BUILDING AN AUTONOMOUS NAVY: ONE ROBOBOAT ENGINEER AT A TIME

STUDENTS SHOOT FOR THE SKY AT CANSAT COMPETITION
Welcome: A Message From the Director

In school and out of school, day and night, student scientists have been spending their time and effort on unique, exciting research projects. They have been preparing for the much-anticipated summer science fairs, which reward the most impressive researchers with a myriad of prizes. These events are held not only to find the best of the best, but also to provide a venue for communication and community. Local and national competitions are held all across the country, allowing like-minded future scientists and engineers to practice their science communication skills, and to celebrate each other’s accomplishments. Merit-based contests like science fairs and robotic competitions provide intrinsic motivation for students to explore STEM, and each participant receives some recognition for their hard work.

In this edition of The Naval Edge: Today’s STEM: Accelerate Your Future, you’ll discover how the Navy supports science competitions, and how they bolster a diverse world-class STEM workforce ready to meet the needs of shifting threat environments. Department of the Navy system commands participate in, and contribute to, summer competitions through coordination and support by the Office of Naval Research. Navy scientist and engineers boost student confidence and foster enthusiasm for STEM in the next generation. These efforts contribute to our ultimate goal—enabling the Navy and Marine Corps to recruit, retain and constantly develop the current and future workforce.

Dr. Michael Simpson
Director of Education & Workforce/Naval STEM
Office of Naval Research

Shining Moment: Student Creates Logo for Girls Day Out Event

On July 28, the Space and Naval Warfare Systems Center Atlantic (SPAWARSYSCEN Atlantic)—in collaboration with local industries and colleges—hosted its seventh annual Girls Day Out STEM Camp.

Each year, rising eighth- and ninth-grade girls are treated to a variety of STEM-based tours, hands-on educational activities and female role models. They leave with memories of fun learning experiences, new friends and a custom-designed camp t-shirt.

As part of an ongoing effort to work with our local school districts and expose their students to real-world work experiences, SPAWARSYSCEN Atlantic reached out to Goose Creek High School’s graphic design teacher to request a student-designed logo for this year’s camp. The 2018 logo was designed by Kumiko Hill, with a theme of “Tomorrow…Made by Girls.” Representatives from SPAWARSYSCEN Atlantic STEM outreach team—including Shanda Johnson, outreach director; Kelly Thompson, career academies lead; and Anish Scott and Jennifer Pinskney, Girls Day Out leads—made a surprise visit to Hill’s graphic design class to thank her for the design and to invite her to attend the summer camp awards presentation.

At the awards presentation, Hill was recognized in front of an audience of girls—each of whom were wearing the Goose Creek High School student’s logo emblazoned on their shirts.
Teams of students from 13 schools—representing six countries—tested their engineering skills by developing autonomous boats during the 11th annual International RoboBoat Competition, held June 18-24 in Daytona Beach, Florida.

Sponsored by the Office of Naval Research (ONR) and the Association for Unmanned Vehicle Systems International Foundation, RoboBoat is an annual robotics contest, where the next generation of engineers put their autonomous surface vehicles (ASVs) through a series of advanced water-based challenges that mirror real-world maritime operations.

“The challenges might seem simplistic, but before the boats even make it to the water to try and complete the course, there’s a lot complex engineering that goes into the ASVs’ development,” said Kelly Cooper, a program officer in ONR’s Ship Systems and Engineering Research Division—and a RoboBoat judge. “This competition really showcases the technical ingenuity of the students.”

That ingenuity will be needed as the desire to grow—not only for the naval service, but across the commercial sector as companies like Dominos, Amazon and Uber all want to use autonomous vehicles for deliveries.

And while these companies are making strides toward autonomous services for the average consumer, the Department of the Navy (DoN) is looking to use the technology to create fundamental shifts in the way the Navy and Marine Corps conduct future naval operations.

According to the recently released DoN Strategic Roadmap for Unmanned Systems (short version), the goal is to “transform modern warfare” by seamlessly integrating unmanned systems into the naval services and across all domains.

This is something that ONR is already doing—pushing the path forward for autonomous technologies like swarming boats, aerial vehicles and unmanned surface ships and helicopters.

RoboBoat showcases the talents of future engineers and serves as a basic introduction to some of what the Navy needs its autonomous systems to do,” said Cooper. “We know there will be a strong pull from the commercial sector to have these kids come work for them, but we want the participants to know that the future is bright with the naval services as well—we have the jobs and we need their talent, too.”

As in the past, this year’s teams, largely composed of university students, were evaluated on their vessel design and performance. The design component focused on innovation, quality of engineering and craftsmanship. The performance component tested a vehicle’s ability to execute specific missions on the water without any human interaction.

As part of the performance challenge, the ASVs had to demonstrate their speed and navigation capabilities by passing through a set of gates before competing for any mission challenge points.

The mission tasks demonstrated the maritime systems’ autonomous behavior in different scenarios, including: speed; automated docking, which demonstrated the ability to launch and communicate with an aerial drone; finding a path in a crowded area; target identification; precise navigation; and, finally, return to dock.

Institut Teknologi Sepuluh Nopember (Indonesia) was this year’s biggest winner, bringing home the top prize of $6,000. Georgia Institute of Technology won second prize and $5,000; Hagerty High School (Florida) took third and $3,000; and Embry-Riddle Aeronautical University (Florida) came in fourth, earning $2,000.

Smaller awards of $500 and $1,000 in various special award categories went to Nathan Hale High School (Washington State), Tecnologico de Monterrey (Mexico), Embry-Riddle Aeronautical University, SRM Institute of Science and Technology (India), Delft University of Technology (Netherlands) and Hagerty High School.

The other participating institutions were Florida Atlantic University, Universitas Diponegoro (Indonesia), University of Iowa, University of Michigan and University of Ottawa.

Sierra Jones is a contractor for ONR Corporate Strategic Communications.
I spent a recent Sunday afternoon at the International SeaPerch Challenge, held at the University of Massachusetts in Dartmouth, Massachusetts. The pool deck was led by Naval Undersea Warfare Center (NUWC) Newport Division and supported by a team of dedicated outreach folks from across the Naval Sea Systems Command (NAVSEA).

SeaPerch is an innovative Office of Naval Research (ONR)-sponsored robotics program designed to generate interest in STEM by giving teachers and students the resources to build an underwater remotely operated vehicle. SeaPerch teaches basic science and engineering concepts, tool safety and technical procedures. More important, it teaches critical thinking and experiential learning, while exposing kids to exciting careers in naval architecture and naval, ocean and marine engineering.

One of the things I like best about SeaPerch is that it’s a very hands-on and adaptable program. NUWC runs it for fifth grade through high school classes, and has developed a host of follow-on programs for students to take their vehicles to the next level. For many kids, it’s their first time using tools, applying measurements and working with electronics. SeaPerch lets them make mistakes and learn to troubleshoot them to get going again. The light bulb soon goes on and students quickly realize they can try different things to improve what they’ve done. It’s the build-test-build paradigm at its finest.

Another thing I love about SeaPerch is the kids’ energy. It’s amazing to be around so many focused, inquisitive students and to get a peek at the next generation of scientists and engineers. The level of innovation at this year’s SeaPerch Challenge was nearly off the charts as 174 middle and high school teams (662 students with some from as far away as New Zealand) competed in two challenges: an obstacle course, and an exercise where students had to move rings, sticks and cubes from one platform to another and keep them there. It sounds a lot easier than it is!

I encourage all of you to check out the program and get involved.

Remember that your involvement makes these programs successful and helps grow a valuable national resource. Best of all, it’s incredibly rewarding to watch the kids learn something new each time they put their vehicle in the water, as they also learn from one another. Kudos to the kids and a big thank you to all the committed folks who support these STEM initiatives.

Donald McCormack
Executive Director
Naval Surface & Undersea Warfare Centers
Local Students Compete in 9TH Annual Carderock Math Contest

More than 220 students from over 30 regional schools participated in the ninth annual Carderock Math Contest (CMC), at Naval Surface Warfare Center, Carderock Division in Bethesda, Maryland.

The contest, part of Carderock’s STEM outreach efforts, was an opportunity for students to showcase their mathematical talents in a series of individual and team MATHCOUNTS-style tests.

Capt. Mark Vandroff, Carderock’s commanding officer, kicked off the event with a brief speech to the elementary and middle school children in attendance.

“Carderock is a place where math and science come together to aid in the defense of our country,” Vandroff said. “We are very proud of what we do here and hope to encourage individuals in our community, and students at all levels, of the power of math.”

The written-test portion of the event consisted of sprint and target rounds and concluded with a team round. The top scorers moved on to the main event—the oral countdown round—answering advanced math questions for speed in a bracket-style tournament.

Naama Endo, vice president of the parent-teacher organization at Gesher Jewish Day School in Fairfax, Virginia, said she was excited to be at Carderock, but even more excited to see the children interacting with their peers and the staff.

“Many of these children have never been on a Navy base, so it’s enjoyable to see them being able to meet with the commanding officer,” Endo said. “It means a lot to me to see them engaged with the math contest and funny jokes on the walls, and just being officer,” Ende said. “It means a lot to me to see them engaged and healthy throughout his lifespan.

Dellis said he was born with an average memory, but the passing of his grandmother from Alzheimer’s disease in 2009 inspired him to start training his memory so that he could keep his mind strong and healthy throughout his lifespan.

Earth Day Naval Support Activity Bethesda

By Chanel Sharp, NSAB School Liaison Officer

"Humans have a stewardship responsibility for the planet.” — Maurice Henderson, NASA outreach engineer

Earth Day Naval Support Activity Bethesda, in honor of Earth Day, hosted Emerson Preparatory High School from the District of Columbia for a day of science, space and hands-on learning. Community organizers also joined the fun as they passed out information regarding preservation and recycling.

The Partnership in Education with Emerson Preparatory School promotes collaboration between the command, military and civilian communities. Forty-three students ranging from ninth through 12th grade, accompanied by 10 staff members, attended the fair. Students listened to Dr. Peter Hildebrand, former NASA Goddard science director, as he gave a demonstration of “Science on a Sphere.”

The sphere is a giant globe displaying real-time planetary data using technology and video projectors that scientists heavily rely on. In addition, two more staff members from NASA utilized the sphere to further teach students how to observe climate changes, space occurrences and weather fluctuations across the globe.

Maurice Henderson, a NASA Outreach Engineer, discussed the spheres on Earth—land, sea, air and water. Henderson enthusiastically encouraged students to preserve the Earth and reminded them that “…humans have a stewardship responsibility for the planet.”
Meet the Navy Winner for Quarter Two

NAME: Kathleen Gately Miranda (pictured right)

WAR雷锋 CENTER: Space and Naval Warfare Systems - Pacific

LOCATION: San Diego, California

Kathleen Miranda from Space and Naval Warfare Systems Center Pacific (SSC Pacific) is the 2018 Second Quarter STEM Education and Outreach Advocate of the Quarter. Her remarkable STEM advocacy annually impacts more than 12,000 students and 600 teachers, over an average of 4,425 STEM engagement hours. In addition, she took on extra responsibility as the lead for the 2017 National Junior Science and Humanities Symposium. We congratulate Miranda for her outstanding accomplishment, and thank her for going above and beyond in the name of STEM advocacy.

Navy Nominees for Quarter Three

Name: Senta Seright (middle)

Warfare Center: Naval Surface Warfare Center - Dahlgren

Location: Dahlgren, Virginia

Name: Melanie Zajic

Warfare Center: Naval Surface Warfare Center - Carderock

Location: Bethesda, Maryland

Name: Richard Blight (right)

Warfare Center: Naval Undersea Warfare Center - Newport

Location: Newport, Virginia

Name: Women and Volunteers in Engineering/Science (WAVES) Team

Warfare Center: Naval Surface Warfare Center - IHEODTD

Location: Indian Head, Maryland

DoD STEM Advocate of the Quarter 2018

STUDENT PROFILE: Joshua Harris

Internship(s): Science and Engineering Apprenticeship Program (SEAP), Naval Research Enterprise Internship Program (NREIP) and Pathways Internship Program

School: University of South Carolina; Anticipated graduation is May 2019

Degree: Major in mechanical engineering/minor in aerospace engineering

Workforce Location: Space and Naval Warfare Systems Center Atlantic

Joshua Harris, who currently attends the University of South Carolina, is pursuing a bachelor of science degree in mechanical engineering. Harris started his journey with the Space and Naval Warfare (SPAWAR) Systems Center Atlantic in 2014. As a SEAP high school intern, he worked with various 3D designs and models in Solidworks, drafted proposals and engineered solutions to problems. Fast forward to 2016. Harris interned as a college student with NREIP and learned how to assemble and configure systems in preparation for testing, and performed metal quality checks and conducted in process inspections. He also worked on air traffic control communications and radio frequency propagation projects and has been trained in the Naval Research Laboratory Interactive Scenario Builder Software. This year, he applied for the Pathways Internship Program and was selected. Pathways is designed to convert interns into government employees. In his free time, Joshua mentors the FIRST Robotics Team at Cane Bay High School. He says that he "educates the students in how to design and build a robot for competition use and is the primary user of the fabrication machine for the team so that parts can be fabricated for the robot.”

Profile written by Zachary Storti, Space and Naval Warfare Systems Center Atlantic (NREIP Intern)

STUDENT PROFILE: Mario Moreno

Internship(s): Problem-based Initiative for Powerful Engagement and Learning in Naval Engineering and Science (PIPELINES) Program

School: University of California Santa Barbara; he graduated in June 2018

Workforce Location: Naval Air Warfare Center Weapons Division, Point Mugu, California

Mario Moreno began working at Naval Facilities Engineering Command Engineering and Expeditionary Warfare Center as a PIPELINES intern during the summer of 2016. He worked on a prototype tethering system for small buoys that incorporated a fiber optic cable for rapid data transfer. His team used analytical spring models to design a system that would meet the specifications, and then developed a manufacturing process to form the novel tethering system from raw materials. Work performed over the summer led to a patent application.

PIPELINES wasn’t Moreno’s first time working for the Navy—he spent nine years in the Navy as an aircraft electrician. He will soon begin work for Naval Air Warfare Center Weapons Division at Naval Air Station Point Mugu, California.
Hundreds of students traveled to Tarleton State University (TSU)—in Stephenville, Texas—to participate in the 14th annual American Astronautical Society CanSat Competition, a design-build-launch competition. More than 40 college and university teams were challenged to complete this year’s mission of launching a self-designed and built space probe that could safely carry an egg through all stages of flight. Each probe was launched inside a rocket, which flew 670 to 725 meters—that’s between 2,198 to 2,379 feet. Inside the probe were sensors that tracked altitude using air pressure, external temperature, battery voltage and GPS position.

Every year, the mission of the competition changes and students have to fulfill a set of mission-based criteria in order to be successful.

“As chief coordinator of the competition, I’ve seen the event grow from five teams, to now screening almost a hundred submitting participants,” said Ivan Galysh, chief coordinator of the competition and an engineer at the U.S. Naval Research Laboratory (NRL). “The event is growing fast, but thanks to the event’s sponsors and contributors, the competition is expanding into a very festive event.”

The competition is a chance for students to be involved in the end-to-end life cycle of a complex engineering project: from conceptual design, through integration and test, to actual operation of the system, and finally conclude with a post-mission summary and debrief to the competition’s judges.

“The competition provides the components necessary for student success in industry and professional work environments, and fortifies the greater STEM community,” said Dr. James R. Pierce, TSU’s Dean of College of Science and Technology. “We look forward to working with NRL each year and hosting CanSat in the future and adding value to its presence.”

Teams from the U.S., the United Kingdom, Canada, Mexico, India, Iran, Italy, Turkey and Poland competed in the event. First place went to the University of Manchester, United Kingdom.

“CanSat is an opportunity to get to know people from different countries, and I found more similarities in all facets of ability than I did differences in each person I met,” said Artur Biernat, a student from the University of Science and Technology in Poland.

Sponsors of the competition include NRL, the American Astronautical Society, NASA Goddard, Siemens, Praxis Inc. and Kratos. The competition is hosted by Tarleton State University, and they provide lodging for teams, food during the event, the grounds for the rocket launches and all necessary personnel to ensure logistics and safety.

The full list of winning teams can be found at: http://www.cansatcompetition.com/winners.html.

Students Shoot for the Sky at CanSat Competition

By Raeanna Morgan, Naval Research Laboratory

U.S. Navy photo courtesy NRL
USNA Best Practices in DoD STEM Outreach

By Angie Moran, U.S. Naval Academy

As part of a series of workshops sponsored by the Office of Naval Research (ONR) and now by DoD STEM, the United States Naval Academy (USNA) STEM Center for Education and Outreach conducted outreach training for DoD scientists, engineers and STEM practitioners from commands across the country. Representatives included personnel from the Army, Air Force, Navy, Missile Defense Agency, National Geospatial Intelligence Agency, National Security Agency, Uniformed Services of Health Sciences and more.

Beginning in 2014, the USNA STEM Center developed a series of workshops to train members of the naval STEM community in best practices for outreach. From 2014 to 2017, ONR supported 14 workshops offered at multiple sites—reaching 257 attendees.

In fiscal year 2018, DoD STEM requested that the Center broaden their audiences to include DoD STEM practitioners nationwide. The first Best Practices in DoD STEM workshop was held at USNA in Annapolis, Maryland on March 12-13, 2018, on behalf of the DoD STEM Programs Office.

Commands were invited to send participants based on a commitment to STEM outreach at their facility. Thirty-four participants attended, coming from 13 commands at 20 sites. The workshop focused on project-based learning methodology and facilitation techniques.

Participants learned how to scale, adapt and teach activities for different age groups; audiences (students, educators and others); and venues such as the classroom, festivals and fairs, and educator trainings, while using hands-on activities to present technical material.

Attendees were provided with documentation of activities and take-home supplies for immediate implementation at their own sites.

To provide participants with additional experience, the workshop also included an opportunity for attendees to put what they learned into practice by planning and implementing a real STEM outreach event.

At the conclusion of the workshop, participants completed an exit survey indicating satisfaction with the workshop, applicability of content and expected use of training. The survey instrument asked participants to rate program attributes using a Likert scale, as well as answer a series of open-ended questions. The survey responses indicated that attendees gained valuable experience at the workshop and intend to apply what they learned in their own communities. The next workshop is scheduled for Aug. 14-15, 2018, at USNA in Annapolis Maryland. Contact Angie Moran, amoran@usna.edu, for more details and to register.

JSHS is a tri-service—Army, Navy and Air Force—program that encourages high school students to conduct original research in STEM fields. JSHS is a collaborative effort between the research arm of the Department of Defense (DoD) and nationwide colleges and universities. JSHS aims to prepare and support students to pursue careers in science and engineering, conducting STEM research. More than 8,000 talented youth compete annually in 48 JSHS regional symposia covering the U.S., Puerto Rico and DoD Dependent Schools in Europe and the Pacific to receive recognition, incentives and scholarships for their research achievements.

The National JSHS brings together approximately 240 of those high school students whose original scientific research qualified at the regional level. National JSHS finalists, approximately 100 adult leaders, high school teachers, university faculty, U.S. Army, Navy— including the Office of Naval Research’s former Executive Director Dr. Walter Jones (back center)—Air Force, and Office of the Secretary of Defense leadership attend to encourage the future generation of scientists and engineers, and to celebrate student achievement in the sciences. You can see all of the winners online at https://www.jshs.org/2018/06/05/2018-national-jshs-winners/.

Top prizes for oral presentations (front from left to right):

**Cellular/Molecular Biology** — David Huang, Iolani School. Topic: A Morphokinetic and Machine Learning Model for Aneuploidy Screening of Human Preimplantation Embryos.


**Environmental Science** — Grace Hall, Camdenton High School. Topic: The Inhibition of β-glucosidase Through Exposure to (S)-4-Hydroxymandelinolβ-D-glucopyranoside: Applications in the Eradication of Lepidoptera cuneatae via Enzyme Inhibition.


**Chemistry and Materials Science** — Skyler Jones, Ossining High School. Topic: Large Polaron Formation as a Charge Carrier Protection Mechanism in MAPbBr3 and CsPbBr3 Perovskites.
DIMENSIONU: Training Students for Future Careers Through Gaming By Kelly Thompson, SPAWARSYSCEN Atlantic

Math can be fun. It is an essential part of our everyday lives and we need it and use it in almost everything we do. This is the message that the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic has been sending to middle school students in the Charleston Tri-County area. To reinforce this message, SPAWARSYSCEN Atlantic has been teaming with DimensionU for the past six years to provide, and host, the Charleston Lowcountry DimensionU math gaming competition. Winners of the competition move to the next level where they return to SPAWARSYSCEN Atlantic to compete in the Virtual Department of Defense (DoD) Math Competition against students from other DoD-sponsored and supported labs.

DimensionU is a creative, engaging and interactive multiplayer video game focused on core skills in mathematics, with content aligned to state standards. Students engage in a series of first-person action adventure missions with three-dimensional graphics, sounds and animation similar to those in popular video games. Students can customize their avatars and go online to play individually or in teams with classmates or students from around the world. In order to advance to the next level in the game, students must successfully answer/solve math problems to earn points. DimensionU is part of SPAWARSYSCEN Atlantic STEM Education Outreach Program, aimed at developing talent in K-12 schools and at universities.

“We believe that we must meet millennials where they are,” said Shanda Johnson, SPAWARWARSYSCEN Atlantic program lead. “Gaming is a big part of this generation’s lifestyle, so why not let them have fun and learn at the same time. It’s always exciting to bring students on site and see their enthusiasm and motivation toward math and technology.”

This year’s DimensionU Math Competition was hosted in the Atrium of SPAWARSYSCEN Atlantic’s main engineering center. Approximately 100 students and educators filled the space, while volunteers from the workforce served as mentors, content experts and competition judges—while demonstrating to the students the value of STEM careers.

The following month, winning teams from the competition returned to face off virtually in the DoD Math Games against teams sponsored and hosted at other military labs. This year’s participants were from the Air Force Research Laboratory in Rome, New York; the Army’s Armament Research, Development and Engineering Center in Picatinny, New Jersey; and SPAWAR System Center Atlantic, Charleston, South Carolina.

Ensuring that students enjoy and have strong math skills is aligned with SPAWARSYSCEN Atlantic’s STEM Outreach mission to inspire, develop and attract the talent essential to delivering innovative solutions for both the nations’ and SPAWARSYSCEN Atlantic’s current and future challenges.
The Naval Science Awards Program (NSAP) is a U.S. Navy and Marine Corps program that encourages our nation’s students to develop and retain an interest in science and engineering. NSAP recognizes the accomplishments of eligible students at regional and state science and engineering fairs, and the Intel International Science and Engineering Fair for producing and presenting quality science and engineering projects.

Sathya Edamadaka, a junior from High Technology High School in Lincroft, New Jersey, was this year’s Chief of Naval Research Scholarship Award winner. He received a $10,000 scholarship from the Office of Naval Research (ONR) for his research project titled RPAL: A Novel Low-Cost High-Efficiency Photovoltaic System Using Tunable Plasmonic Nanostructures. Edamadaka also won the Intel “Best of Category” for Physical Engineering and the IEEE President’s Scholarship.

**Top (from left to right):** Anthony C. Smith Sr., director, Department of the Navy, Historically Black Colleges and Universities/Minority Institutions program; Cmdr. Mark Murray, a professor at the U.S. Naval Academy; Sathya Edamadaka; and Dr. Michael Simpson, ONR director of Education & Workforce/Naval STEM (Photo courtesy of the Society for Science and the Public).

Inset photo: Edamadaka presents his topic during ISEF. (Photo courtesy of IEEE)

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**Photo Rewind:**

1. Participants use an antenna to track their launched CanSat.
2. University of Minnesota students find their CanSat and open it up to see if their egg is intact... it was unbroken!
3. The University of Maryland team SHIELD (Simulating Heat Inhibiting Entry and Landing Device) has their CanSat inspected prior to launch day. (Photos 1-3 are courtesy of NRL)
4. A team readies their SeaPerch for competition. (Photo courtesy Naval Surface & Undersea Warfare Centers)
5. U.S. Naval Academy workshop attendees explore programming platforms and utilization of sensors. (Photo courtesy of USNA)