



naval STEM

The **2015** Year in Review



IN THIS ISSUE

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MESSAGE FROM THE NAVAL STEM EXECUTIVE



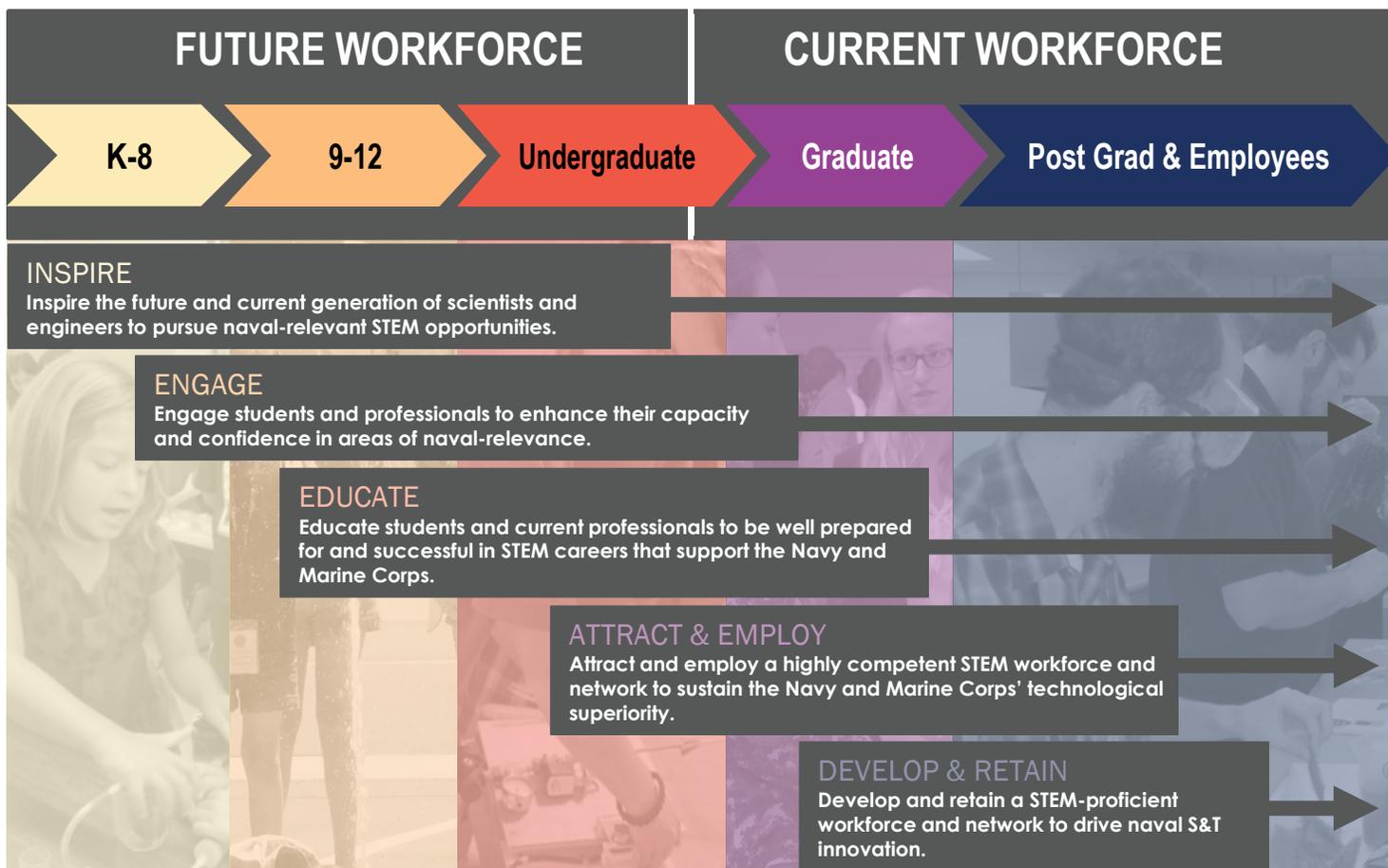
The last year within the Naval STEM community has been one of growth and evolution. We have welcomed numerous naval agencies to our community and have connected with an impressive collection of organizations and individuals who share our desire to promote Naval STEM education and workforce opportunities.

As you may have noticed from the cover of this newsletter, Naval STEM has a new look. Naval STEM replaces STEM2Stern as our unifying brand and better represents the diverse components and efforts within our broad community. This umbrella brand connects efforts from the various Naval STEM stakeholder organizations and promotes awareness of the breadth of opportunities within our community.

We also started work on a new Naval STEM Strategy that highlights the new direction of Naval STEM. This strategy promotes efforts for both the current and future workforce and emphasizes the importance of developing and

supporting individuals at all stages of their professional and educational journey. This strategy will be released in early 2016 and we expect to have exciting opportunities for you to share ideas on how you can help us to implement this strategy. See below for a sneak peek of the strategic priorities from the Naval STEM Strategy.

Our team has exciting plans for 2016, including increased opportunities to participate in Naval STEM programs, to meet naval scientists and engineers, and to lend your voice and perspective to help guide future Naval STEM efforts. Thank you for your dedicated efforts this year and keep up the great work in the new year.



NAVAL STEM COORDINATION OFFICE UPDATE

By now you are probably aware of the robust, diverse community under the Naval STEM banner. We are proud of the work being done by local naval facilities and commands, and are constantly impressed by the quality of programs and people engaged in Naval STEM efforts across the country.

The Naval STEM Coordination Office was established to serve as the central coordination and information resource for Naval STEM efforts. Our office aims to leverage each respective stakeholder's assets, workforce and expertise to develop and execute the highest caliber naval-relevant programs and initiatives. During the past year, these efforts have focused on two main goals: improving information sharing and engaging the community around common interests.

Improving information sharing within the Naval STEM community is done both within the general STEM community as well as internally within the Naval STEM stakeholder organizations. To support these efforts, we unveiled a new brand identity for the community under the banner of Naval STEM. This new brand includes a new logo and website as well as revamping the STEM2Stem newsletter series with the Naval STEM brand. We're open to any ideas and recommendations you have for content for these materials!

Engaging the community around common interests is centered on providing venues to share best practices related to program execution, overcoming barriers to success and implementing initiatives in new communities. To promote awareness of these best practices, our office has worked to improve and streamline data collection while promoting transparency and access to materials and information. We also worked together with our partners in the Naval STEM community to draft the Naval STEM Strategy, which will guide our efforts into the future.

We are proud to be a part of this vibrant community and look forward to an exciting 2016.

Engage with your local community on Naval STEM



Visit the new Naval STEM website
<http://navalstem.navylive.dodlive.mil>



Education Initiatives



Workforce Initiatives



Naval Stakeholders



Participate in our Naval STEM Forum in 2016



Contact the Naval STEM Coordination Office

Share your ideas, experiences or send us questions to learn more!

naval_STEM@navy.mil

MARINE CORPS FEMALES IN TECHNOLOGY MARKS FIRST ANNIVERSARY AT QUANTICO

BY MIKE FERRARO, MARINE CORPS SYSTEMS COMMAND



Jamesia Hobbs, a chemical engineer with MCSC, speaks to students at Quantico Middle/High School during Women's History Month in March 2014. Hobbs and other MC-FIT members told students stories of how they came to work in STEM professions. The connection was especially powerful when Hobbs, who was a "Marine Corps brat" herself, identified with the students' lives as military dependents and middle schoolers. (U.S. Marine Corps photo by Monique Randolph).

The Marine Corps Females in Technology (MC-FIT) program, which provides a forum for women in technical domains to exchange ideas and develop opportunities for personal and professional growth, marked its first anniversary this past September.

The MC-FIT program is chartered by the deputy commander for Systems Engineering, Interoperability, Architectures and Technology at Marine Corps Systems Command (MCSC). Membership includes 134 women within the Marine Corps engineering competency at MCSC and Program Executive Officer Land Systems. For a full year, the organization has worked to fulfill its vision to "empower women in technical domains to successfully thrive within the Marine Corps environment." The organization promotes networking, mentorship and career opportunities among members to enhance the workforce.

Jeanette Evans-Morgis, founder of the MC-FIT program, is proud of what they have accomplished in such a short time.

"I think the MC-FIT has made a difference across the command," she said. "When I'm stopped in the hallway and asked when our next event will occur, I know the MC-FIT is a success. We have a great group of women whose diverse backgrounds have been the key to this success, and I'm fortunate to have the chance to work with them to meet our goals and vision."

In its inaugural year, MC-FIT organized several activities, including a walk for National Mammography Day with informational handouts and quizzes, a session on the optimization of mind and body, a series on emotional intelligence, a panel on designing for supportability, and

FIT fall forum, which included Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation Mary Lacey as the guest speaker. The spring forum included Executive Director for the F-35 Lightning II Joint Program Office Steffanie Easter. Both women talked about the challenges and growth they experienced working for the Department of Defense.

MC-FIT closed out the year with the award of "You Make a Difference" certificates, presented to members who were nominated by their supervisors for exhibiting the characteristics of the MC-FIT vision. The certificates were presented by James Smerchansky, Marine Corps chief engineer and MCSC executive director.

"I can think of nothing more important to the development of our technical workforce than to have competent, experienced and dynamic leaders mentor others," Smerchansky said. "MC-FIT pulls together an incredibly important demographic—our female employees—to ensure we are providing every opportunity for them to excel in the United States Marine Corps acquisition community."

MC-FIT will launch its second year of operation with the second annual Fall Forum called "Real Talk, Finding Confidence in Your Voice."

The **Marine Corps Systems Command (MCSC)** serves as the Department of the Navy's systems command for Marine Corps ground weapon and information technology system programs, equipping and sustaining Marine forces with current and future expeditionary and crisis-response capabilities.

NAVAL HOSPITAL BREMERTON STAFF TAKE STEM SHOWCASE TO THE STUDENTS

BY MASS
COMMUNICATION
SPECIALIST 1ST CLASS
(SW/AW) GRETCHEN
M. ALBRECHT, NAVAL
HOSPITAL BREMERTON
PUBLIC AFFAIRS



Hospital Corpsman 3rd Class William Hayes of Naval Hospital Bremerton's Operational Readiness Department takes a visiting student through the steps required to bandage a person in need during the third annual West Sound STEM Showcase at Kitsap Mall. (Official Navy photo)

Students of all ages and from all corners of Kitsap Peninsula, Washington, saw STEM come to life when Naval Hospital Bremerton (NHB) staff members held the third annual STEM Showcase at the Kitsap Mall.

Multiple groups and organizations from the surrounding area set up nearly 60 booths showcasing talents from news broadcasting and 3D printing to video game design—helping to connect visitors with the fun, real-world applications of STEM.

“The goal is to inspire and pique the interest of youth in the community to engage in STEM, especially in relation to the medical field,” said Chief Hospital Corpsman Beverley Glauber. “Our overall goal was to teach the public of all ages how the medical field relates to STEM.”

The showcase gave NHB the opportunity to share certain specialties with the community and relate STEM to the medical field through hands-on experiences with dental technician work, a biomedical equipment technician, cardiology and neurology, a Staff Education and Training Department simulation mannequin, and first aid and vital signs practice.

“We linked up with explosive ordnance disposal techs from Joint Base Lewis-McChord to come out with two of their robots. We set up a basic first aid display, dental lab display, and neurology and cardio display, where the public could see the tools we use for our specialties and gain hands-on experience,” said Glauber. “It was definitely a success with over 2,000 people who came, making it bigger and better than we expected.”



Hospitalman Joshua Buchholz of Naval Hospital Bremerton explains proper first aid procedures during the West Sound STEM Showcase at the Kitsap Mall. Sixty-five booths showcased and promoted the awareness of STEM. (Official Navy photo)

STEM is a focused and integrated curriculum based on educating students in the four disciplines (science, technology, engineering and mathematics) rather than teaching them as separate, distinct subjects.

“I have always loved science and technology, so when I saw the chance to volunteer I took it as an opportunity to pass knowledge and inspire kids,” said Hospital Corpsman 1st Class Christopher Miguel, assigned to NHB's Biomedical Repair department. “I think science, engineering and math can be made fun if you are hands-on and enable kids to interact. It is really neat for the kids to see things work. Then they get involved and excited,

which hopefully inspires them to see how fun STEM programs can be."

STEM offers real-world applications in an effort to motivate and inspire children to excel in those fields and propel American students from the middle of the pack in science and math to the top in the international arena.

Sailors and civilian staff from NHB planned, attended and participated in approximately 10 local STEM events in 2015.



NHB STEM volunteers help at the annual Central Kitsap High School Sports Medicine tour that included a visit to the command's 'Simulation Lab' equipped with mannequins used in training evolution. The tour included emergency first aid, cardiac and respiratory arrest, and tactical combat casualty control. (Official Navy photo)



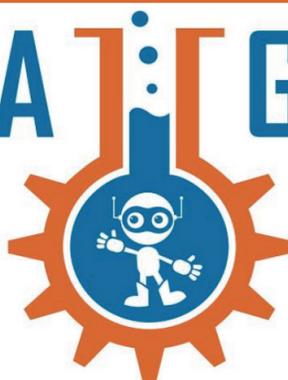
NHB STEM volunteers join forces with West Hills STEM Academy students for their Kiosk Project. (Official Navy photo)

Naval Hospital Bremerton (NHB) is a community-based acute care and obstetrical hospital, offering expert primary care, urgent care and a broad range of medical and surgical specialties. NHB has a threefold primary mission: to support warfighters, past and present, and their families by providing exceptional care anytime, anywhere; to shape military medicine through training, research and graduate medical education; and to prepare our forces for deployment.

NAVSEA | GAMES Center

Naval Sea System Command (NAVSEA) will replace the former "Starbase Atlantis Program and Center" with "NAVSEA Gateway through Adventures, Mathematics, Engineering and Science (GAMES) Center."

The GAMES Center will bring fifth-graders from District of Columbia public schools to the Washington Navy Yard for hands-on, inquiry-based activities and lessons in STEM. The program will offer fun and real-world engineering experiences, giving students the opportunity to imagine and pursue careers in STEM.

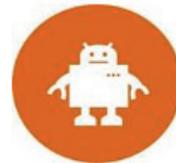
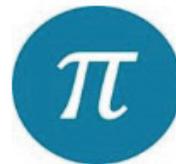


GATEWAY THROUGH ADVENTURES, MATHEMATICS, ENGINEERING & SCIENCE

All activities and events will be aligned with the Common Core and Next Generation Science Standards and will feature:

- Enrichment activities such as special presentations, mini classes and demonstrations
- Tours of the National Museum of the United States Navy
- Learning experiences with civilian and military engineers
- Hands-on lab activities with professional lab grade equipment

For more program information, please visit <https://navsea.portal.navy.mil/etm>.



INTERN DEVELOPS SMALL, INEXPENSIVE STAR TRACKER

BY KENNETH A. STEWART, NAVAL POSTGRADUATE SCHOOL

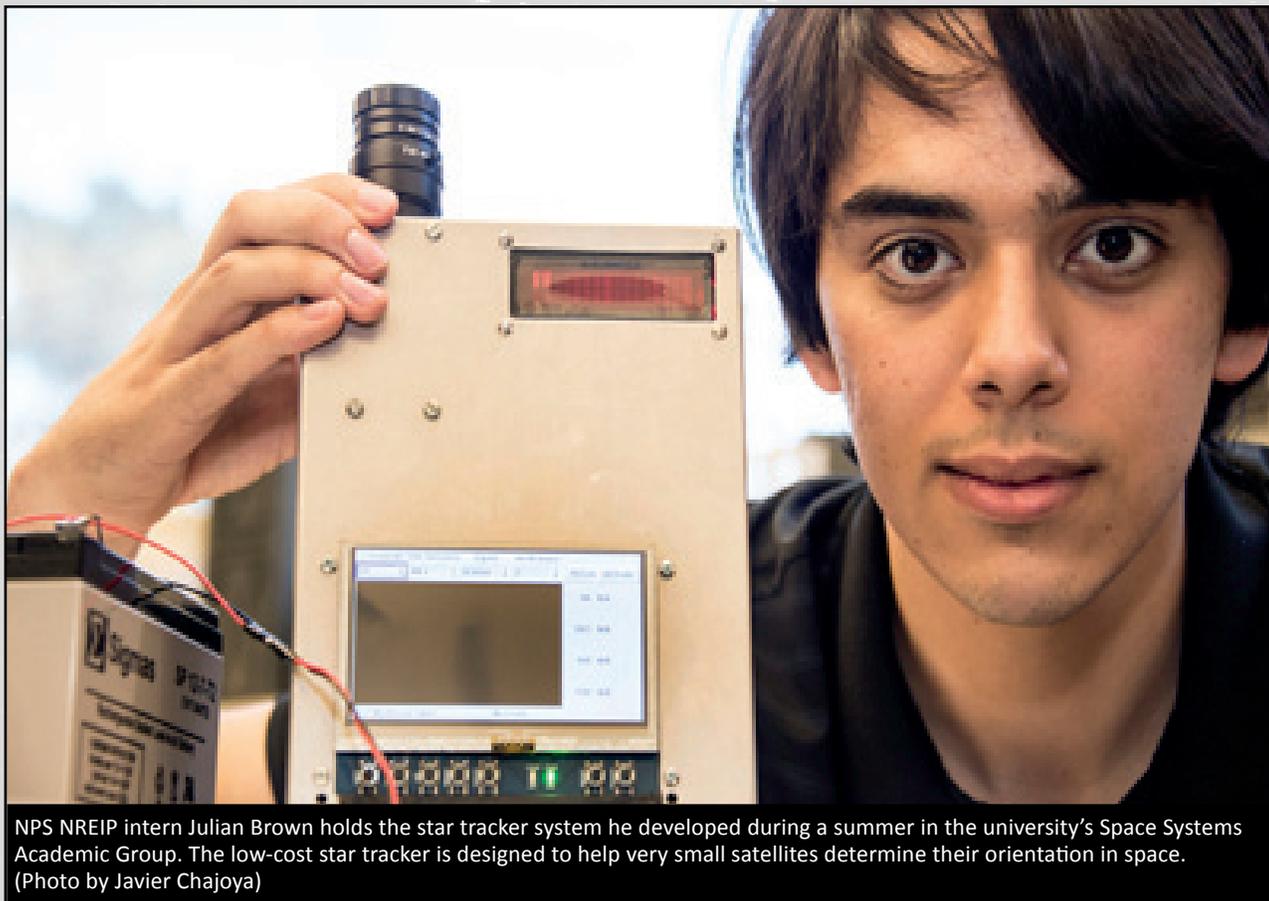
Naval Postgraduate School (NPS) intern Julian Brown is just 21 years old, but don't let his young age and boyish charm fool you. He is a serious scientist and is working to build a star tracking system at NPS designed to help very small satellites determine their orientation in space.

After graduating from Massachusetts Institute of Technology (MIT) with a degree in electrical engineering and computer science, and then interning with the Space and Naval Warfare Systems Command (SPAWAR), Brown began working for NPS Professor Jim Newman through the Naval Research Enterprise Internship Program (NREIP).

"As I was reviewing resumes for the summer of 2014, his stood out," said Newman. "He had shown interest in trying to do some really hard projects. Professor Mathias Kolsch and I had been working part-time with students on developing a low-cost, very small star tracker to challenge the price point that industry currently provides, and I realized this would be a great project for Julian."

"It's cool stuff," Brown said. "I've known what I wanted to do since I was 5 years old. When I learned that the Navy was sponsoring students to come and work in their labs, it was so amazing to me. I couldn't believe that they would give me money to play around with all of their cool toys," he added with his usual zeal.

"A star tracker is used to take a picture of the sky and identify the patterns of stars in an image. Based on this, a



NPS NREIP intern Julian Brown holds the star tracker system he developed during a summer in the university's Space Systems Academic Group. The low-cost star tracker is designed to help very small satellites determine their orientation in space. (Photo by Javier Chajoya)

satellite can tell which direction it is facing. Because stars are little specks of light that don't move, it is very easy to know where you are looking if you know which stars you are looking at," explained Brown.

Star trackers have been used in various forms since ancient times. The sextants used by ancient mariners are an example of early star

tracker technology. And though the star tracker developed by Brown is far more complex than a mariner's sextant, it is similarly designed to tell an operator where his craft is relative to the stars in the sky.

"When taking pictures of the stars for general navigation, there are many systems that provide course attitude information offering accuracy down to a tenth of a degree, but if you want accuracy down to arc seconds, 1/3600th of a degree, then you need to use a star tracker," explained Brown. "They offer the highest accuracy pointing that you can get in space. They are very valuable for a lot of different missions and we would like to make them accessible to research groups like the one here at NPS."

“

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AMAZING TO ME.

—Julian Brown

Star trackers are currently employed by most large commercial satellites, but they are generally too large and too costly to be employed aboard small satellites.

“They are also really expensive. A good model will cost hundreds of thousands of dollars and installing a single star tracker on a nanosatellite would wipe out a significant portion of your total satellite budget,” said Brown.

According to Newman, school and university budgets for nanosatellites usually cap out between \$50,000 to \$100,000, whereas government-sponsored satellite budgets range from anywhere between \$100,000 to \$3,000,000.

“We want to create much cheaper star trackers and put them on satellites that would not normally be able to afford them due to budgetary constraints,” Brown noted.

Newman and his colleagues got Brown started on an appropriate algorithm and purchased the necessary hardware to advance the project, but Brown was thwarted by the realization that there was not an algorithm available that was strong enough to work in conjunction with the off-the-shelf parts that he was using.

“I ran an algorithm on a Beagle-Bone Microcomputer, but it ran very slowly. I wanted something that could run continuously so I rewrote the algorithm making it about a thousand times faster,” said Brown. “I knew that once I had a good algorithm written that the hardware wouldn’t matter as much so I devoted a lot of time to getting it right.”

And Brown’s algorithm not only had to work when applied to inexpensive off-the-shelf parts, it had to be “independent to the first order.”

“If you see a fist, you know roughly how big it is because you have seen a fist before. But if you had only one eye, like a star tracker, you wouldn’t know if the fist was close or faraway, except that when it got closer, you would not be able to see as far around it.

“Similarly, when you see pictures of the earth, you are seeing about half of it. When you are really close in, you cannot see as much of it. That’s a second order affect. To the first order, the fist looks the same. It’s just scaled bigger. But with second order effects, you can see around the fist,” Brown explained. “A nondimensional algorithm is independent to the first order, which means you remove the scale factor. If you have a shape, say a triangle, it should look the same whether it’s small or large.”

All of this matters because there are a lot of things that can go wrong during a satellite launch and when a satellite is released into space, there is rarely an opportunity for a do-over.

“[During a launch] the shaking of the rocket can dislodge a lens or cause it to change position. If the lens is moved closer, [and your algorithm is not independent to the first order], it can make everything look bigger or smaller depending upon its location, which can throw off all of your calibrations, especially when measuring the distance between stars.

“But by taking the ratios between stars, you get shapes and not just lengths, which allows you to make an algorithm that does not rely upon the calibration of your equipment. It will still work even if things get moved around,” said Brown.

Brown’s work comes on the heels of increased research interest in satellite technology and greater industry and academic reliance on the information gleaned from commercial satellites.

“Because satellites are becoming so popular in research, we would like to develop our own nonprivate star tracker that we can build ourselves and hopefully pass off to private industry once we have designed the basics,” said Brown.

Newman agrees. His goal is to develop a government-owned, government-shared star tracker whose technology can be transferred to industry and spur motivation to improve the existing star trackers on the market.

The **Naval Postgraduate School (NPS)** provides relevant and unique advanced educational and research programs to increase the combat effectiveness of commissioned naval officers. Its headquarters are located in Monterey, California.

SSC ATLANTIC YEAR IN REVIEW

BY KELLY THOMPSON, *SPACE AND NAVAL WARFARE SYSTEMS CENTER ATLANTIC*

The Space and Naval Warfare Systems Center (SSC) Atlantic Outreach Program had a banner year in 2015, reaching more than 30,000 students in grades K-12 through a variety of STEM projects. SSC Atlantic has a very active volunteer staff based in Charleston, South Carolina; Hampton Roads, Virginia; and New Orleans, Louisiana. In 2015, SSC Atlantic volunteers exceeded 10,000 hours of service time in their surrounding communities.

The STEM outreach program supported a variety of activities such as robotics, career fairs and STEM festivals. We are proud to sponsor and host several large-scale annual events including IT Shadow Day, DimensionU, Palmetto Cyber Security Summer Camp, Palmetto Cyber Defense Competition (PCDC), Palmetto Digital Forensics Competition, Girls Day Out and Robotics Summer Camp. The following highlights some of these events.

DimensionU



DimensionU teams compete for a place at the DoD Math Games final. (All photos by Joseph Bullinger)

Children love to play video games, and SSC Atlantic's STEM outreach program connects with students by meeting them where they are. DimensionU is an interactive Department of Defense (DoD) video game that enhances students' skills in math. To be successful at the game, students must solve problems to move to the next phase of the game.

In 2015, SSC Atlantic hosted 24 middle school teams in a DimensionU Tri-County Competition in Charleston. These teams went head-to-head for a chance to return and compete in the annual DoD Math Competition—a virtual competition with students from other states, sponsored by

various DoD labs. This year, our Navy team was the overall winner.

We are proud of SSC Atlantic's efforts to promote DimensionU in our local schools, and of the tremendous support provided by our volunteers during the competitions.

Palmetto Cyber Security Summer Camp

SSC Atlantic hosted and sponsored the 2015 Annual Cyber Security Summer Camp in collaboration with the Charleston County School District and the Lowcountry Technical Academy. SSC Atlantic has continued a tradition for the past three years of providing high school students with a week of hands-on training designed to educate them on new skills and encourage their interest in STEM careers. Campers were able to choose from tracks that included cyber security, programming, robotics and computer network defense. SSC Atlantic professionals taught these classes and had campers deconstructing computers, writing HTML, building robots and other fun, educational activities.

This year's popular camp was made extra special by adding a new track with curriculum that inspired middle school campers. For this track, campers learned Snap Circuits, scratch programming and internet security, to name a few.

On the last day, campers donning "Defend Your Domain" t-shirts proudly filed into the auditorium for a wrap-up and awards ceremony that brought an end to the week-long adventure in cyber, but a brand new beginning to their futures in cyber security.



Learning something new at summer camp.

Palmetto Digital Forensics Competition

In September 2015, a Palmetto Digital Forensics Competition was hosted for the first time for students in grades 9-12. Competition participants were provided with several rounds of exercises at various levels of difficulty that they were required to solve by forensically examining provided artifacts, answering questions and articulately describing the solution methodology.



A team competes at the Palmetto Digital Forensics Competition.

This year's competition had 20 teams from 14 different schools, both public and private, made up of 51 students from various counties in South Carolina and with forensic subject matter experts (SMEs) from the SSC Atlantic Cyber Forensics Program. In addition to extensive planning and support for the competition, SMEs analyzed more than 163 exercises submitted by the participating teams during the competition. The objective of the Palmetto Digital Forensics program is to encourage high school students to engage in competitions focused on digital forensics, to enhance student's skills, and to generate interest in critical thinking, research and exploration in the field of "cyber."

Girls Day Out

In 2015, SSC Atlantic, in collaboration with local colleges and business, sponsored the largest Girls Day Out (GDO)



Participants learn about Snap Circuits at Girls Day Out.

to date in Charleston and Hampton Roads. GDO is an informative STEM event for rising eighth and ninth grade girls, and is designed to inspire the next generation of women to pursue STEM careers. The program is structured to educate girls and their parents on how to make appropriate curriculum choices in high school that will prepare them for STEM degrees, as well as by providing them with college and university requirements for STEM degree programs. GDO focuses on fun and educational activities to introduce girls to various STEM topics such as cyber security and robotics. The girls are taught important life skills such as how to dress appropriately and conduct themselves on interviews, social events, etc. The event also features a keynote speaker who is a successful female in a STEM field, a business and college expo, and a panel of female STEM professionals who give the girls an opportunity to ask questions and listen to personal testimonies.

Robotics Summer Camp

SSC Atlantic is proud that their new professionals orchestrated their first Robotics Summer Camp in New Orleans. During the week-long camp, 24 students from area school districts participated in hands-on activities such as robotics and design engineering, went on tours of the New Orleans Navy Enterprise Data Center and Help Desk, and experienced demonstrations from NASA, FIRST Robotics, the Southern University of New Orleans Physics Department and the University Of New Orleans Department of Computer Science. The goal of the camp was to create excitement in the area of STEM and to also introduce and expose students to technology that will start them on a path to become the engineers and developers of the future.



Students program their robot during the robotics summer camp.

The **Space and Naval Warfare Systems (SPAWAR) Center (SSC) Atlantic** is a Department of the Navy organization, reporting directly to the SPAWAR Command located in San Diego, California. SSC Atlantic meets the nation's demands for uninterrupted vigilance, fail-safe cybersecurity, adaptive response and engineering excellence by delivering secure, integrated and innovative solutions to many naval, joint and national agencies.

MEET NAMRU-SA'S 2015 NREIP SUMMER INTERN, EBONY MILLER

BY NAMRU-SA PUBLIC AFFAIRS



During her NREIP Internship at NAMRU-SA, Ebony Miller will gain valuable laboratory experience that she can carry with her as she finishes her master's degree in Public Health at San Diego State University, San Diego. (Photo by Flisa Stevenson, NAMRU-SA Public Affairs)

Ebony Miller, Navy Reservist and second-year graduate student at San Diego State University (SDSU), was one of 75 graduate students selected to participate in a 10-week paid internship with the Naval Research Enterprise Intern Program (NREIP).

Miller's internship will be in conjunction with the Naval Medical Research Unit San Antonio's (NAMRU-SA) Department of Biomaterials and Environmental Surveillance. She will work under the guidance of Dr. Amber Nagy and Nagy's Immunologist and Lead Technician, Ann Marie Foushee.

Miller's project will focus on the potential health effects associated with inhaled dental laboratory materials. Specifically, she will test the biocompatibility of dental materials that contain nano-sized particles.

The use of nanoparticles in dental materials is becoming more commonplace since material size can enhance parameters such as strength and durability. However, the biological response associated with exposure to nanoparticles is lesser known. The size-dependent effects that can improve material performance must also be safe for humans and the environment.

To understand these effects, Miller will characterize the size, charge and agglomeration of nanomaterials that are

frequently used in dental laboratories to make molds and casts of teeth. She will also learn cell culture, viability assays and how to measure inflammatory proteins in response to exposure to dental dusts. The goal of her project is to help answer the question: Do nanodusts contained in dental materials have an effect on bronchial airway cells?

Miller's research will set the stage for future studies where real-time air samples will be collected from fully operational dental laboratories. In this project, air will be sampled and the nano-fraction will be characterized by size and composition so better laboratory simulations can be conducted. The research project will hopefully supplement ongoing hazard and risk assessments with respect to indoor nanoparticle exposure.

Nagy and her team plan to introduce Miller to the nuances of scientific research by immersing her in daily lab tasks, and familiarizing her with scientific research articles, the Internal Review Board Process, and Biosafety Level II training. It is NAMRU-SA's intention that Miller will gain valuable laboratory experience that she can carry with her as she finishes her master's degree in Public Health.

Miller's transition to laboratory science will be an exciting one. She graduated from the United States Naval Academy, Annapolis, in 2007 with a Bachelor of Science degree in Political Science with a concentration

in International Relations. She served as a Surface Warfare Officer, as an active duty officer, for seven years prior to pursuing her interests in environmental health and sciences.

Miller is a native of Riverside, California, and once the internship is complete, she will be returning to SDSU to finish her degree. After completing her degree, Miller wants to go back on active duty and be redesignated into the Medical Service Corps as an Environmental Health Officer.

NREIP is sponsored by the Office of Naval Research and is a 10-week intern program designed to provide opportunities for undergraduate and graduate students to participate in research, under the guidance of an appropriate mentor, at a participating Navy laboratory.

To culminate her 10 weeks at NAMRU-SA, Miller will be making a poster of her research and presenting it to the NAMRU-SA Command.

Naval Medical Research Unit San Antonio's (NAMRU-SA) mission is to conduct medical, craniofacial and directed energy biomedical research, which focuses on ways to enhance the health, safety, performance and operational readiness of Navy and Marine Corps personnel and address their emergent medical and oral/facial problems in routine and combat operations.

STUDENT PROFILE: FRANK BOGART



INTERNSHIP: Naval Research Enterprise Internship Program (NREIP)

SCHOOL: University of California San Diego

GRADE: Senior

INTERNSHIP LOCATION: Space and Naval Warfare Systems (SPAWAR) Center (SSC) Pacific, San Diego, California

DIVISION: Unmanned Maritime Vehicles Lab

MENTOR: Dr. Vladimir Djapic

What was the best part of your internship? The teamwork and friendship of the intern developed system and directly applying my computer vision/robotics talents to the project for which I was recruited.

What did you get out of your experience? I am now confident in my abilities to support the development of any unmanned system by adding sensors, computers, communications and autonomy algorithms within a system's software framework.

What recommendations do you have for students applying to this program? Work hard to think and understand what you enjoy in school. Know what you like and what you're good at. Stay concise and focused on improving that skill. Work that angle into your resume and applications. If a project has a need for that skill, you will be on the top of their list.

What's next for you? Apply to the SPAWAR New Professionals program. I hope to continue to work on my project or any other computer vision/robotics platform that the Navy needs.

Note: Frank's NREIP internships were made possible by the support and sponsorship of the Office of Naval Research. Frank participated in two tours within SSC Pacific's Center for Innovation in Naval Technologies-Information Dominance (CINT-ID) initiative. This effort works to create and enable the encouraging science and technology innovation and sound engineering practices to potential new naval scientists and engineers via strong mentoring. Frank is a success story for SSC Pacific's CINT-ID initiative.

The **Naval Research Enterprise Internship Program (NREIP)** is a 10-week undergraduate and graduate summer research internship opportunity at a naval laboratory or warfare center. Selected applicants work under the guidance of a mentor conducting naval-relevant research at one of nearly 30 sites across the country.

USNA “SET SAIL” STEM EDUCATOR TRAINING: LONG-TERM IMPACT

BY SARAH DURKIN, UNITED STATES NAVAL ACADEMY

The United States Naval Academy (USNA) STEM Center is focused on addressing an urgent national need for more young people to pursue careers in science, technology, engineering and mathematics. The STEM Center provides STEM Educator Training programs, designated as “SET Sail,” to instruct teachers in methods for implementing quality STEM education in and out of schools. Training focuses on project-based learning methodology, with an emphasis on a hands-on approach, connections to real-world applications and techniques for student engagement.

SET Sail programs are offered year-round to meet the needs of educators, ranging from several hours to week-long sessions. Educators include K-16 teachers from public, private and Department of Defense Education Activity schools around the country and overseas, as well as informal educators. Workshops are held onsite at USNA in Annapolis, Maryland and at remote locations.

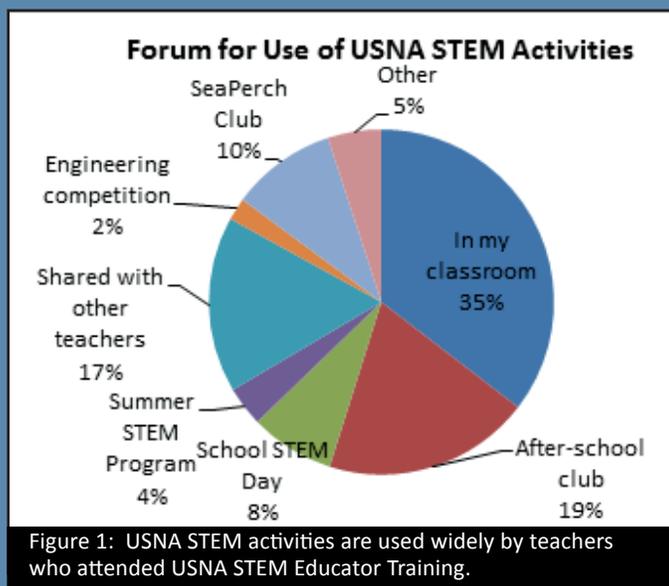
The STEM Center has amassed a growing list of educators who have attended training since 2011. These teachers belong to the USNA STEM educator community of practice, totaling 1,000 educators in August 2015. The STEM Center follows these teachers over the long term

to assess the impact of our programs. In May 2015, an annual survey was sent to teachers in the database to evaluate the impact of training on STEM teaching, and to assess the use of USNA STEM curriculum and methodology.

Survey data shows that each curriculum area presented at STEM workshops has since been used or adapted by teachers at their own schools. While many activities have been used in the classroom, they also have been implemented in after-school clubs, summer STEM programs, engineering competitions and school STEM days — as well as shared with other teachers (Figure 1). Teachers who attend USNA STEM workshops are equipped to return to their schools and train other teachers, spreading the curriculum and methodology far beyond a single classroom.

Teachers were asked to describe how attending USNA training influenced them as a STEM educator.

Respondents cited growth in activities and ideas, project-based learning methodology, engagement techniques, motivation and self-confidence and use of real-world applications in the classroom (Figure 2). Upon implementing the methodology and activities learned at the USNA training, teachers notice a difference in student



STUDENT PROFILE: BROOKE MERRYMAN



INTERNSHIP: Science and Engineering Apprenticeship Program (SEAP)

SCHOOL: Home School, Fairfax County, Virginia

GRADE: Senior

INTERNSHIP LOCATION: Naval Surface Warfare Center, Carderock, Bethesda, Maryland

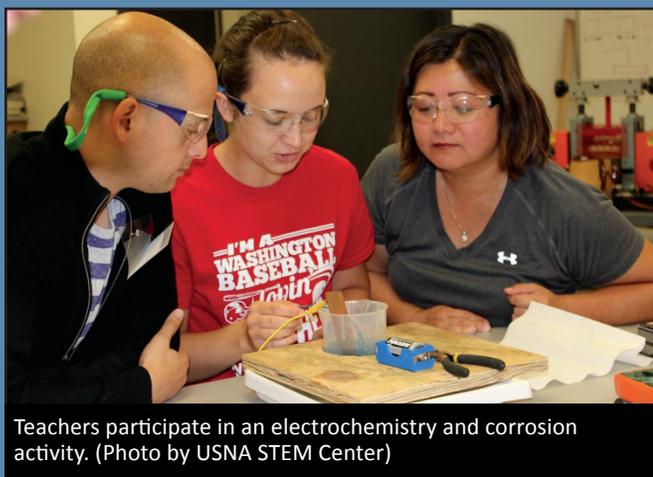
DIVISION: Welding, Processing & NDE Branch

MENTOR: Jennifer Wolk

What was the best part of your internship? The best part of my internship was conducting an experiment in testing 3D printed polymers for swelling by soaking them in liquids. I learned a lot from experience such as using 3D printers, doing

learning. "My experience influenced me tremendously," shared Audre Van Story, a New Jersey teacher who attended SET Sail Summer 2014. "I overcame my reluctance to try new things and I am more committed to allocating time for collaboration and hands-on learning. Students are understanding concepts more deeply, asking many thoughtful questions and are more engaged in learning."

Teacher responses to the long-term survey indicate that USNA STEM Educator Trainings are effective in improving teacher confidence and motivation to promote hands-on, project-based learning in their own classroom. Furthermore, many teachers are empowered to share their training with colleagues at their own schools and with other teachers in their regions. In this way, USNA STEM teaching methods and philosophy are imparted to a wide range of students, teachers and schools, helping to share the STEM message with a wider audience.



Teachers participate in an electrochemistry and corrosion activity. (Photo by USNA STEM Center)

How did training influence you as a STEM educator?

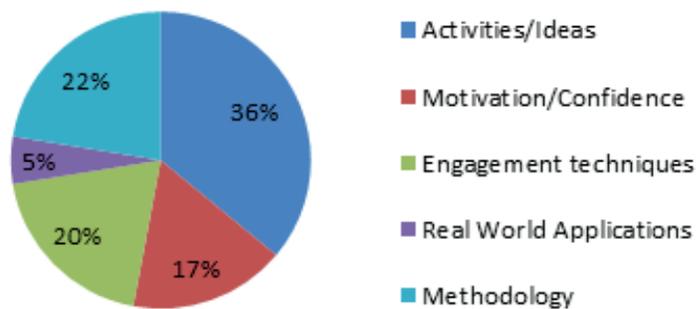


Figure 2: USNA STEM Educator Training has positive impact on teachers.



Teachers work on an engineering design challenge. (Photo by USNA STEM Center)

The **United States Naval Academy (USNA)**, as the undergraduate college of the naval service, prepares young men and women to become professional officers in the U.S. Navy and Marine Corps. After four years of undergraduate study and military training, midshipman graduate with Bachelor of Science degrees and reserve commissions.

lab work, analyzing data, and writing a report. It was fun doing hands-on work and picking out the variables for my experiment.

What recommendations do you have for students applying to this program? Take advantage of all the opportunities for learning. Not only can you learn more about science and engineering through the projects the mentors give you, you can also learn about what other people are working on and about the working environment. I learned so much from the variety of people I got to talk to in the labs and offices.

What's next for you? After I complete my last year of high school, my hope is to attend Virginia Tech next fall and pursue a degree in engineering. My desire is to use engineering to help people in developing countries.

The **Science and Engineering Apprenticeship Program (SEAP)** is a eight-week high school summer research apprenticeship opportunity at a naval laboratory or warfare center. Selected applicants work under the guidance of a mentor conducting naval-relevant research at one of nearly 25 sites across the country.

THE U.S. NAVY'S YELLOW BRICK ROAD TO HIRING STEM GRADUATES

BY DAN BROADSTREET, NSWC PDC PUBLIC AFFAIRS

Naval Surface Warfare Center Panama City Division (NSWC PCD) mechanical engineer Bill Porter and NSWC PCD physicist Dan Flisek partnered with Bay County School District, Gulf Coast State College (GCSC), Embry-Riddle Aeronautical University and Florida State University Panama City Campus (FSU PC) to present a SeaPerch seminar to Florida's Northwest Panhandle teachers.

"This is the beginning of the yellow brick road to immerse students in science, technology, engineering and mathematics (STEM) thinking," said Porter. "It's also used to prepare them for challenges they're going to face should they consider becoming a naval engineer."

Flisek said he also considered the SeaPerch program a long-term recruitment campaign for the U.S. Navy.

"SeaPerch is an underwater robot that kids can build. It's an underwater remotely operated vehicle (ROV) built out of PVC pipes, DC motors and a control box. This project requires them to learn skills to build ROVs, which is a big part of what our Naval Warfare Center researches," said Flisek.

According to NSWC PCD STEM Outreach Coordinator Ed Linsenmeyer, only five percent of native-born United States graduates are obtaining STEM-related degrees.

"It's a problem,

causing our nation to fall in rank from 3rd to 17th in the world regarding engineering graduates," said Linsenmeyer.

The SeaPerch robotics program is sponsored by the Office of Naval Research (ONR) and managed by the Association for Unmanned Vehicle Systems International Foundation.

"It is structured, of course, to inspire students in the STEM disciplines and to increase our nation's STEM graduates," said Linsenmeyer.

According to GCSC Associate Dean of Program Development Dr. Steve Dunnivant, direct funding for this SeaPerch campaign was being provided by Embry-Riddle Aeronautics University, a new partner to GCSC and FSU PC. The funding for this particular SeaPerch competition campaign is providing SeaPerch kits for a large part of Florida's Panhandle school districts, including school districts in Escambia; Santa Rosa, Okaloosa, Walton, Holmes, Washington, Calhoun and Bay counties.

"The SeaPerch, as an ROV, is a

fundamental step toward building unmanned systems. And, unmanned systems are reliant upon sensors," said Dunnivant. "So essentially, you're putting sensors on unmanned systems to gather data, geospatial intelligence and those activities help create careers."

Dunnivant said GCSC and Embry-Riddle Aeronautical University have partnered to create a 'Two-plus-Two' program.

"Essentially this will require students to study two years at GCSC, then transfer to Embry-Riddle Aeronautical University to earn certifications and/or bachelor degrees in drone technologies and related career fields," Dunnivant said.

Porter told teachers from various districts that in addition to introducing the program to teachers, the SeaPerch campaign intends to get students excited about building the underwater ROVs.

"We're introducing teachers to how fun this hands-on SeaPerch activity can be for their students. And, once

the teachers come back in late October to get their full training in how to build these, they'll be able to initiate STEM clubs for their students at their schools," said Porter. "But, this doesn't end there. We intend to arrange our own regional competition. This will give the teachers something to work toward with their students. What we're introducing to the Florida Panhandle is the opportunity for teachers to prepare classroom champions to win a regional competition, so those students have



Naval Surface Warfare Center Panama City Division Mechanical Engineer Bill Porter (standing left of center with black sunglasses and white polo shirt) gathers with Florida Northwest Panhandle teachers at the Panama City Boys and Girls Club to introduce operating, handling and maneuvering of the SeaPerch underwater remotely operated vehicles. (Photo by Dan Broadstreet, NSWC PCD)

a chance to compete with their peers in the National SeaPerch Challenge."

A biology teacher at Rutherford High School, Beverly Barron, said she couldn't wait to get started. According to Barron, her daughter experienced a SeaPerch introduction mentored by engineers from NSWC PCD approximately five years ago.

"My daughter's name is Abby Barron and she told me Navy engineer Paige George inspired her so much when coaching her that she knew right then that she wanted to become an engineer, too," said Barron.

Surfside Middle School math and pre-engineering teacher Eddie Mills said he's had his students involved in the SeaPerch program for the past five years.

"When my students are introduced to STEM projects like SeaPerch, I get inspired. I've actually seen students, who normally didn't care for the STEM courses, change their attitudes entirely," said Mills. "Not only is this a great way for our students to learn, but it's a great opportunity for us as teachers to learn, too. This is truly one of the best ways to teach in the world!"

The **Naval Surface Warfare Center Panama City Division (NSWC PCD)** is part of the Naval Sea Systems Command and one of the major research, development, test and evaluation laboratories of the U.S. Navy and boasts a wide base of expertise in engineering and scientific disciplines.

STUDENT PROFILE: KRISTINA DRONENBURG



INTERNSHIP: Science, Mathematics & Research for Transformation (SMART)

SCHOOL: University of Colorado at Colorado Springs

DEGREE: Bachelor of Science in Physics

WORKFORCE LOCATION: Naval Air Station Patuxent River, Maryland

DIVISION: Antenna Systems Branch

SUPERVISOR: Leonard De La Cruz

What was your inspiration for joining DoD? It was very important for me to be able to support the Armed Forces as a civilian. My dad was in the Navy, my sister-in-law is in the Air Force...every generation in my family had someone in the military going back to the Revolutionary War. I am very passionate in that I help save lives, make the warfighter's job easier and help develop technology that makes us the best military in the world. Working for DoD means a great deal to me because I knew I could work anywhere in the world and support a cause I truly believe in.

What was the best part of your scholarship? SMART gave me a path and an avenue to make my dreams a reality. SMART gave me the ability to not worry about school loans, which is a huge deal. They provided me the opportunity to start my career very young and continued to provide this path for me into the Naval Air Systems Command. SMART allowed me to step forward and brought me from not knowing where I was going, to giving me a clear path to help these military members—I can develop technology for the Navy and it really provided that spark for my career.

What recommendations do you have for students applying to this program? SMART as an organization is outstanding—very good people to work with. SMART provides some incredible opportunities, both Navy and DoD-wide, for an amazing career. You really get to help some great people and help these military members. I think that if you are torn (as to what scholarship to apply for), I would really look at SMART. I had other options, but for me, being involved in the DoD was bigger and the highest honor.

The **Science, Mathematics & Research for Transformation (SMART)** program offers scholarships to undergraduate, graduate and doctoral students who have demonstrated ability and special aptitude for training STEM fields. The DoD also offers career opportunities for students to continue their research as civilian employees at a DoD laboratory after graduation.

THE **NEW** NAVAL STEM WEBSITE

The new Naval STEM website provides information about naval STEM programs, partners and resources in a single site. This site will continue to evolve and offer content for users interested in learning more about Naval STEM, how to participate in specific programs, how to apply for internships and much more. Check out the website and send us your thoughts! We've included a few details about what you can find under the tabs on the new site below!

naval STEM

THE U.S. NAVY AND MARINE CORPS SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EFFORTS

Search...

About - Naval STEM Stakeholders - Education Initiatives - Workforce Initiatives - Resources

NAVAL STEM

The Department of the Navy's STEM program aims to inspire, engage, and develop the current and future generation of naval scientists and engineers in coordination with other federal STEM initiatives.

Education Initiatives

INSPIRE ENGAGE EDUCATE

Programs that inspire, engage, and educate K-12 students.

Workforce Initiatives

ATTRACT & EMPLOY DEVELOP & RETAIN

Programs that employ, retain, and develop the future and current Naval STEM Workforce.

Naval Stakeholders

Learn more about the organizations and people leading grassroots Naval STEM efforts across the country.

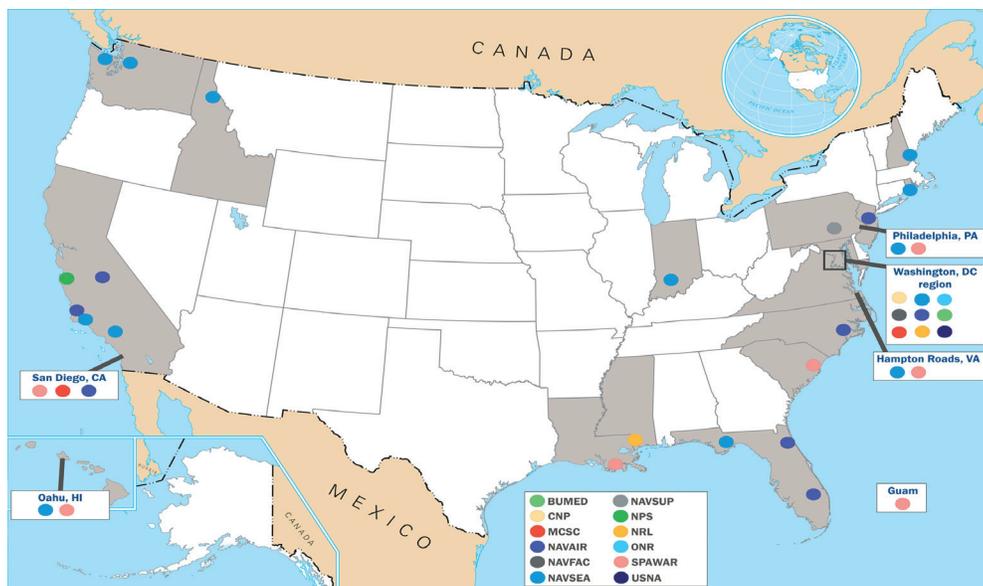
Visit the Naval STEM website at:
<http://navalstem.navylive.dodlive.mil>

About

Learn about the Naval STEM executive and how Naval STEM is coordinated across the country. Visit the Contact Us page to send us your ideas and recommendations!

Naval Stakeholders

The Naval STEM community consists of a variety of diverse Navy and Marine Corps organizations that each offer education, outreach and workforce initiative in their communities.



Education Initiatives

Discover some of the programs or opportunities offered for students and educators to engage with Naval STEM and learn about naval science and technology. This section includes information on:

- expos, festivals and demos
- classroom activities and curriculum
- extracurricular opportunities
- K-12 teacher training information



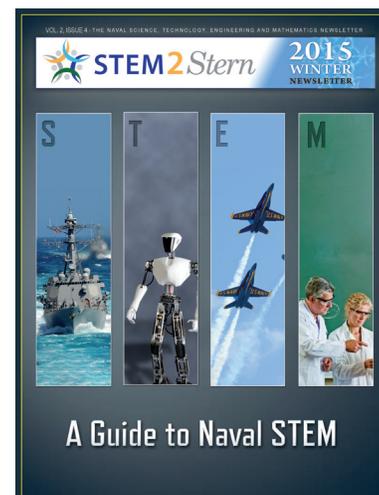
Resources

Check out the resources page to find collateral materials related to Naval STEM. Currently this section includes all of the previous Naval STEM2Stern newsletters released over the last few years. This section will ultimately include reports and other documents related to Naval STEM.

Workforce Initiatives

We are focused on workforce issues in addition to the traditional education and outreach efforts. Visit this section to learn about:

- internships
- fellowships and scholarships
- faculty and professional development opportunities



U.S. NAVAL HOSPITAL OKINAWA MENTORS STUDENTS

BY JOE ANDES, UNITED STATES NAVAL HOSPITAL OKINAWA PUBLIC AFFAIRS OFFICE



High school students on Okinawa participated in the Science, Service, Medicine and Mentoring (S2M2) program at United States Naval Hospital Okinawa (USNHO) from July 27 to July 31. S2M2 is an annual event first executed at USNHO during the summer of 2012. The goal is to take local high school students from diverse cultural backgrounds and cultivate them into the next generation of health care professionals.

"These are some of the top students in the local area," said Lt. Danilo Mendoza, a registered nurse at USNHO and one of the participating staff members. "They were selected to be part of our hospital immersion program because they showed or spoke of an interest in the medical field."

A group of 20 students took part in this year's program, coming from the AmerAsian School in Ginowan City, Kadena High School on Kadena Air Force Base and Camp Foster's Kubasaki High School. The students were put through an intense weeklong program that included panel discussions, hands-on medical applications and workshops, all led by subject matter experts from USNHO. Participating staff ranged from trained surgeons to junior hospital corpsmen.

Planning for S2M2 began three months in advance and included visits to schools to introduce prospective students to the program, applicant review and selection, and the recruitment and assignment of volunteers. Other work ranged from coordinating schedules, tours and activities to obtaining and preparing dissection specimens.

"We really want to spark the interest in health sciences in young minds," said Mendoza. "A lot of work was put into this iteration of the program to do just that."

A total of 75 USNHO personnel volunteered in various

capacities. Volunteer participation ranged from two hours to nearly 30 hours during the course of this 40-hour program. Volunteers came from each directorate of the hospital, as well as medical assets of other Okinawa-based U.S. military commands. The volunteers planned and executed presentations and activities with the emphasis placed on clinical applicability, hands-on experience and safety.

"Personally, I like to do hands-on activities, so this is definitely amazing for me," said Mikayla Bredshall, a participating student. "They're taking time from their work day to show us what they and other doctors do at the hospital."

Sailors didn't have to wait long to discover the effects they had on participating students. Within hours of the 2015 program's completion, one of the Japanese-American students wrote an email to the program coordinators stating that despite having had no interest in a medical career prior to S2M2, his experiences during the week had convinced him to pursue a healthcare career. Another student cited her rotation in the Neonatal Intensive Care Unit as sparking an interest in pediatrics. These revelations were relayed on the post-program evaluation forms, which will be used to further strengthen the program.

In addition to fine-tuning future curriculum based on participant feedback, USNHO will also continue to interact with students who have completed the program, to ensure they have the support needed to pursue what may be a lifelong calling to service and care of their fellow human beings.

"Hopefully out of this we'll be able to grow some aspiring doctors and nurses—our future health care professionals," said Mendoza.

The **U. S. Naval Hospital Okinawa** is the largest overseas military treatment facility in the Navy, serving a beneficiary population of 55,000 active duty personnel, family members, civilian employees, contract personnel and retirees. The facility also provides referral services for more than 189,000 beneficiaries throughout the western Pacific. For more news and information about U. S. Naval Hospital Okinawa, visit www.navy.mil/sites/nhoki or the hospital's official Facebook page at www.facebook.com/usnho.

THE POWER OF MENTORING

BY FIORENZO OMENETTO, PH.D., TUFTS UNIVERSITY

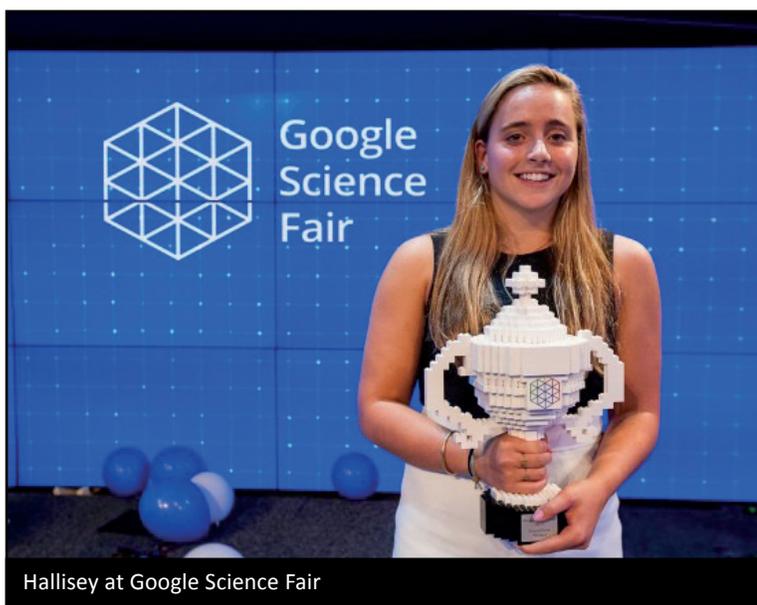
In 2011, I delivered a TED Talk about the potential of silk as a material platform for high-technology applications. Little could I have imagined then that four years later, my talk would inspire a 16-year-old to come up with a new, potentially life-saving way to test for the Ebola virus. The story is a good lesson for both teachers and students on the importance and impact of mentoring.

That's when she found my TED Talk. Fascinated with the possibilities of silk, she emailed me to introduce herself, describe her research program and ask if I would meet with her to discuss the applicability of silk to her research. She hoped for a response but, frankly, she also recognized that researchers are busy people and that it was entirely possible that her inquiry would hit a dead end.

Instead, that email led to a series of meetings and exchanges over several weeks among Olivia, me and Benedetto Marelli, a postdoctoral research associate in my lab in the Department of Biomedical Engineering at Tufts University. We talked with Olivia about the stabilizing properties and potential of silk protein, which had never been used in the way she proposed before, and discussed other aspects of her project as well.

Some have asked me why I responded to Olivia in the way I did. The question left unsaid is, "Why would a researcher as busy as you spend time helping a high school student?"

The short answer is that there is always time for genuinely motivated people, and age doesn't really matter. In fact, I think many scientists, me included, take it as a serious obligation to help young people who want to do research. In return, I and others in my lab found Olivia's dedication and enthusiasm to be rewarding and inspiring.



Hallisey at Google Science Fair

Olivia Hallisey, now 17, of Greenwich, Connecticut, was named the grand prize winner of the 2015 Google Science Fair. Her invention, the **Ebola Assay Card**, promises to make it possible to detect Ebola earlier, faster, far less expensively and without need of refrigeration, which current Ebola detection methods require. Olivia's findings could curb Ebola's spread and reduce deaths significantly. For her work, Time Magazine recently named her one of the **30 most influential teens of 2015**.

Her path to these well-deserved honors started with some Internet sleuthing. Olivia read research papers that she found online that had been written by David Kaplan, Stern Family Professor of Engineering and chair of biomedical engineering at Tufts University's School of Engineering, and me. She theorized that silk's stabilizing properties might make her Ebola Assay Card temperature-independent and permit water-activated detection of Ebola antigens.

There is nothing more personally satisfying than seeing a student transform into a collaborator and colleague. That's why I encourage both teachers and students to be open not only to the wonders of STEM but also to the power of mentoring.

“

...THERE IS ALWAYS TIME FOR
GENUINELY MOTIVATED PEOPLE, AND
AGE DOESN'T REALLY MATTER.

— *Fiorenzo Omenetto*

Dr. Fiorenzo Omenetto is an associate dean for research and Frank C. Doble professor for biomedical engineering in the School of Engineering at Tufts University. His research program is currently supported in part by a grant through the Office of Naval Research's (ONR) Biomaterials and Bionanotechnology Program, managed by Dr. Laura Kienker. His ONR-sponsored research involves an investigation of silk for the generation of functional materials for applications in technology, with a focus on electronic applications (batteries and energy storage).



WITH INFINITY TO BEYOND!

BY SHANNON MENSI, NAVAL RESEARCH LABORATORY
STENNIS SPACE CENTER

Nestled on the banks of the Pearl River, amidst the palmettos and pine trees on 199 acres of NASA's 125,000-acre buffer zone, sits Mississippi's premier science education center.

Right before crossing into Mississippi from Louisiana along Interstate 10, there is little to see. Aside from the live oaks heavy with Spanish moss, you may pass an occasional pickup truck pulled off the highway, parked and facing swampy Cypress knees. Men in white rubber boots carry bright orange baskets as they gather wild crawfish for dinner.

Then you rise above the Pearl River and see the canopies of oaks and pines stretching for miles. To the north, far off in the distance, square, manmade mountains demand your attention. If you were closer you would see each rocket engine test stand, ornate with steel girders and stairways that climb to the sky. To the south, a river snakes through marsh grasses, occasionally brushing up against a sandbar. Ahead, just after the Welcome to Mississippi sign, in a clearing of trees to your right, is INFINITY Science Center.

It's a curious juxtaposition—this sharp-angled, glass-walled building with exposed metal trusses that surveys a small marsh habitat from the high safety of a significant concrete foundation. The light bounces off its windows and onto a rocket engine, a Navy SEAL's riverine boat, a NOAA weather buoy and other examples of man's technological feats.

The Naval Research Laboratory at Stennis Space Center,

Mississippi, (NRL-SSC) began its STEM program in 2009, when it received funding via the National Defense Education Program. Since 2009, NRL-SSC has developed relationships with teachers, principals, superintendents, university leaders and community partners to InSuRe the Navy's future workforce—inspire students to pursue math and science careers, share the Navy's mission with the local community and retain the best and brightest to staff our Navy's STEM-rich local commands.

INFINITY opened its doors in 2012 and initially struggled to find its way as a new quasi-NASA visitor center/nonprofit/educator resource without a solid funding stream and laden with federal and state regulations. As evidence of its challenges, 70-something former astronaut and Mississippi native Fred Haise, who saw INFINITY's potential, would visit INFINITY daily to do whatever needed done—whether swinging a hammer or charming potential donors.

In 2014, INFINITY hired new leadership, determined more than ever to meet its goal: "Be the place where the curious at any age can lose themselves in the depths of the ocean and the farthest reaches of space." They staffed the science center with former scientists and professional educators from South Carolina to Missouri. They reached out to schools and companies across the Gulf region, sharing their vision.

In 2015, following the 2012 oil spill in the Gulf of Mexico, INFINITY received a \$10 million grant to develop interactive exhibits at the science center to enhance understanding

of the Gulf Coast's natural resources. Infinity leadership traveled three miles north to meet with Stennis Space Center leadership—NASA, NOAA, Navy and other agencies—to determine how to better tell the unique federal city's science story.

After providing personnel to support some of INFINITY's outreach endeavors and discussing their future plans, the NRL-SSC STEM team decided to be a part of their impressive undertaking. This past summer, NRL-SSC executed a formal educational partnership agreement with INFINITY.

INFINITY's mission is to "be a place where guests can explore our earth, oceans and space through deepening levels of involvement, ranging from walks through museum galleries, bus tour rides to historic sights, memorable videos and live presentations, engaging, unique citizen science programs and occasionally participating in world-class historic events."

Stennis Space Center employs approximately 5,000 civilian, military and contract personnel. In 1976, the Naval Oceanography Command broke ground on its first building at the then-named Navy Space Technologies Laboratory. Fast forward 39 years and the Navy now employs roughly 2,500 people at Stennis—more than any other organization. The Navy is largely responsible for making Stennis home to more oceanographers than anywhere else in the world.

In October 2015, NRL-SSC formed an alliance with the Commander, Naval Meteorology and Oceanography Command (CNMOC), to jointly support INFINITY together as one unified Navy STEM team.

CNMOC, Mississippi's only admiral, oversees nearly 1,000 civilian scientists and engineers in addition to officer and enlisted STEM personnel. Recently realigned under Information Dominance Forces, CNMOC is keenly interested in staffing its commands with a highly skilled STEM workforce.

Since formalizing our relationship, NRL-SSC has begun working with INFINITY and CNMOC on a variety of projects.

In 2016, NRL-SSC will send a research scientist and an operational CNMOC scientist to accompany two INFINITY educators to attend STEM training at the U.S. Naval Academy. Upon return, the four-person team will employ the activities and methods learned at the Academy with the science center's student guests. INFINITY educators will also employ a train-the-trainer model with their colleagues and thus spread the Navy STEM message to an even more diverse population beyond K-12.

Plans are being discussed to host the Naval Academy STEM team at INFINITY to provide additional STEM training for Mississippi teachers, additional INFINITY educators and/or Navy personnel. The training may be augmented with midshipmen interning at NRL-SSC—representing the complete Navy STEM pipeline!

This collaboration among research and operational Navy scientists and engineers, service academia and informal, nonprofit STEM educators is unlike any other. We hope to create a model of sustainable engagement for other Navy commands.

Reaching beyond our own command to engage other Navy personnel reinforces the value of the Navy STEM mission. Both Navy research and development commands and operational commands benefit from a more diverse workforce,

a more informed public and a more engaged community. Moreover, Navy STEM is not limited to only impacting K-12 populations; by working with nontraditional educators, we have an opportunity to further develop the appreciation for our Navy civilian and uniformed scientists and engineers.

Keep up with the Navy's partnership with INFINITY at www.visitinfinity.com.



From left to right: John Wilson, director of INFINITY Science Center at Stennis Space Center and Dr. Herb Eppert, superintendent of the Naval Research Laboratory at Stennis Space Center, sign the educational partnership agreement between the two organizations. (U.S. Navy photo by Shannon Mensi)

The **Naval Research Laboratory Stennis Space Center (NRL SSC)** serves as the lead Navy laboratory for research in ocean and atmospheric sciences with special strengths in physical oceanography, marine geosciences, ocean acoustics, marine meteorology, and remote oceanic and atmospheric sensing.

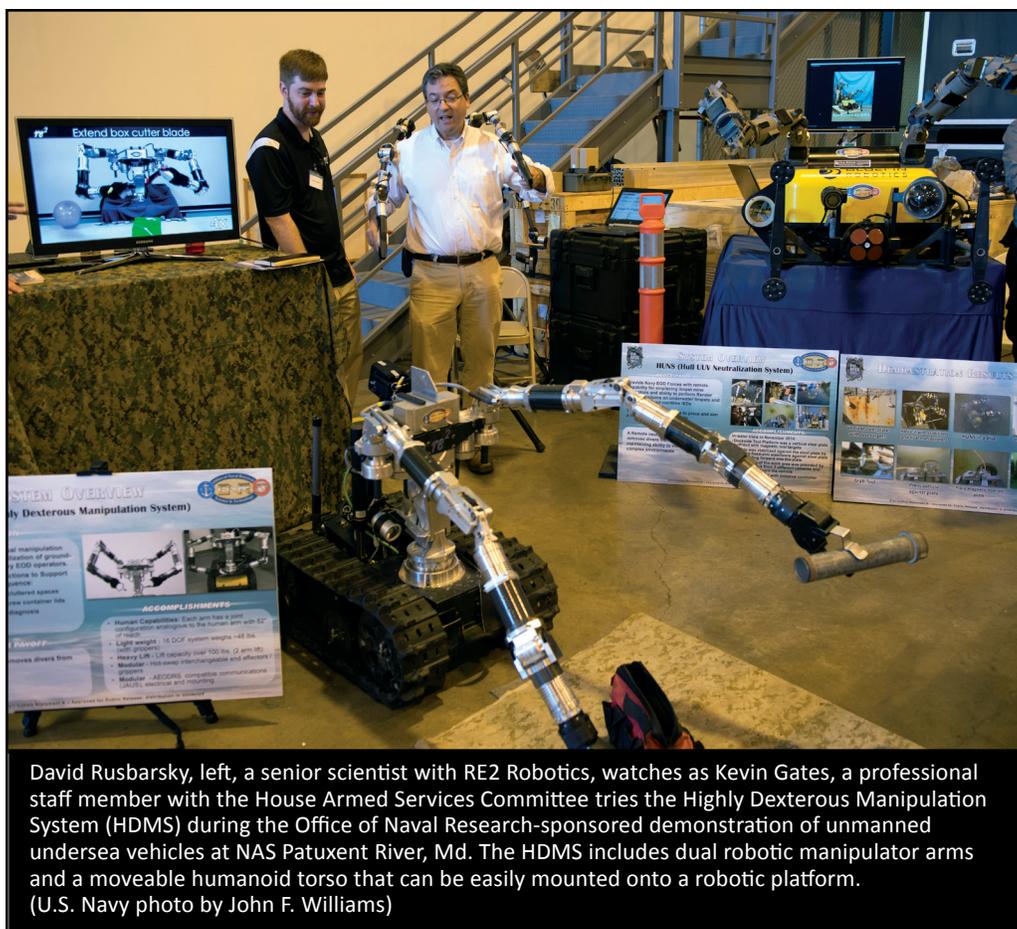
PAX
RIVER
2015EXPLORES
AUV TECHNOLOGIES

BY PETER ATKINSON, NAVY LEAGUE

Officials with, and participants in, PAX River 2015—a two-week U.S. Navy emerging autonomous underwater vehicle (AUV) demonstration—hosted a STEM and media day to show off their systems, discuss their experiments and stress the importance of STEM education.

More than 150 STEM students from St. Mary's County, Maryland, schools were among the event attendees. Naval Air Station Patuxent River Commanding Officer Capt. Heidi Fleming, Office of Naval Research (ONR) Program Manager Dr. Jason Stack and Demonstration Manager Robert Gibson all geared their remarks toward them during an introduction that preceded a tour of the AUV technologies at the air station's Advanced Maritime Technology Center.

"You are the next generation of pioneers," said Fleming. "This is about the future and you guys are the future."



PAX River 2015 was sponsored by ONR and brought together 150 participants, about 30 technology teams, 40 unmanned systems and 24 support vessels to jointly explore AUV technologies in common, at-sea environments along Maryland's shoreline. Six countries participated, including Canada, Australia, New Zealand, Germany, the United Kingdom and the United States.

Since 1997, ONR has hosted eight AUV Fests and Science and Technology Demonstrations (S&T Demos) in Panama City, Florida. This is the first unmanned aerial vehicle demonstration hosted by ONR to be held at PAX River.

Noting that "robotic technology is moving at a very, very fast pace," Gibson said that among PAX River 2015's objectives was "to put the end users with the scientists" in order to accelerate the relevance and utility of the emerging technologies. The technologies included mine countermeasures and

target detection systems, data processing and mission analysis advances, maritime inspection and archeology survey equipment, and explosive ordnance disposal (EOD) systems.

The ultimate aim of these technologies, Gibson said, is for them to do as much of the dangerous underwater work (e.g., mine-hunting, ordnance survey and disposal or infrastructure inspection) as possible while keeping Sailors and Marines at a safe distance.

"Our big thing is to keep the warfighter out of harm's way," he said.

Included among the technologies on display were AUVs with robotic arms for both mine or improvised explosive device identification and neutralization. The Highly Dexterous Manipulation System showcased its dual manipulation capability and imitative controller that allow its robotic arms to replicate the body movements of its operator.

David Rusbarsky, left, a senior scientist with RE2 Robotics, watches as Kevin Gates, a professional staff member with the House Armed Services Committee tries the Highly Dexterous Manipulation System (HDMS) during the Office of Naval Research-sponsored demonstration of unmanned undersea vehicles at NAS Patuxent River, Md. The HDMS includes dual robotic manipulator arms and a moveable humanoid torso that can be easily mounted onto a robotic platform. (U.S. Navy photo by John F. Williams)

Attached to a wheeled vehicle on the display floor, the system was able to unzip a small bag and pick out pieces of candy to hand off to attendees—as well as pick up and uncap a simulated pipe bomb as an operator from its developer, RE2 Robotics of Pittsburgh, stood behind it manipulating a matching set of wearable arms, serving essentially as a human joystick.

The system has a remarkably delicate touch and its robotic manipulator arms and movable humanoid torso can be mounted onto a land- or water-based robotic platform to conduct a variety of missions, including EOD, according to Reeg Allen, director of business development at RE2.

Another PAX River 2015 system ended up unintentionally utilizing another up-and-coming technology that was not part of the demonstration—3D printing. When a part on the Submerged Threat ID-Neutralization system—an unmanned surface vehicle that is the host to a smaller underwater remotely operated vehicle (ROV)—was damaged, program officials were able to have a new part created via 3D printing and replaced, saving valuable time and expense.

The part, a plastic docking collar that helps the ROV attach to the surface vehicle for transport, was printed in five hours, according to program representative Anthony Jones, and re-attached to the surface vehicle, where it finished out the experiment.

Along with the very high-tech, there also were more modest systems participating in the demonstration, from a solar-powered kayak and a small, battery-powered catamaran to the Riptide micro-AUV that Gibson said “could be thrown in the water like a football.”

Weighing about 20 pounds, the football-shaped, battery-powered system more likely would need to be heaved in like a bowling ball. It is designed for marine survey, oceanographic and mine neutralization operations, according to Riptide Autonomous Solutions representative Lenny Baker. It is an example of the kind of commercial, off-the-shelf, open-source technology that can be put together quickly to meet a critical need that is driving many of the advances in unmanned systems.

The company didn't start building the Riptide until May and the system made its first test on one of the final days of the demonstration, Baker said.

“Knowing that it worked was a nice milestone,” he said.

As the demonstration's Technology Cooperation Program, international participants tested, among other things, mission-planning innovations and multi-vehicle cooperation operations.

Pedro Patron, a representative of U.K.-based unmanned vehicle software developer SeeByte, said the experiments “gave us a lot of lessons learned to go home with” as well with a mountain of data to sift through.

SeeByte tested its autonomous software architecture in experiments that included multiple underwater vehicles from the U.K. and Canada operating under the control of a surface vessel. During one test, a vehicle became inoperable and floated to the surface, but the others were able to adjust and cover for it, he said.

“When you're able to do something like that on the fly, it helps prove the concept and show just what you can do with these systems,” Patron said. “You never stop being surprised.”

This article is reprinted with the permission of Seapower Magazine, the official publication of the Navy League of the United States.



A submerged threat identification and neutralization (STID-N) vehicle conducts a survey of the sea wall adjacent to the Naval Test Pilot School during the Office of Naval Research-sponsored demonstration of unmanned undersea vehicles (UUV) at Naval Air Station Patuxent River, Maryland. (U.S. Navy photo by John F. Williams)

Naval Air Station Patuxent River (NAS Pax River) is home to the Naval Air System Command headquarters, affiliated program executive officers and the Naval Air Warfare Center Aircraft Division. NAS Pax River conducts more than 200,000 air operations annually and is located in St. Mary's County Maryland.

FUN WITH STEM: KEYPORT UNDERSEA MUSEUM

BY MC3 SETH COULTER, NAVY PUBLIC AFFAIRS SUPPORT ELEMENT



Students of West Hills STEM Elementary School participate in a cooperative robotics exercise with remotely operated vehicles (ROV) at the Naval Undersea Warfare Museum in Keyport, Wash. The one-day workshop was offered to more than 100 students who participated in a variety of hands-on STEM activities and interacted with DoD educators about ROVs. (U.S. Navy photo by MC3 Seth Coulter)

More than 100 West Hills STEM Academy students participated in events at the Naval Undersea Museum in Keyport, Washington.

The STEM event was a cooperative effort between the Keyport and Bremerton Naval Museums with help from Naval Base Kitsap-Bangor, Naval Undersea Warfare Center Keyport, Puget Sound Naval Shipyard (PSNS) and Intermediate Maintenance Facility.

"It is great to see all these groups come together for the STEM program," said Steve Mastel, continuous training and development leader at PSNS. "Showing what these normally shied-away-from subjects can let you do as a career is a really good thing to strike home at a young age."



Students participate in a cooperative robotics exercise with remotely operated vehicles at the Naval Undersea Warfare Museum in Keyport, Washington. (U.S. Navy photo by MC3 Seth Coulter)

Groups of students were able to test their robotic and engineering skills at multiple stations throughout the museum.

"This is an awesome, hands-on way to test what students learn in school, while also learning something new," said Desiree Hall, a teacher from West Hills STEM Academy in Bremerton, Washington. "It is cool to see real-world applications for what everyone learns in class."

The ultimate test was to pilot underwater remote operated vehicles that students designed and constructed themselves.

"It's really great to see how far the children have come since first designing their rovers," said Angela Long, a parent of one of the students.

"Everyone had different challenges to overcome, including a few students doing last-minute fixes on the bus ride here." The STEM program was implemented to show younger generations there are exciting jobs in the science and technology fields and to help foster the growth of future scientists for America.

The **Naval Undersea Museum** is the only official Navy museum that interprets all of the Navy's undersea activities. Our mission is to collect, preserve and interpret naval undersea history, science and operations for the benefit of the Navy and the people of the United States. The Naval Undersea Museum is one of 10 museums operated by the Navy under the direction of the Naval History and Heritage Command.



Students from the Academy participate in a remotely operated vehicle competition during Navy STEM day held at the Keyport Naval Undersea Warfare Museum. (U.S. Navy photo by MC2 Justin A. Johndro)



A student looks through a model submarine periscope during Navy STEM day held at the Keyport Naval Undersea Warfare Museum. (U.S. Navy photo by MC2 Justin A. Johndro)



A student from West Hills STEM Academy writes down answers to a scavenger hunt during Navy STEM day held at the Keyport Naval Undersea Warfare Museum. (U.S. Navy photo by MC2 Justin A. Johndro)

MINNOW VERSUS SHARK: ROBO-BATTLES, ONR AND THE FUTURE FORCE

BY SIERRA JONES, OFFICE OF NAVAL RESEARCH



During the 2015 AUVSI Foundation and Office of Naval Research-sponsored RoboBoat competition held in Virginia Beach, Va., student teams race autonomous surface vehicles (ASVs) of their own design through an aquatic obstacle course. (U.S. Navy photo by John F. Williams)

For most students, summer is a time to break from the rigors of math and science, spending their days relaxing at the beach or pool. For others, however, it means building platforms, writing program code and tweaking various hardware components.

Team S.S. Minnow falls into the latter category. Meet Nick Serle, 15, and Abby Butka, 14, a homeschooled robotics team from Florida.

For the past three years, the pair has competed against some of the finest technical universities in the world via the SeaPerch, RoboSub and RoboBoat robotic competitions—all co-sponsored by the Office of Naval Research (ONR).

"I've seen Nick and Abby rise through these contests and become fierce competitors," said Kelly Cooper, a program officer in ONR's Sea Warfare and Weapons Department. "It is success stories like theirs that motivate us to support these competitions."

These programs align with one another and provide continuous educational opportunities for students from middle to graduate school.

"Competition opportunities like these are important because they build confidence, teach life skills and mature real-world problem solving abilities," said Chief of Naval Research Rear. Adm. Mat Winter. "These are key

attributes we value for all personnel entering into our naval workforce and research community—which in turn will be the driving force behind our Navy and Marine Corps' technological superiority."

The two students started their journey in 2013 at the Daytona Beach Museum of Arts and Sciences, where they took a robotics science class and were introduced to SeaPerch—a student-built underwater remotely operated vehicle.

After placing second overall in the SeaPerch regional competition, the team built an even faster model for nationals, where they finished third in the deep-water challenge.

Feeling inspired by their success, Nick and Abby wanted more.

"We had done well at SeaPerch and wanted a bigger challenge," said Butka. "When we talked to the students in the Robotics Association at Embry Riddle University [their technical mentor], they suggested the RoboSub competition, which was similar to SeaPerch but fully autonomous."

But were they ready for the big leagues? The short answer was yes, but there was some trepidation. As Butka put it: "RoboSub, that's a college competition! We'll be like

minnows swimming with sharks!"

The fear would soon fade. After gaining permission to be the first middle school team ever allowed entrance to the competition, the pair set off to build their RoboSub prototype, designed to resemble the SeaPerch used in the national competition, yet operate autonomously. During the competition, they were one of only three teams to circumnavigate the gate—a difficult task that required teams to pass their submarine through a three-pronged gate and circle the middle pole.

They finished the competition ranked 11 out of 33 teams.

In 2014, team S.S. Minnow took the lessons learned and made their way back to the regional and national SeaPerch and international RoboSub competitions, where they placed first, third and 11th, respectively.

This year, the team decided to compete on top of the water instead of under, and entered RoboBoat, an autonomous surface vessel tournament.

"RoboBoat offered different areas of engineering that we wanted to try, such as GPS," said Serle. "That made this competition very enticing."

The team placed fourth out of 16 teams, an impressive showing for their first time out, but said they'll be back next year with new ideas on how to improve their performance even more.

Sierra Jones is a contractor for ONR Corporate Strategic Communications.



Abby Butka and Nick Serle with their boat, S.S. Minnow. (Photo courtesy Abby Butka)

The **Office of Naval Research** provides the science and technology necessary to maintain the Navy and Marine Corps' technological advantage. Through its affiliates, ONR is a leader in science and technology with engagement in 50 states, 55 countries, 634 institutions of higher learning and nonprofit institutions, and more than 960 industry partners. ONR, through its commands, including headquarters, ONR Global and the Naval Research Laboratory in Washington, D.C., employs more than 3,800 people, comprising uniformed, civilian and contract personnel.



Staff members of Naval Health Clinic Charleston (NHCC) volunteered to assist Space and Naval Warfare Systems Command (SPAWAR) Systems Center Atlantic during "Girls Day Out," which is an educational outreach program for young women, ages 12 to 14, to learn about various STEM career opportunities. The event was tailored to rising 8th and 9th grade female students from various local schools in the Charleston, South Carolina, area. Boeing, Google, Bosch, along with SPAWAR and other local companies, provided STEM exhibits to educate and inspire the potential future scientists and engineers. Back row: Petty Officer 3rd Class Laquisha Byrd, NHCC hospital corpsman. Middle row, from left to right: Lt. j.g. Samantha Santiago, NHCC nurse; Seaman Maria Martinez, NHCC personnel specialist; Seaman Laquisha Roe, NHCC hospital corpsman. Front row, from left to right: Capt. Rosemary Malone, NHCC executive officer; Petty Officer 2nd Class Nicole Johnson, NHCC hospital corpsman; Capt. Elizabeth Maley, NHCC commanding officer. (Navy photo by Joseph Bullinger)

The **Naval Health Clinic Charleston** provides a wide range of services including a National Committee for Quality Assurance certified Medical Home Port program for family practice, pediatrics and internal medicine patients; dermatology, ophthalmology, ambulatory non-interventional radiology, physical therapy; optometry and a wide variety of well programs.

STEM INTERNS GET REAL-WORLD EXPERIENCE IN A VIRTUAL REALITY LAB

BY LT. MICHAEL D. YOUNG, RESEARCH PSYCHOLOGIST, *NAVAL HEALTH RESEARCH CENTER*

For aspiring young scientists, what could be more exciting than working with cutting-edge virtual reality equipment on a project that has the potential to make a real-world impact on military performance? That question is being answered by scientists at the Naval Health Research Center (NHRC), who are partnering with local schools to provide high school and college students with hands-on experience as they explore the world of health research and development.

One team at NHRC that is actively mentoring these future scientists is the Physical and Cognitive Operational Research Environment (PhyCORE) team in the Warfighter Performance Laboratory. This team conducts research to enhance rehabilitation, training and assessment of healthy and injured warfighters through interactive and enhanced technology. With a full-time staff consisting of research scientists, engineers and research assistants, the PhyCORE team stays busy with several ongoing projects, using the Computer Assisted Rehabilitation Environment (CAREN) and other state-of-the-art equipment. The CAREN, one of the lab's most impressive tools, is a 3D virtual environment with a 180-degree view inside a 9-foot-tall curved panoramic screen that provides research subjects and patients the sensory rich experience of movement in an experimentally controlled setting.

Interns at NHRC have an opportunity to work with the PhyCORE team on their current projects, which include a training program to prevent falls in amputees, balance training in warfighters with traumatic brain injuries and evaluation of personal protective equipment. PhyCORE's interns have received hands-on experience with validation efforts for force plate software (which can measure the forces developed during stepping, jumping and other human-scale actions) for future clinical work, analyzed treadmill walking data on a ProtoKinetics walkway and performed pilot testing as models wearing military backpacks on treadmills.

During the past fiscal year, the PhyCORE team welcomed eight interns, primarily recruited from High Tech High School and San Diego State University. High Tech, a charter high school in San Diego's Point Loma neighborhood, has been an excellent source for interns as 34 percent of the school's graduates go on to major in STEM fields in college—more than double the national average.

While some interns received school internship credits for their work at NHRC, others simply used the opportunity to gain experience using cutting-edge technology. Work generated by the interns has been included in technical reports and presentations, directly contributing to the PhyCORE team's success.

"It's great to be able to mentor these students and give them opportunities they wouldn't have had elsewhere," said Dr. Pinata Sessoms, a biomechanist with NHRC's PhyCORE team and an avid supporter of STEM interns.

The team's seasoned scientists recognize and appreciate the diverse contributions these interns have made, and intend to continue recruiting from high schools and colleges with STEM programs and seek other motivated students looking for their first taste of professional research.

Original Art by Topher McCulloch/Flickr

The **Naval Health Research Center** (NHRC) supports fleet readiness through research, development, test and evaluation on the biomedical and psychological factors affecting the performance of operational warfighters and field medical personnel.

THE MENTOR FILES: NAVAL AIR WARFARE CENTER TRAINING SYSTEMS DIVISION

BOB SELTZER:



Bob Seltzer has provided aerospace engineering expertise in the design, development and acquisition of naval aircraft and flight simulators for more than 30 years. He's led and supervised aerospace engineers and other modeling and simulation experts. Additionally, Seltzer is the Naval Air Warfare Center Training Systems Division (NAWCTSD) representative to the Central Florida STEM Education Council (CFSEC) and the Central Florida YMCA. He co-chairs the CFSEC's Educator Advising Committee, organizing educator training workshops and coordinating with Central Florida county public school representatives. Seltzer has spearheaded the growth of the Office of Naval Research-sponsored SeaPerch program in Central Florida through coordination and partnerships with the YMCA, the Orlando Science Center, Orange and Seminole County public schools and Embry-Riddle University. He supports the Florida High Tech Corridor techPATH program; in particular, techCAMPs for educators and middle school students at the Interservice/Industry Training Simulation and Education Conference. Seltzer also

coordinates STEM events and resources, taking NAWCTSD scientists and engineers (S&Es) into the classrooms, bringing local educators and students into NAWCTSD labs to understand careers available in the Department of Defense, and partnering teachers with S&Es.

RUSS TORRISI:



Russ Torrisi is a Naval Air Warfare Center Training Systems Division in-service engineer servicing Naval Air Station Oceana and Norfolk. In his off time he volunteers weekly at Kempsville High School to review pre-algebra lessons with sixth-graders. Torrisi also manages the Parent Teacher Association (PTA) membership database, compiles the volunteer database, helps in the library, chaperones dances, participates in spirit days, tutors students and helps teachers with their needs. "I volunteer because I am interested in education and the education process," says Torrisi. "I enjoy the interaction with the kids and the teachers. I enjoy math, and I like the challenge of trying to explain math in a way that the kids can understand it. I have learned that what works for one student will not necessarily work for another student." Torrisi's time spent volunteering has led him to consider becoming a math teacher once he retires from the government. "Volunteering provides a way to meet

other parents, teachers and students," he says. "I like being around people and working with them to make Kempsville Landing/Old Donation School a great experience for all involved." His fellow PTA board members, parents and school volunteers wrote letters and emails about Torrisi's selection as the school's 2015 Volunteer of the Year featuring words like: genuine asset, team player, workhorse, dependable, never-ending energy, enthusiasm, great attitude, always there, lifesaver and selfless. The Kempsville High School alumnus may one day have a classroom of his own, but, in the meantime, Torrisi is content to continue his service as a volunteer.

CHRIS SPRAGUE:

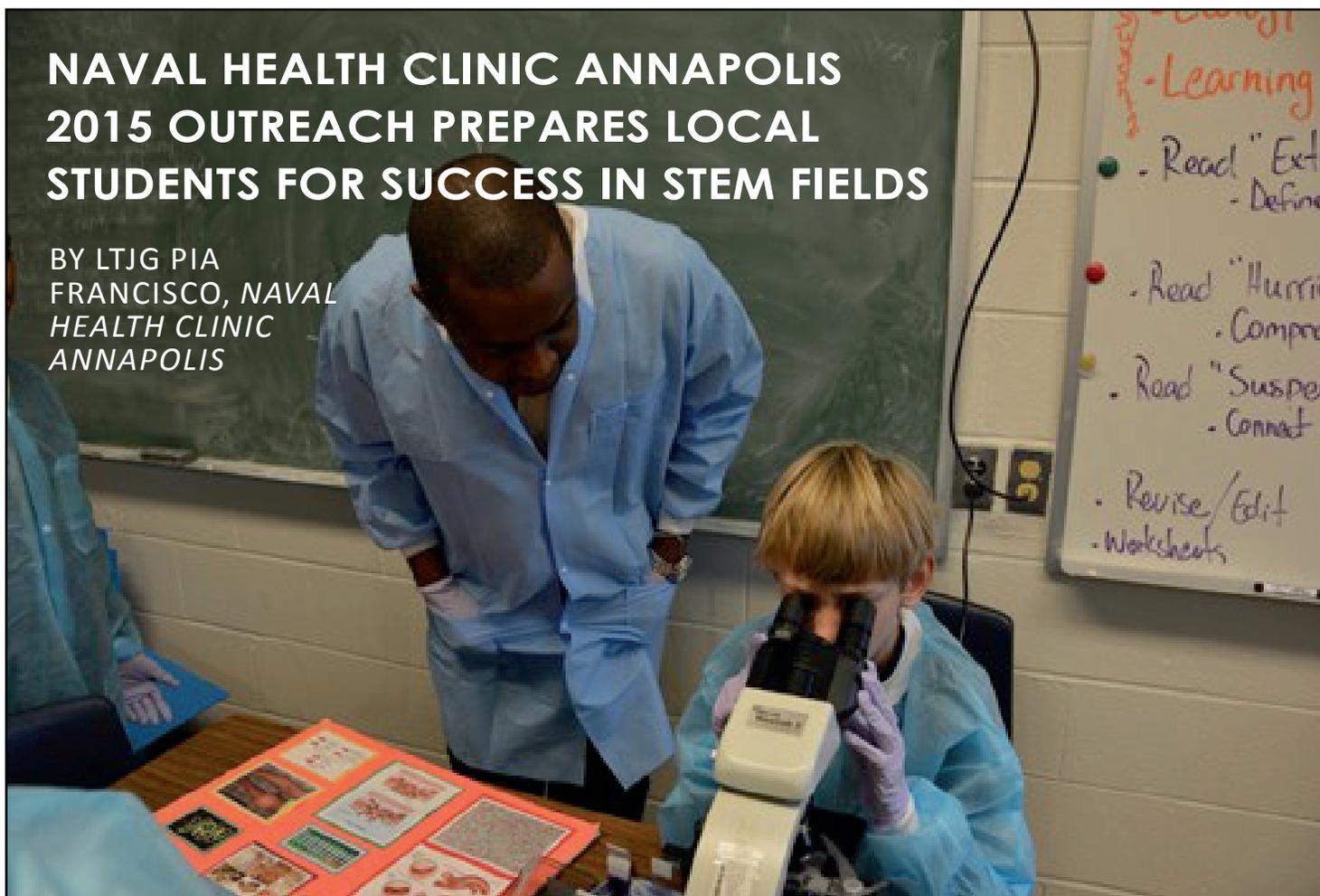


Chris Sprague earned his bachelor degree in electrical engineering and master's in computer engineering from the University of Central Florida (UCF) in Orlando, Florida. He is currently working as a computer engineer in the NAWCTSD Advanced Simulation Division, Concept Development and Integration Laboratory. His robotics background dates back to his time in college, where he spent years mentoring University High School students. Chris remains invested in the robotics community as he is a Robotics Laboratory UCF Alumnus (2003-2006), robotics mentor for the University High School FIRST FTC Robotics team (2011-present) and UCF Robotics Club Industry Advisor (2014-present).

The **Naval Air Warfare Center Training Systems Division (NAWCTSD)** is the Navy's source for a full range of innovative products and services that provide complete training solutions. This includes requirements analysis, design, development and full life cycle support. Of significance is NAWCTSD's ability to provide continuous learning across a wide variety of applications (aviation, surface, undersea, etc.).

NAVAL HEALTH CLINIC ANNAPOLIS 2015 OUTREACH PREPARES LOCAL STUDENTS FOR SUCCESS IN STEM FIELDS

BY LTJG PIA
FRANCISCO, NAVAL
HEALTH CLINIC
ANNAPOLIS



Hospital Corpsman 1st Class Isaac Kimble Naval Health Clinic Annapolis laboratory technician, shows a student from Eastport Annapolis Elementary School the structures of blood cells through a microscope as part of its science, technology, engineering and mathematics outreach program on DATE. (U.S. Navy Photo by Hospital Corpsman 1st Class Dwayne Lopez)

Naval Health Clinic Annapolis (NHCA) offers a comprehensive STEM-focused outreach program to nurture the next generation of medical professionals and scientists. Collaborating with the United States Naval Academy (USNA), NHCA conducts a quarterly SeaPerch program in partnership with several Maryland schools. As part of the program, more than 20 volunteers from NHCA train students in areas of science and medicine.

Anchored by its ongoing mission to address the nation's need for more young people to pursue STEM careers, NHCA's outreach program encourages interest in STEM subjects by showcasing Navy medicine as a potential career path. "The goal is to provide students with critical thinking and problem-solving skills to give them the tools to lead in STEM fields inside and outside the classroom," said Hospital Corpsman 1st Class Michael Weaver, NHCA assistant command diversity officer.

In addition to the SeaPerch program, NHCA hosts a medical and dental showcase every fall and spring for more than 120 students from Annapolis, Germantown and Eastport elementary schools. During the showcase, students visit several STEM-focused departments within the health clinic, where each department educates the students in its respective field.



Hospitalman Brittany Booth, Naval Health Clinic Annapolis optician technician, shows students from Eastport Annapolis Elementary School the structure and anatomy of the eye. (U.S. Navy Photo by Hospital Corpsman 1st Class Dwayne Lopez)

The laboratory department showcases basic cell identification on a microscope. The radiology department uses sample

radiographic images to display bones of the human body and discusses the technology and physics of how X-rays are made. The optometry department presents information on different eye exams and tests the students' eyesight to show how these tools work. The orthopedic and physical therapy departments outline proper form during physical activities and conduct a stretching routine with the students to explain the mechanics of the body. The dental department spotlights proper dental hygiene and demonstrates proper brushing and flossing techniques.



Hospital Corpsman 3rd Class Zachary Martin, Naval Health Clinic Annapolis laboratory technician, shows students the structures of blood cells through a microscope. (U.S. Navy Photo by HM2 Michael Romero)



Hospital Corpsman 2nd Class Rafael Garganta, Naval Health Clinic Annapolis radiology technician, shows students radiology test films of different types of bones in the human body. (U.S. Navy photo by Hospital Corpsman 1st Class Dwayne Lopez)

Each year, the **Naval Health Clinic Annapolis (NHCA)** and its four branch health clinics in New Jersey and Pennsylvania serve thousands of midshipmen, active duty, reserve and retired service members and their families, offering a highly qualified, diverse health care team and state-of-the-art benefits.

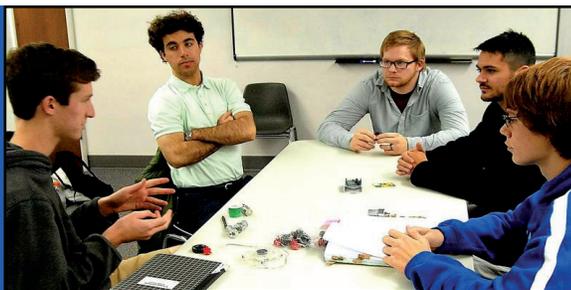
NAWCAD SCIENCE FAIR MENTOR PROGRAM

BY HOLLY KELLOGG, NAVAL AIR SYSTEMS COMMAND

The Naval Air Warfare Center - Aircraft Division (NAWCAD) Science Fair Mentor Program began in the fall of the 2014-2015 school year. It is a formal and structured mentoring opportunity for public, private and homeschooled high school students to collaborate and consult with STEM professionals in preparation for their school and county science fairs. Scientists and engineers are invited to volunteer with this program, then participate in two training workshops and a kick-off event, where they meet the students they will mentor.

The inaugural program had 19 students and 37 mentors. The mentor matching process included consideration of the mentor's education and work experience, as well as personal hobbies and interests, to provide a common interest area for students to relate to their mentor. Participating scientists and engineers spent an average of 20 hours each (collectively 740 hours) mentoring their student over four months. They worked with their students on topics such as understanding the scientific method, how to research, how to quantify and collect data and how to clearly display results.

Eight of the mentored students placed in the top three within their respective categories.



Mentors from the NAWCAD Science Fair Mentor Program gather at a local library to provide assistance to their students. (Photo by Jesse Yeatman)

The **Naval Air Warfare Center Aircraft Division (NAWCAD)** manages test ranges, test facilities, laboratories and aircraft necessary to support the fleet's acquisition requirements.

STUDENT PROFILE: **VERNON PRYOR**

INTERNSHIP(S): Science and Engineering Apprenticeship Program (SEAP); Naval Research Enterprise Internship Program (NREIP); and Science, Mathematics & Research for Transformation (SMART) Scholarship for Service Program

SCHOOL: University of South Carolina

GRADE: Junior

WORKFORCE LOCATION: SPAWAR Systems Atlantic

Vernon Pryor began working for SPAWAR Systems Atlantic as a high school intern via SEAP, an internship program sponsored by the Office of Naval Research. The following year he was selected to be an NREIP intern. Pryor applied for the SMART scholarship, a Department of Defense (DoD) scholarship for service program. Under the program, he was selected by SPAWAR Systems Center Atlantic (SSC Atlantic) to intern every summer leading up to graduation. Pryor was pleased to hear that he had received the SMART Scholarship award and will become an employee of SSC Atlantic upon graduation.

What was the best part of your internship? The best part was being an active part of supporting our nation's warfighters. I was able to explore several facets of the electrical engineering field, which put me at an advantage over some of my peers. I gained knowledge of various coding languages and different types of communication methods. I gained a wealth of knowledge and experience this past summer and was able to strengthen my skills in circuitry and radio frequencies, which are major parts of electrical engineering.

What did you get out of your experience? Over the past summer, I was exposed to some of the material that I would be involved with as my sophomore year at the University of South Carolina began. Learning how to code was one of the most exciting facets of my summer. In addition to coding, I was also tasked with finding ways to communicate through underwater tagging that involved radio waves, radio frequencies and piezoelectricity. During the communication projects, I was also exposed to sonars, ultrasounds and acoustics. I got a feel of what it would be like to be a real Department of Defense employee. I also learned skills that I now use outside of the classroom, such as time management and paying attention to detail. The most memorable part of my summer internship was when I was able to meet an elite group of our nation's warfighters: Navy Seals.

Would you recommend this program to other students and what advice do you have for them? I would absolutely recommend this program to any student planning to pursue any type of engineering study. This program prepares you for the real world better than any classroom setting. The hardest part of the program is going from a high school or college student having little responsibilities, to having real-world issues sitting at a desk in front of you. Being responsible, punctual and mature are three qualities that any candidate must have in order to fit into this program and be successful. I would also tell someone applying for this internship that they must be able to handle working under pressure. The fact that my mentors had deadlines they had to meet meant that I had deadlines I needed to meet as well.

What's next for you? My next step is preparing myself for my internship this upcoming summer. I have learned so much information this year that I will be able to bring much more to the table as it pertains to my knowledge of new information. I will be able to get involved in more discussions and take more substance away from those discussions and be able to take this new knowledge back to school next fall. By participating in this program, I have learned to be much more mature and conscientious of deadlines. Having to keep up with other people's deadlines made me a more time-conscious student and has helped me get off to a great start in my sophomore year in college. During my time at the University of South Carolina, I plan to continue to do my best to help make the command look as good as possible. My classroom experience will definitely be put to good use. It gives me great gratification knowing the work engineers do for the DoD plays a very vital role in the success of our warfighters.

The **Science, Mathematics & Research for Transformation (SMART)** program offers scholarships to undergraduate, graduate and doctoral students who have demonstrated ability and special aptitude for training STEM fields. The DoD also offers career opportunities for students to continue their research as civilian employees at a DoD laboratory after graduation.

BEST PRACTICES IN STEM OUTREACH: A SERIES OF WORKSHOPS SPONSORED BY ONR

BY ANGELA MORAN, UNITED STATES NAVAL ACADEMY



Workshop attendees facilitated a STEM outreach event for military youth. (Photo by USNA STEM Center)

The United States Naval Academy (USNA) STEM Center has hosted a series of multi-day workshops, sponsored by the Office of Naval Research (ONR), on STEM outreach methodology for naval scientists and engineers.

Attendees participated in hands-on educational modules focused on project-based learning methodology, naval-relevant curriculum and practical take-away activities. Representatives attended from Marine Corps Systems Command, Naval Air Warfare Center, Naval Recruiting Command, Naval Research Laboratory, Naval Surface Warfare Center, Naval Postgraduate School, Bureau of Medicine and Surgery, Naval Underwater Warfare Center, ONR, Space and Naval Warfare Systems Command and USNA.

Modules covered topics such as chemistry and electrochemistry, corrosion, transportation and navigation, helicopters and aviation, fluids and hydraulics, biology and bioengineering, cyber, cryptography and coding, and engineering design. Discussion forums focused on a range of pressing topics like sustainability and leveraging, identifying and establishing partnerships, utilization of volunteers, assessment methods and outreach methods and venues.

Participating commands were invited to send STEM personnel and bring naval-relevant activities to share. During each event, working groups focused on developing new STEM activities. An online repository of best practices and naval-relevant curriculum has been established and made available to participants.

As a result of these workshops, scientists and engineers have become more proficient in project-based learning techniques, age-appropriate approaches to teaching, the use of hands-on activities to present technical material and outreach tactics and assessment methods to assure success at their sites. A survey of the attendees from the most recent workshop is representative of the results determined following the first two (Figure 1). One attendee stated, "This workshop just makes me want to continue to improve my own skills as an informal educator as well as expand on the materials we teach within our own program."

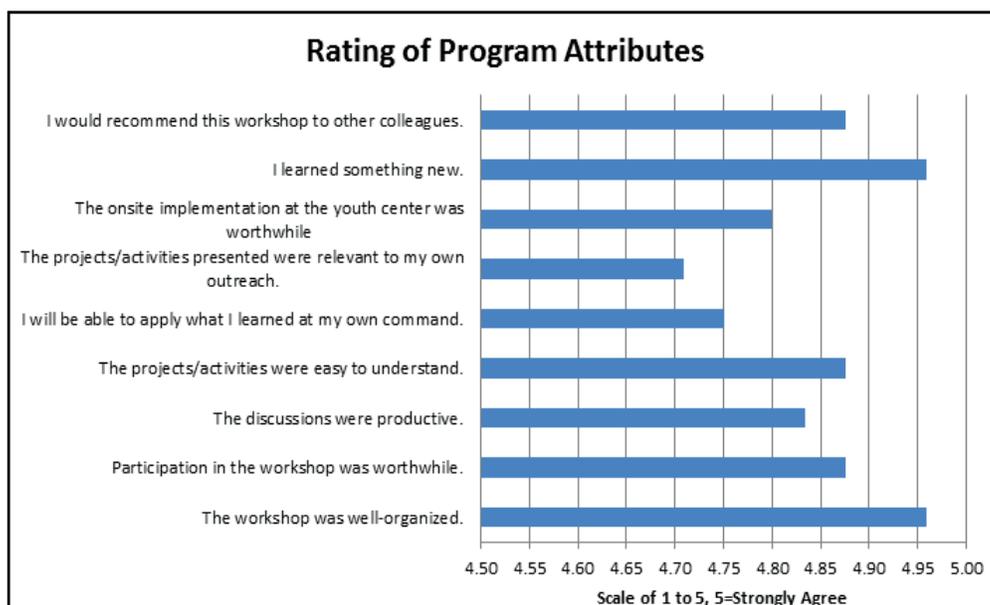


Figure 1: Survey results from Workshop 3 in the STEM Best Practices series of workshops.

Follow-up will be conducted at various command sites as requested, as well as via telecommunications methods, to assure sustainability. The benefit of this initiative is to strengthen the Navy approach to expanding the STEM pipeline, better utilizing a most valuable resource: our own scientists and engineers.

The **United States Naval Academy (USNA)**, as the undergraduate college of the naval service, prepares young men and women to become professional officers in the U.S. Navy and Marine Corps. After four years of undergraduate study and military training, midshipman graduate with Bachelor of Science degrees and reserve commissions.

NPS STEM INTERNS SPREAD THE WORD, WHILE LEARNING PROFESSIONAL DEVELOPMENT

BY ALISON KERR, NAVAL POSTGRADUATE SCHOOL

After working with Naval Postgraduate School (NPS) faculty doing hands-on research this summer, select interns volunteered to present their personal and professional stories to local middle and high school students. NPS STEM Internship Coordinator Alison Kerr and NPS Graduate Writing Center coach Marianne Taflinger worked with these students to refine their messages and organization of material. Their PowerPoint presentations served as a backdrop on how to present information, cope with presentation anxiety, answer questions and command the stage. Each student rehearsed and received feedback from NPS professionals.



Amara Borchers, a senior at Santa Catalina High School, said, "I was really nervous, but I volunteered to do this so I could learn how to do presentations ... it will help me with presentations in the future." Borchers served as a 2015 SEAP intern at NPS with Dr. Susan Sanchez of the SEED Center, mapping the spread of malaria using an agent-based modeling system. (U.S. Navy photo by Alison Kerr)

Recently, several of these volunteers gave presentations to Walter Colton Middle School STEAM (STEM with Arts) classes. More than 125 sixth-, seventh- and eighth-grade students attended the presentations. Information on STEM internships was also offered.

By cultivating a group of near-peers, former NPS interns gain valuable experience that will help them better communicate future scientific work, as well as increase interest in local schools through exposure to young STEM professionals. Near-peers complement traditional mentor-student relationships by exposing students to beginning researchers—younger students find it easier to approach and emulate them because of the closeness in age. Near-peers also can discuss similar experiences and challenges, transform stereotypes, offer insights about how to communicate with professors/mentors and provide strategies for career paths.

Besides the experiential learning and mentoring relationships interns garner through summer internships, NPS also recognizes professional development as vital for these young students.

With the support of ONR, NPS' SEAP and NREIP 2015 summer interns experience many professional development opportunities throughout the summer.

These experiences encourage participating interns to grow their professional development skills and empower them to see themselves as contributors and role models. Their experiences also cement the power of giving back and establish habits of professional generosity throughout their future careers.

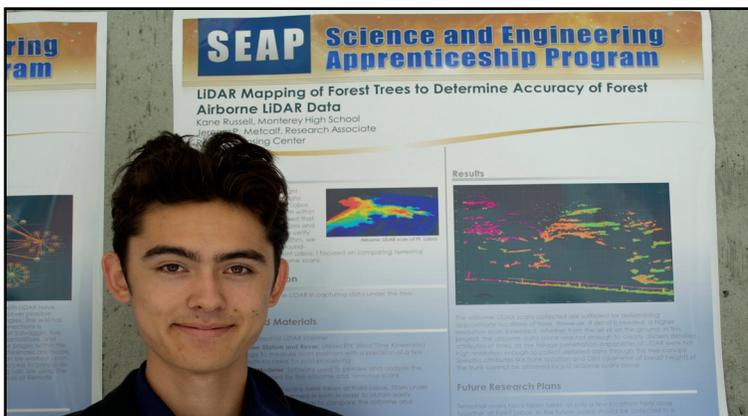


Carson Vogt recently earned his master's in robotics from the University of Edinburgh. He served as an NREIP intern with Dr. Tim Chung and the ARSENL lab during the summers of 2013 and 2014. Soon to return to Scotland for his PhD, he brought two quadcopters he built and goggles so students could have a quadcopter-eye view as it flew. (U.S. Navy photo by Alison Kerr)

The **Naval Postgraduate School (NPS)** provides relevant and unique advanced educational and research programs to increase the combat effectiveness of commissioned naval officers. Its headquarters are located in Monterey, California.



Interns lead a tour of their lab. The work they are doing for their cohort that solidifies their knowledge and polishes presentation skills. Interns in attendance get exposure to a wider array of naval projects. (U.S. Navy photo by Alison Kerr)



Interns complete weekly exercises to compile research poster components, learn scientific writing techniques and present their posters at a research showcase. (U.S. Navy photo by Alison Kerr)



Stephan Edgar, a volunteer student service intern, is a Monterey Peninsula Community College student, studying computer science and has applied for an NREIP internship for next summer. (U.S. Navy photo by Alison Kerr)



Special guest STEM professionals share their experiences, inspiration and opportunities with NPS STEM interns. Speakers included NPS President Ronald Route, Provost Douglas Hensler, various faculty members, Dr. Leedjia Svec (a NASA AMES scientist) as well as representatives from the NPS Scholarship for Service and the SMART programs. Anita Borg Institute International Initiatives lead and Silicon Valley Society of Women Engineers President Dr. Claudia Galvan, pictured above, came for a special event with female interns. (U.S. Navy photo by Alison Kerr)

FY15 ONR STEM GRANTS OVERVIEW

BY JASON FESER, NAVAL STEM COORDINATION OFFICE

The fiscal year (FY) 2015 Office of Naval Research (ONR) STEM Grants Program portfolio represents a major step forward in aligning the education and workforce mission with naval science and technology (S&T) priorities while meeting federal STEM education guidance.

From a testing phase in FY14 focusing on exploratory projects, the STEM Grants Program made a major investment in FY15, starting 23 new projects. The STEM Grants Program's mission is to develop solutions that establish and/or maintain a diverse pipeline of U.S. citizens interested in uniformed or civilian Department of the Navy (DoN) STEM careers. The program supports projects that address STEM education and naval science and technology issues while engaging community partners to broaden and sustain the impact. Supported projects establish metrics and evaluation plans.

These 23 new starts meet that mission by developing projects in high schools and higher education institutions that can improve the quality of STEM education for students while fostering connections with the naval S&T and STEM Education communities. In a broad approach, the grants impact high schools by supporting teacher training, curricula development and classroom resources. At higher education institutions, faculties are changing STEM education and support experiences for students to excel in their STEM futures. For the DoN to have a leading scientific and engineering workforce, the projects supported now can be a critical tool for communities to develop STEM education and achieve

Key - ONR FY15 STEM grants new starts

 High school students
  Undergraduate and graduate students
  Current Professionals

- 1** **Aligning Career and Technical Education with Naval STEM** • *Research Triangle Institute*

Produces an analysis between Virginia's technical education system and naval S&T needs to inform future program initiatives  
- 2** **California State Naval STEM Program** • *California State University*

Provides underrepresented minority engineering students at Cal State University with improved STEM education opportunities and pathways to SYSCOM Naval STEM careers  
- 3** **Cognitive Radio Education** • *Virginia Tech*

Develops cognitive radio educational materials for students and naval personnel to address technical gaps in the workforce  
- 4** **Digital Power and Energy Course** • *Purdue University*

Develops a face-to-face and digital course aligned with the naval S&T Strategic Plan in the power and energy domain for current students and naval personnel  
- 5** **Diversifying DON at Portsmouth** • *University of Massachusetts, Lowell*

Develops summer academic experiences to increase STEM degree success and mentoring connections for students with Portsmouth Naval Shipyard 
- 6** **Engineering and Physics in High Schools** • *East Bay Education Collaborative*

Develops hands-on engineering/physics curricula and teacher professional development in 12 New England high schools 
- 7** **Engineering School Implements 21st Century Skills** • *Colorado School of Mines*

The project enhances university engineering courses with hands-on learning and computation experience and skill development in leadership and group management for engineers to succeed 
- 8** **Enhances Hydrodynamic Science Education** • *University of Iowa*

Changes student education experience to hands-on and student-centric driven learning for undergraduate and veteran students, while engaging area high school students for pathway development  
- 9** **Enhancing Veteran Success in STEM** • *Tidewater Community College*

Develops community college physical and digital infrastructure to support veterans in STEM degrees and connect with naval STEM careers 
- 10** **Hydrographic Science Pathway** • *University of Southern Mississippi*

Develop undergraduate hydrographic science program to meet DON and regional workforce needs 
- 11** **Immersive Aviation in High Schools** • *Central Kitsap, Washington*

Implements aviation projects in district high schools to create a regional pathway for students to excel in military and industry aviation careers 

the best outcome for students.

The STEM Grants Program strives for an agile process and encourages interested educational institutions, non-profits, and industry stakeholders to consider the FY16 STEM Funding Opportunity Announcement at <http://ow.ly/VolbN>. Contact ONR_STEM@navy.mil for more information.

Below is a brief overview of the ONR STEM Grants FY15 new starts.



- 12** **Improving Veteran STEM Education** • *Old Dominion University*
 Develops scalable initiative to improve veteran success in baccalaureate STEM degrees through rapid education success in key STEM gateway classes and develop support services ●
- 13** **Naval Architecture and Ocean Engineering Education** • *Michigan Tech University*
 Develops scalable university initiatives in the Great Lakes region to provide hands-on learning in topical naval S&T areas for undergraduate and high school students ●
- 14** **Naval Ship Museum STEM Expansion** • *USS Hornet Museum & USNA*
 Expands STEM curricula and training for naval volunteers and naval STEM teacher training materials in naval ship museums ●
- 15** **Navy League STEM Expo** • *Navy League*
 Supported the Navy League's STEM Expo at the Sea, Air, Space Conference to showcase naval STEM career opportunities ●
- 16** **Pathways for Engineering Students** • *University of California, Santa Barbara*
 Develops project-based learning courses and entrepreneurial experiences for veterans and minority students in community colleges collaborating with NAVFAC Engineering and Expeditionary Warfare Center ● ●
- 17** **Pathways for Maritime Mechatronics** • *Tidewater Community College*
 Establishes a pathway from high school to undergraduate for maritime mechatronic education aligned with DoN and maritime industry competency needs ● ●
- 18** **Patuxent Partnership** • *Patuxent Partnership and NAWCAD*
 Bolsters partnerships and academic programs between NAVAIR and local universities and high schools for enhanced STEM education experiences and workforce development ● ● ●
- 19** **SeaPerch Virtualization & Data Curriculum** • *AUVSI*
 Develops the SeaPerch program to achieve virtualization and sensor technology for scaling access and supporting data-quantitation curriculum focus ●
- 20** **Signals Education Through Gamification** • *Western Washington University*
 Explores changing education practices by using gamifications and hands-on practices to improve quality and success of diverse students and veterans ●
- 21** **Systems Engineering Thinking** • *South Dakota School of Mines*
 Incorporates systems thinking training for students by using case studies on naval S&T topics across mechanical engineering courses at the institution ●
- 22** **Systems Security Education** • *Tennessee State University*
 Develops integrated academic and hands-on training in embedded systems and cybersecurity for students and naval personnel ● ●
- 23** **Translating ONR Research into STEM Education Tools** • *University of California, San Diego*
 Links ONR-funded researchers with high school science teachers and classrooms to translate their research into usable teaching materials for area high schools ● ●



The Naval STEM Coordination Office (NSCO), located at the Office of Naval Research, under the leadership of the chief of naval research, as the the Naval STEM executive, serves as the central coordination and information resource for Naval STEM efforts. The NSCO works with naval system commands, laboratories, warfare centers and other research and education institutions to leverage resources and maximize the impact of the Department of the Navy's STEM investments.

These investments support a wide variety of STEM educational and workforce programs, ranging from activities designed to spark younger students' interest in STEM careers, to more in-depth, hands-on learning opportunities for middle and high school students, internships and research fellowships for older high school and post-secondary students and professional development opportunities for Naval STEM professionals and faculty.

Please visit <http://navalstem.navylive.dodlive.mil> for more information about Naval STEM or contact the Naval STEM Coordination Office at naval_STEM@navy.mil.

