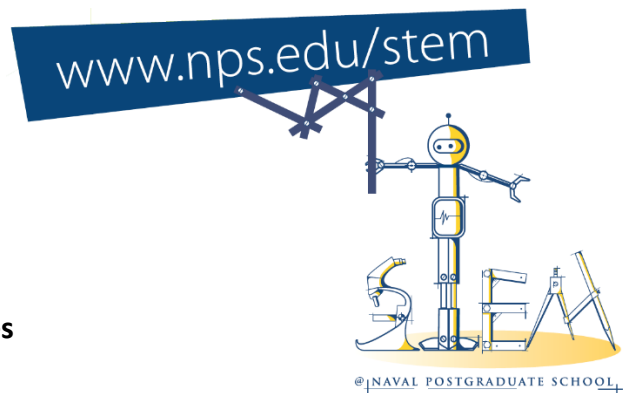# 2018 NPS SUMMER INTERN PROJECTS

1. Finding Associations between Computer Drives
POC: Dr. Neil Rowe, Computer Science

This project is finding connections between different people by analyzing the computer and mobile-disk storage they use. We have a collection of data from 4000 storage devices from around the world. Recent work has focused on extracting email addresses, phone numbers, and personal names. We can do better if we extract other kinds of words about the people and look for uncommon words that users share. We can then build graphs of connections between people and visualize those graphs.   In particular, we are interested in criminal conspiracies, and the intern will also help with creating plausible data of criminal activity.

Must Haves: Some programming skills
Nice to Haves: Computer major

2. Hands-on Experience in the Small Satellite Laboratory
POC: Dr. James Newman, Space Systems

Examples of this summer's projects include, but are not limited to:

• 	Help redesign and fly a modernized CricketSat High Altitude Balloon.
• 	Update the CubeSat HAB structure for future use.
• 	Learn to use the GPS simulator and develop some scenarios for testing our HAB flight hardware and software.
• 	Learn to use our Software defined radios and expand the use of them with Raspberry Pi and other processors.
• 	Help fix up our amateur band ground station. Calculate whether we could bounce an rf signal off the moon and receive it. Then try it.

Must Haves: Strong technical background and interest in programming, electrical engineering, or structural engineering; ability to work independently and as part of a team
Nice to Haves: Strong Python programming, EE interest and PCB design experience, Solid Works experience, RF engineering or interest, amateur radio license
Unacceptables: Less than a strong work ethic, need for constant supervision, inability to focus or persevere through technical difficulties

3. Biomimetic Microfluidic Artificial Muscles for Powered Armor and Unmanned Vehicles
POC: Dr. Emil Kartalov, Physics

We have an ongoing project to build artificial muscles using microfluidic devices printed in 3D using soft resin. The idea is based on the attractive force between the plates of a capacitor. The force becomes significant when many capacitors are arrayed, the plate separation is small, and the voltage is high. We expect a couple hundred pounds of force per cubic inch. The idea is to build this by 3D printing to allow for large-scale integration, using microfluidic channels filled with electrolyte as the wiring while the bulk of the material acts as the capacitor dielectric. We have the appropriate 3D printer in the lab, which uses both hard and soft resins. We would like to prototype the devices and measure the force as a function of applied voltage in the system. This is a great project for an intern to work on, if he/she is interested in the related fields: 3D printing, CS, materials, biomimetics, artificial muscles, robotics. The work if successful can revolutionize powered armor suits as well as terrestrial and maritime robots and drones. Acknowledgement and co-authorship on resultant scientific papers are available based on the intern contribution to the project.

Must Haves: There are no particular technical requirements, but we do expect a strong work ethic, integrity, ability to focus, good attention to details, self-motivation, and ability to work independently once trained.
Nice to Haves: some physics, chemistry, CS, and/or math background would be beneficial. Experience with AutoCAD or SolidWorks would be of great help.
Unacceptables: The opposites of the must-haves

4. Microsphere-based Thermal Insulation for Diver Suits
POC: Dr. Emil Kartalov, Physics

We have an ongoing project to build thermal insulation for diver suits using hollow microspheres embedded in elastomeric materials. We build the material in the lab then measure its thermal properties. We have proven principle and now we work on characterization, optimization, and conversion to a full suit. We hope to build a new class of diver suits using the material, which would allow divers to work longer and more safely in cold waters. Interns joining the project will work with Prof. Kartalov and his NPS students. Interns will learn to build the material and characterize it using testing equipment, and can take part in building the new suit. Acknowledgement or co-authorship on resultant scientific papers is available based on intern contribution to the research work.

Must Haves: There are no particular technical requirements, but we do expect a strong work ethic, integrity, ability to focus, good attention to details, self-motivation, and ability to work independently once trained.
Nice to Haves: some physics, chemistry, and/or math background would be beneficial
Unacceptables: The opposite of the must haves

5. Development of Weapon Effects Analysis Software
POC: Dr. Joseph Hooper, Physics

I am looking for a student to turn some of our theoretical work on specific weapons effects into a usable program (with GUI) that can be routinely run by an analyst. The specific effect of interest is related to shaped charge jets interacting with nontraditional targets. The underlying physical theory for this has largely been worked out, but I would like an intern to develop a MATLAB GUI that allows an analyst to run our analysis in a convenient way with supporting user documentation. Prior MATLAB experience is ideal but not necessary; some manner of scripting experience (Python, Unix shell scripts, etc) is necessary.

Must Haves: Experience with some type of scripting language (ideally MATLAB, Python, or shell scripting).
Nice to Haves: Experience programming in MATLAB.

6. Testing Support and Data Reduction for Rocket Engine Testing
POC: Dr. Christopher Brophy, Mechanical and Aerospace Engineering

Intern will participate in liquid rocket engine testing and operate cameras, data acquisition equipment, and engine assembly.   There will also be some expectation to handle post-processing of experimental data and plotting of results.

Must Haves: Comfortable in a hands-on environment and familiarity with physics/chemistry
Nice to Haves: Familiar with Python programming
Unacceptables: No laboratory experience.

7. Display and diagnostic programs in Python for Meteorology
POC: Dr. Wendell Nuss, Meteorology

Project is aimed at furthering the development of a GUI to access various display and diagnostic programs using atmospheric model data. Python has been used to access a major geophysical display package (NCAR Graphics) and a simple GUI has been developed. Further flexibility to properly select time periods and diagnostic fields of interest is the emphasis of this development.

Must Haves: Willingness to program in python and learn scientific applcations
Nice to Haves: Knowledge of NCAR graphics and display of weather data

8. (c) Networks
POC: Dr. Alex Bordetsky, Information Science and Space Systems

Cyberspace of tactical, manned-unmanned, and orbital networks. Conducting bench and field experiments with maritime-land self-forming networks, ground and aerial robots, cube satellites.
Must Haves: CS, Engineering

9.Laser and Optical Communications
10.Femto Satellite design with SensorTiles for Terrestial apps
11. Energy Harvesting and hacking Micro grid Security
POC: Dr. Peter Ateshian, Computer Science

1. We have optical Morse and QR code laser & LED signaling - Machine Learning (AI) Neural Nets (Movidius) Fathom is being applied to correct far field signals - this technology works in five domains and at their boundaries of Space, Airborne, Terrestrial, Marine and Undersea.

2. Femto Satellites are thumb nail size satellites due to Moore's law we have shrunck your Father's satellite from a school bus to a thumbnail.

3. Energy harvesting of Heat, Kinetic/Wind, Regenerative Braking sources and storing on LA, LiPo batteries or Super capacitors and securing them with Raspberry Pi3 IoT systems running BlockChains or Secure Smart Contracts for distributed consensus security to have a hold off period of 24 hours during a series of three sponsored hackathon phases.

Must Haves: Heard of coding, and tried it want to do more. Good personality and fun
Nice to Haves: PC Chromebook or even Mac