immune system.

Prediction of Regional Voting Outcomes Using Heterogeneous Collective Regression

David Liedtka (SCS & SIT)

Purpose: Can exploiting links in relational data lead to greater accuracy in predicting elections as they unfold in real-time? For a set of Swiss voting data, we look at national political party recommendations, voting histories, and demographic region information and take advantage of different regression techniques to predict election outcomes. This project demonstrates the viability of using machine learning to analyze timely relational data.

Development of the Next-Generation Coastal Kayak Autonomous Surface Vehicle

Tong K. Ma (EOE)

Purpose: In the fall of 2017, testing and evaluation of the current Coastal Kayak Autonomous Surface Vehicle (ASV) platform was conducted to provide baseline metrics for system improvements that will be incorporated into a next-generation Coastal Kayak ASV design. Engineering design changes were implemented to improve stability, maneuverability, and thrust and to evolve the Coastal Kayak ASV to a more compact platform with an integrated, modular system of components. The next-generation Coastal Kayak ASV was tested during test surveys at select field sites in the spring of 2018.

Blockchain: Strengths, Weaknesses, and Application

Seth McNally (SMA)

Purpose: I will discuss some of the vulnerabilities to blockchain technology. These exploits will range from innate weaknesses to weaknesses in the application of blockchain.

Comparison of Relative Water Levels at the U.S. Naval Academy and Annapolis City Dock in Response to Different Meteorological Forcing Conditions

Benjamin McGrath (SOC), Paul H. Spalding (SOC)

Purpose: Continuous water levels measurements were collected at City Dock, Annapolis, MD and compared to those collected at the NOAA/NOS/CO-OPS tide water level gage (8575512) at Hendrix Oceanography Laboratory, U.S. Naval Academy over the same time period to identify any differences in recorded water levels. Meteorological data was used to identify forcing conditions that can potentially result in water level differences between these two sites. Results will be used to identify conditions where there in an increased risk of flooding at Annapolis City Dock relative to the flood risk at the U.S. Naval Academy.

Classical Cryptosystems: Modern Usages

JadeAnn Miller (SMP)

Purpose: I will be looking at the classical cryptosystems employed by the Zodiac Killer and used on the Kryptos statue. I will look at the techniques that were used to break portions of it and what didn't work.

Understanding the Secure Evaluation Protocol for Personalized Medicine

Paige Monk (SMA)

Purpose: This capstone projects seeks to understand the proposed encryption protocol for personalized medicine using the Paillier encryption for private information retrieval.

Improvised Wireless Device Development and Defeat

James Morgan (SCY), Dylan Struthers (SCY), Kate Swafford (SCY)

Purpose: Completed in support of the Joint Improvised-Threat Defeat Organization (JIDO), this study developed a method for remotely detonating an IED using 4G-LTE cell service. 4G-LTE triggered devices are en emerging threat, and this project will be used as a test bed for the next generation of counter IED jammers.

Steganography by LSB Embedding

Devin Nathan (SMP)

Purpose: I will be looking at steganography by cover modification techniques which include bitshift and LSB embedding.

Counterfactual Simulations of Liver Allocation

Kaitlyn O'Reilly (SMO)

Purpose: The current liver allocation method in the United States creates a geographic disparity that results in an unfair disadvantage for those in need of a liver transplant. Some experts believe this disparity is due to low conversion rates in some areas, while others believe the disparity could be fixed by allowing candidates to travel to the areas with a higher liver supply. I built a counterfactual simulation of a world with ideal donor conversion rates in all areas, and another allowing a percentage of transplant candidates to move to locations with a larger number of liver donations. I analyzed the results in order to compare variance of median MELD at transplant (which is our measure of fairness) across the simulations.

Atmospheric Glories: Cloud Optics Meets Microphysics

Michael Pahissa (SOCH)

Purpose: In atmospheric optics, glories are pastel-colored rings of light centered on a sunlit observer's shadow (i.e., the antisolar point) cast on fog or a cloud deck below. While glories have been observed for centuries, this long history has not led to easy optical explanations: only in the last few decades have Mie-theory calculations of glory spectra, intensities, and colors been practical. This research project compares Mie backscattering spectra by polydispersions of cloud droplets with observed glory colors and intensities acquired from digital images. When paired with Mie theory, the Deirmendjian modified-gamma drop-size distributions (DSDs) for clouds produce good fits to glories' visible-wavelength features, with the DSD modal radius largely determining their angular pattern of colors.

Print-Welding Functional Biopolymer Composites

Seok Park (SCH)

Purpose: Noble-metal nanoparticles were synthesized in a linen matrix by the process of incipient wetness impregnation. The linen-nanoparticle composites were then bound to a cellulosic support in a spatially controlled manner using an ionic liquid based process called Natural Fiber Welding. These novel materials were then evaluated for enhanced Raman and IR signatures.

Extreme Weather Simulation

Matthew Shirey (SCS), Stephen Steckler (SCS), Orion Vedral (SCS)

Purpose: We have built a forest fire and flood simulation to showcase the power of High Performance Computing on inexpensive mini-clusters.

IoT and a Cybersecurity Framework

John Trezza (SCY)

Purpose: Cyberspace is growing - thanks in large part to the so-called "Internet of Things" (IoT) - and cybersecurity is suffering as a result. Addressing this issue will not only require technical solutions, but also an appropriate regulatory framework. This research will identify legal and economic solutions to the IoT threat, identify the limitations of such regulations, and apply these findings to existing and proposed legislation.

Creating a Fast SMT Solver for the Theory of Real Non-Linear Constraints

Fernando Vale-Enriquez (SCS)

Purpose: Satisfiability Modulo Theory (SMT) Solvers for the theory of real non-linear constraints have a wide variety of real world applications, but remain too slow for many practical uses. The aim of this project is to improve solvers for this theory by incorporating a fast but partial theory solver. We based our partial theory solver off of existing algorithms for fast satisfiability detection, which we augmented for use in the SMT framework.

Innovations to Increase the Power of State-of-the-Art Graph-Theoretic Two-Sample Statistical Tests

Michael Wallace (SMOH)

Purpose: Classical two-sample statistical tests are often subject to severe shortcomings in high dimensions. With the rise of "big data", recent developments in the area of nonparametric statistics and graph-theoretic tests offer novel solutions to these types of problems. This project seeks to extend existing methods and achieve new and improved results.

GPS and Cryptography

Katherine Wasielewski (SMP)

Purpose: This capstone explores the math behind spoofing attacks.

Division of Humanities & Social Sciences

Girlhood Lost: Child Marriage Among Syrian Refugees

David Alicea (FLA)

Purpose: In both refugee camps and foreign cities, Syrian girls face stigmas, sexual harassment, sexual assault, and bleak economic opportunities. I will ascertain the cultural climate surrounding child marriage in the Middle East and the wider world, gather virtual testimonials from child brides and social workers in the Syrian conflict, and suggest a possible solution to lessen the factors which have caused a rise in child marriage among Syrian refugees.

An Analysis on the Legality of Honor Killings According to Hanafi Law in Jordan

Ian Bagent (FLA)

Purpose: With any religion, there always tends to be a balance between faith and reason. Some statements in religious texts are taken literally, while others are interpreted to remain applicable to a changing world. I will research how Hanafi Law is applied in Jordan in regards to the religious legality of honor killings. I will analyze the rulings and reasoning of religious courts in Jordan to see whether or not there is any credible likelihood of making honor killings illegal in Islam.

Exergy Recovery from Human Movement: Potential and Economic Limitations

Jordan Baker (FQE)

Political Religious Marketplace Theory

Noah Becker (FPS)

Purpose: The Political Religious Marketplace Theory assumes an actor is rational, seeking to maximize their political payout given marketplace conditions. Middle Eastern states solidify power within the political religious marketplace by manipulating the dynamics of institutions, control the influence of clerical networks, religious groups and movements within society and impose marketplace conditions that favor the state.

Queen of Sheba: The Role Model for Yemeni Women

Solomon Belhu (FLA)

Purpose: In Yemen today, women are at a significant disadvantage compared to their male counterparts. Although the government is making strides towards their advancement, the current situation and conditions women face are unfair. I seek to highlight and discover who Queen of Sheba was, her achievements and wisdom, and through that provide lessons and an example for Yemeni women to aim towards in terms of empowerment in their Yemeni society.

Regional Economic Effects of Nuclear Power Stations

Jadean Bernstein (FQE)

Trading India for Pakistan

Meghan Brophy (FPS)

Purpose: Although physical violence has ceased between Pakistan and India, a high level of disdain and animosity remains between the two countries and has caused issues domestically, preventing the United States from having a productive relationship with either country. Even though the U.S. has maintained an alliance with Pakistan since the country's founding, their military helps harbor and fund terrorist groups, its social and governmental institutions are failing, and the state is in constant need of outside support. In order to keep from abandoning the Pakistani people, the U.S. must set hard lines, acting as a stable partner as long as the Pakistani government and military follow the expectations set for them. Despite the fact India's democratic government and similar values make a more long-term, mutually-beneficial, and stable alliance seem possible, differing strategic values lend itself most firm to a military alliance above all else.

A CGE Approach to Modeling the Impact of Asylum Seekers and Refugees on the Swedish Labor Market

Timothy Fulton (FQE)

Leila Khaled: A Role Model for Palestinian Women

Mike Germano (FPS & FLA)

Purpose: Despite often being portrayed as a villain by the West, my paper will show how Leila Khaled is a role model for women of Palestine. Khaled defied the Arab stereotype and her actions were heard by the entire world. My paper will address many works including books, films and scholarly works. These books will be about her life, but also about the Arab-Israeli conflict as well as feminism and terrorism. A significant part of the paper will address her image in the west.

The Rise and Decline of Nuclear Power

Cord Hansen (FQE)

Amazigh Women in Morocco: The Foundation of a Culture Steeped in Tradition and the Benefits of a Matriarchal Society

Eliza Harris (FLA)

Purpose: This paper will examine Amazigh women in Morocco. They are the primary caregivers and in charge of educational development for the children, but they also have had a hand in social movements toward equality for their people by organizing protests and setting up organizations to bring about change. This research is an attempt to bring awareness to this cause and show how the foundation of this ancient culture is rooted in its women.

Does War Help Women? The Case of Lebanon

Evan Head (FLA)

Purpose: After the Lebanese Civil War (1975-1990) women gained rights. Although there were groups such as the Lebanese Council of Women that pressured the government for the right to vote as early as February 1953, there was still significant progress yet to be made in regards to political participation, education and economic independence. My research will examine the effect the Civil War had on women and their struggle for rights.

The Banality of Evil in Joseph Conrad's *Heart of Darkness*

Benjamin Johnston (HEGH)

Purpose: An analysis of the way in which evil played a role in the European colonization of Africa and how this evil was operated in the context of European enlightenment ideals.

The Political Economy of Wind Power in the U.S.

John Kenyon (FQE)

Amy Levy's New Woman: The Increase in Visual Freedom for Women during the Nineteenth Century

Olivia Kluger (HEGH)

Purpose: How a woman's role in society increased during the Victorian Era.

An Analysis of Internal Migration in the United States

David Laszcz (FQE)

Forbidden and Unforbidden Love in a Post-Colonial Context

Jane Lee (HEGH)

Purpose: A post-colonial analysis of typical and atypical, romantic roles of the male colonizer and the submissive woman.

Kurdish Women Fighters in the Middle East

Kenneth Levens (FLA)

Purpose: Female-comprised militant groups such as the Women's Protection Units have witnessed a tremendous increase in size, operability, and geographical presence and influence in the Middle East since 2013. In this study, I will analyze Kurdish militias solely, as well as partly, composed of women. My focus will be on the motivation behind these revolutionary female fighters in modern conflicts and what they intend to and have accomplished as a result of fighting.

The Judeo Christian Death Tradition in the Victorian Era: Preservation through Photography

Shon Maduka (HEGH)

Purpose: Victorian Culture was marked by a rather obsessive societal interaction with death. The concept of memento mori (literally "remember you will die") captures and immortalizes the final moments of life as a keepsake for those of us who survive. Post mortem photography provides insight on perspectives of life and death to viewers in our modern era, and perhaps can help us understand our own attitudes about death.

1/c Weekday Liberty and Forecasting Effects on Food Services

Travis Marshall (FQE)

Living in Plato's Shadows: Oscar Wilde's *The Picture of Dorian Gray*

Matthew McKee (HEGH)

Purpose: Oscar Wilde argues that his novel is a masterpiece of aestheticism, a 19th century artistic movement. However, his incorporation of Platonic imagery calls this notion into question so much so that he may have failed at writing an aestheticist work.

Japan's Security Triangle

Ryan Meehan (FPS)

Purpose: With growing security risks and political changes in East Asia, Japan's security policy and military role will expand. As China continues to rise, North Korea destabilizes, and the United States looks inward, Japan needs to remain a competitive economic force, develop its military and political power. It also needs to continue to normalize and strengthen the alliance with the United States, in order to balance the security dilemma with China and North Korea. At the center of Japan's international challenges are the questions of if and how it should advance its military and security forces, despite its historic pledge for pacifism.

Renewable Energy Investments in Developed Versus Developing Countries

Elijah Merchant (FQE)

Post Colonialism and *Wide Sargasso Sea*

Grace Miller (HEGH)

Purpose: This is an analysis of the character Antoinette Cosway and her experience as a woman within a post colonial society. As she looks into the mirror of both the native culture and the English culture, she cannot identify with either. This isolation makes her an abject subject and her inability to feel safe in any physical location is a manifestation of her feeling like she is in limbo with regard to her identity as a creole woman. Thus, she slips into madness as a reaction to the abjection she experiences.

The Blackhole of the Middle East: Forgotten Asian Migrant Workers

Jen Nguyen (FLA)

Purpose: Human trafficking is a widespread phenomenon across the world, and countries which rely heavily on foreign workers in the labor market have less incentive to create legislation against human trafficking, especially in the Middle East. I will explain the widely used sponsorship, also known as the kafala system and provide motivations and reasons to explain the migration of female workers to the Middle East.

Are Athlete Endorsements Really Worth It?

Madeline Ostrowski (FQE)

Words, Words, Words: Trends in Presidential Campaign Speeches

Nicholas Paraiso (FPS)

Purpose: This study applies Flesch-Kincaid Grade Level testing and qualitative word analysis by QSR NVivo 11 to the announcement, campaign, and election night speeches of every major party candidate to advance to the general election since 1972 in order to explore changes in candidates' rhetoric over time. The paper explains the political implications of the identified speech patterns and concludes with proposals for future research in the field of presidential rhetoric.

The Manifestation of Violence in *The Lesser Blessed*

Anna Paz (HEG)

Purpose: A postcolonial analysis of Canada's First Nations in one boy's coming of age story.

The Political Environmental Kuznets Curve

Salvador Perez (FQE)

The Price of Olympic Rings: The Economics of Hosting the Olympics

Jack Ray (FQE)

How is the Taxi Industry Economically Impacted by App-based Transportation?

Tyler Sayles (FQE)

Post Colonialism and *Wide Sargasso Sea*

Cady Sheeks (HEGH)

William Morris' Red House: The Mecca of the Arts and Crafts Movement

Andrew Sikora (HEGH)

Purpose: This analysis of William Morris' Red House demonstrates how the building's cultural significance to the Arts and Crafts Movement parallels that of Mecca to Islam. It was not enough that the architecture reflected and developed these Arts and Crafts ideals but that the methods of construction followed the values of the movement as well.

Personality and Performance at the U.S. Naval Academy

Timothy Smith (FQE)

Foreign Policy in a New American Era: How Domestic Disillusion Impacts US Foreign Policy Commitments

Alejandro Sotillo (FPS)

Purpose: The United States has, since the implementation of the Truman Doctrine, undergirded the liberal international order as the foremost influential geopolitical leader. What are the domestic factors indicating a push for isolationist foreign policies? Has the cost of recent protracted wars pushed the American people to pursue self-interests? Perhaps populist idealism is more ardently penetrating the nationalist fervor? Has this rejection of interventionist policy gone relatively unnoticed for several decades? Firstly, the United States is departing an era of global leadership, largely due to three domestic factors.

Journey to the West in Contemporary Media: How Martial Arts Literature like Journey to the West Shaped Both Modern Chinese Culture and Modern American Chinese Culture

Daniel Stitt (HEG)

Purpose: This project explores how martial arts literature like Journey to the West shaped both Modern Chinese culture and Modern American Chinese culture.

Double-Face in Blackface: How Performance of a Stereotype can Confront the Stereotype

Daniel Stitt (HEGH)

Purpose: Explores examples of novels and performances where displays of stereotypes actually subvert their racist undertones.

Broken Bodies - A Postcolonial Perspective on Injury and Illness in *The God of Small Things*

Nicole Thatcher (HEGH)

Economic Implications of Antimicrobial Resistance

Raymond Wardell (FQE)

The Volatile South: Election Dynamics in the American South (2008-2016)

W. Kirk Wolff (FPS)

Purpose: The American South stands alone politically within the United States. Studies of electoral volatility have neglected to examine the political climate of the South, and current methods of studying electoral volatility are inadequate. I investigate the likely causes of instability in the South utilizing a new measure of electoral volatility, the Wolff Index of Volatility. Specifically, I examine the association of electoral volatility with race, economics, and education.

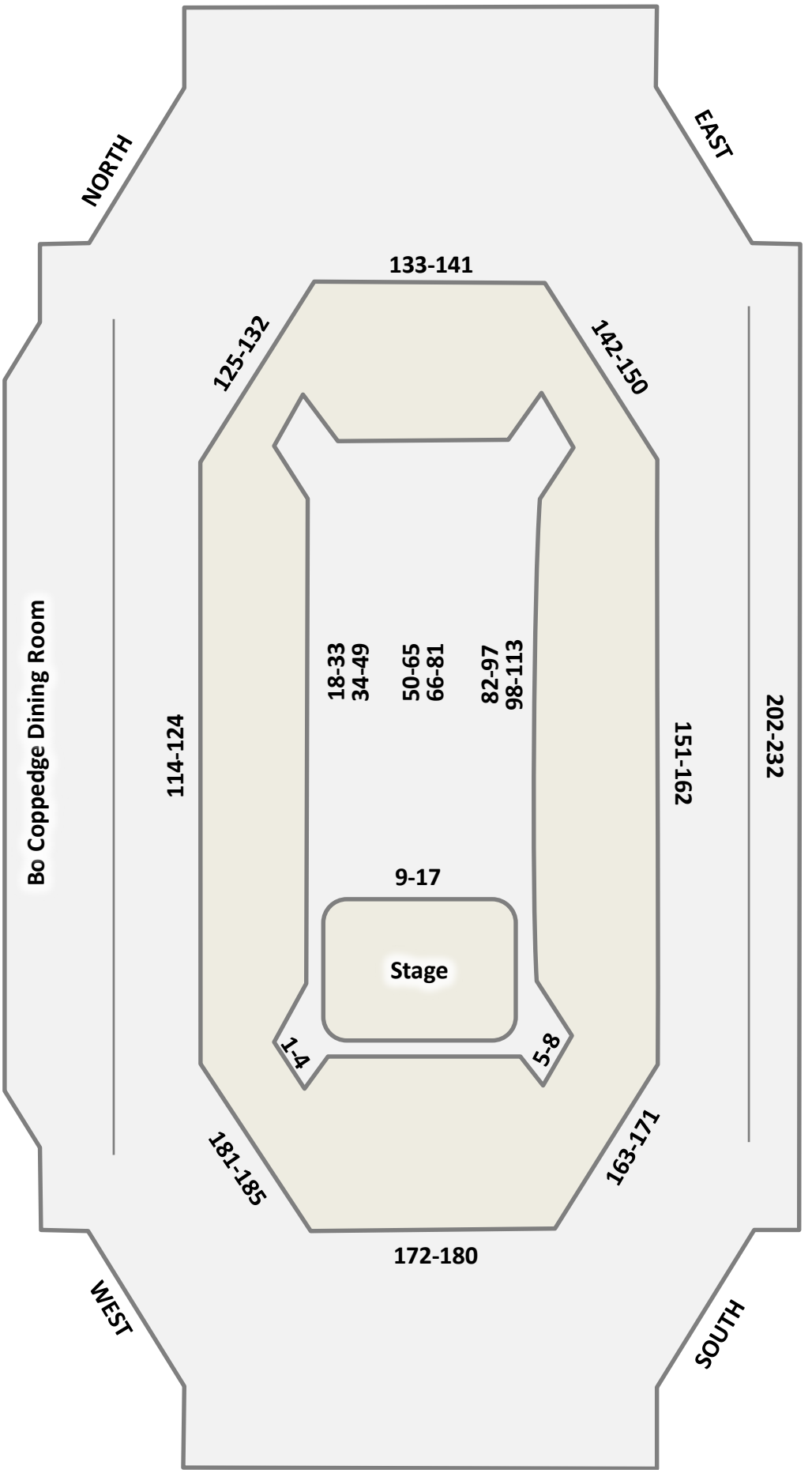
A Hope of Healing: Literature's Coping Qualities for Societal and Personal Trauma in *The Lesser Blessed*

Eli Wood (HEGH)

Purpose: This is an investigation of trauma and the use of literature as a healing mechanism within socieities through a post-colonial lens. It will utilize The Lesser Blessed and its focus on the personal traumas faced by the characters, as well as the group traumas experienced by Canada's First Nations, to answer why literature is so effective in this restorative role.

The Effect of Weather Conditions on the U.S. Fishing Industry Over Time.

Jammie Xie (FQE)


NORTH
EAST
133-141
125-132
142-150
Bo Coppedge Dining Room
114-124
18-33
34-49
50-65
66-81
82-97
98-113
151-162
202-232
9-17
Stage
1-4
5-8
181-185
163-171
172-180
WEST
SOUTH



U.S. Naval Academy Senior Capstone Projects
April 25, 2018
Annapolis, Maryland