

# The Talent Imperative:

Filling the Navy Pipeline in

# STEM

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS



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# Navy STEM for the next generation



This report describes the joint effort of the Naval Systems Commands, the U.S. Naval Academy, and the U.S. Naval Research Laboratory to craft an approach to K-12 STEM outreach that meets the Navy's talent imperative.

Navy leadership has an obligation to help produce the diverse pool of world-class talent that is needed to secure the Navy's future work force in science and engineering. This commitment cannot wait until the college level. It must begin earlier by providing rich learning experiences for students from all backgrounds in science, technology, engineering, and mathematics (STEM). By sparking interest and building skills, the Navy is investing in our future research enterprise as well as the nation as a whole.

The approach focuses on more than 30 communities around the country where the Navy maintains state-of-the-art research facilities. The most powerful asset we have to deploy is our own committed STEM professionals where they live and work. They have collaborated with educators inside and outside the classroom. At the same time, they have created awareness, enhanced critical-thinking skills, and served as role models and mentors for the next generation of Navy scientists and engineers.

With the support of leadership at the lab and headquarters levels, community-based outreach is affordable, sustainable, and targeted to meet the Navy's evolving needs.

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# INTRODUCTION

The Navy has a widely recognized stake in contributing to the development of a world-class pool of U.S. talent in science, technology, engineering, and mathematics.

Three compelling factors argue for an approach that starts early to fill the Navy's STEM pipeline:

First, the level of interest of American students in technical disciplines is comparatively low. Engineering accounts for 4 percent of U.S. bachelor's degrees, compared with about 33 percent in China and 19 percent in the rest of Asia (National Science Board, 2012). The Navy has the capacity to light the spark that encourages thousands of students to pursue STEM careers.

Second, the performance of American students does not measure up to international standards. In both 2006 and 2009, 15-year-olds in the United States scored below those of many other developed countries on the Programme for International Student Assessment (PISA), which is designed to test literacy in mathematics and science (NSB, 2012). The 2009 National Assessment of Educational Progress (NAEP) showed that only 26 percent of 12th-grade students scored at or above the proficient level in math and that only 21 percent of 12th-grade students scored at or above the proficient level in science (NSB, 2012). Only 45 percent of U.S. high-school graduates in 2011 were ready for college work in math and 30 percent were ready in science (ACT, Inc., 2011). The Navy cannot wait for the nation's education system to meet its demand for highly qualified U.S. students. The Navy must take action throughout middle and high-school to expand the pool of proficient students from which we draw.

Third, key segments of the U.S. population are underrepresented in the Navy's (and the nation's) technical work force. Women, who now represent the majority of the U.S. postsecondary population, account for 27 percent of the U.S. technical work force. Underrepresented minorities, making up 24 percent of the U.S. population, comprise about 10 percent of the U.S. STEM work force (NSB, 2012). A diverse, demographically representative work force requires upping the numbers from historically underrepresented groups. The Navy cannot wait until students are in high-school to intervene.

Recognizing the imperative of active engagement, the Office of Naval Research presented a vision of comprehensive Navy capacity-building in its June 2011 report, "Securing Our Future: The Navy STEM Work force." This report laid out a continuum of priorities stretching from inspiration and engagement to

## AGGREGATE NAVY IMPACT AT A GLANCE

Schools	2,012
Teachers	5,123
Students	122,018
Site Coordinators	47
Scientists and Engineers	3,486

employment, retention, and skills development. Earlier, ONR and the Naval Warfare Centers had launched a joint Naval Research-Science and Technology for America's Readiness (N-STAR) initiative aimed at creating a continuum of educational activities and programs to stock the Navy's technical talent pool. The centerpiece of this effort, the Virginia Demonstration Project, received a total of \$4.6 million in Navy funding from FY05 to FY08. Of this funding, more than \$1.4 million was provided to school systems for materials and teacher training.

Consistent with the vision of securing the Navy's future, selected Navy sites launched community-based K-12 STEM outreach programs in 2008 through the newly established National Defense Education Program (NDEP) in the Office of the Assistant Secretary of Defense for Research and Engineering. The inclusion of sites from the Naval Air Systems Command, the Naval Sea Systems Command, and the Space and Naval Warfare Systems Command gave the three Naval Systems Commands (SYSCOMs) a direct stake in engaging in local communities.

This DoD-wide initiative has provided a total of \$24 million to the Naval SYSCOMs, the Naval Academy, and two NRL sites from FY08 to FY13. In addition, NDEP has sponsored Navy participation in DoD national partnerships with FIRST Robotics, MATHCOUNTS, the American Society of Engineering Education, and other organizations. These partnerships were funded at a total of approximately \$3.7 million from FY08 to FY13. NDEP also funded the production of LabTV, a collection of polished,





content-rich four-minute videos. More than 20 of these widely used videos feature Navy STEM professionals speaking informally and enthusiastically about their research and careers.

In short, the Naval SYSCOMs long have viewed K-12 STEM outreach as part of a continuum of K-20 learning opportunities that lead to STEM degrees and contribute to Navy work force development. The K-12 segment of the continuum targets the goals of awareness, inspiration, and engagement, with particular focus on developing the potential of students who ordinarily would not have the chance to successfully pursue a STEM degree.

**Part 1** of this report briefly describes the Navy Model of building STEM capacity through community engagement that has taken shape during the past six years. The signature focus of the model – the engagement of Navy scientists and engineers (S&Es) in their own communities – aligns fully with the Next Generation Science Standards (NGSS) released in April 2013. NGSS were developed to stimulate and build STEM interest and to better prepare high-school graduates for the rigors of

college and careers. Additionally, NGSS make engineering and technology an integral part of the science curriculum for the first time, putting a premium on cross-cutting concepts, disciplinary core ideas, and real-world applications. These priorities play to the unmatched strengths that Navy STEM professionals have to offer inside and outside the classroom.

**Part 2** highlights implementation of the Navy Model at 31 sites in 17 states and the District of Columbia. Its purpose is to provide an overview of how Navy S&Es allocate their time at the community level. Significantly, the SYSCOMs are putting more effort into developing meaningful educational relationships rather than simply producing show-and-tell demonstrations.

The **Beyond K-12 Appendix** illustrates the Navy’s goal that outreach efforts support current and STEM talent needs not only in K-12, but also “K through gray.” The Naval enterprise recognizes the need to continually strengthen scientific and technological capabilities, including current warfighting systems and military personnel needs, and enhance the quality of the Naval work force.



# PART 1: THE NAVY MODEL OF COMMUNITY-BASED STEM DEVELOPMENT

The Navy approach is based on three core assumptions:

First, scarce STEM outreach resources should be concentrated in Navy communities. Despite its importance as a national institution, the Navy does not have the capacity, know-how, or mission of taking on the STEM education challenge for the country as a whole. To be sure, the Navy's approach must be informed by a clear understanding of the national landscape of STEM education, including the implementation of common core standards, the work of the National Science Foundation and National Research Council, and the policies of the U.S. Department of Education.

A more targeted approach, concentrating on communities where the Navy has a long-term presence, represents a more effective use of limited resources. This strategy has the added benefit of impacting educational opportunities for large numbers of military dependents who live near Navy labs, a national priority set by the White House and Congress.

Second, the most important asset the Navy can deploy to help build K-12 STEM capacity is its work force of STEM professionals. Navy S&Es are important stakeholders in the communities in which they live. They can make pivotal contributions not only as role models, but also as collaborators with teachers both inside and outside the classroom (Owens, 2000). Navy personnel have rich experience in the development of critical-thinking skills based on real-world applications – precisely the skills that students will be expected to master.

Third, the challenges and opportunities to build STEM capacity vary from community to community. School organization, instructional materials, standards, assessments, teacher preparation and salaries, access to technology, student demographics, and parental engagement all differ by state and by locale. A one-size-fits-all approach is less likely to be effective than one that is geared to the strengths

of an individual Navy site and the needs of particular Navy communities. While each site must have local knowledge and regional relevance, it is also essential that sites learn from each other. Uniform reporting and a strong network of communication between sites maximize collective knowledge.

These assumptions have led the Navy to craft an approach to STEM outreach that links local empowerment with a shared commitment to Navy STEM work force development. Navy sites have the freedom to set priorities, choose partners, and select activities that represent the best fit between limited Navy resources and community needs. At the same time, each site benefits from the collective knowledge and experience of other sites. This approach has led to tailored – not scattershot – STEM outreach initiatives. Consultation among sites, facilitated partly by ONR and the SYSCOMs, has kept Navy practitioners in close touch with each other and developed a Navy-wide community of practice.



# **THE NAVY MODEL**

*For Building STEM Capacity  
Through Community Engagement*

## **10 Actionable Components**

- 1. Create STEM Development Pathways**
- 2. Engage Leadership**
- 3. Recruit Volunteers**
- 4. Focus on Inquiry and Design**
- 5. Support Teachers**
- 6. Forge Partnerships**
- 7. Capitalize on Out-of-School Time**
- 8. Stress Inclusiveness**
- 9. Share Know-How**
- 10. Measure Impact**



In FY13, the SYSCOMs, the Naval Academy, and two NRL sites partnered with 2,012 schools, collaborated with 5,123 teachers, and reached 122,018 students with a coherent, multidimensional STEM outreach strategy. Strikingly, the SYSCOMs invest well over half of their outreach effort providing in-depth learning opportunities to deliver a minimum of 10 hours of contact with Navy STEM professionals. The Navy Model encompasses 10 actionable components: (1) Create STEM Development Pathways; (2) Engage Leadership; (3) Recruit Volunteers; (4) Focus on Inquiry and Design; (5) Support Teachers; (6) Forge Partnerships; (7) Use Out-of-School Time; (8) Stress Inclusiveness; (9) Share Know-How; and (10) Measure Impact. These components represent the actions that the SYSCOMs are taking individually and collectively to secure the Navy's future STEM work force.

The paragraphs that follow highlight the components that the SYSCOMs, NRL sites, and the Naval Academy have developed and refined over the past six years. In our view, this Navy Model provides a template for community-based STEM outreach across the federal government as well as the private sector.

## 1. Create STEM Development Pathways

The direct payoff of K-12 STEM outreach does not come until students attain postsecondary degrees or certificates and join the Navy's work force. Therefore, the Navy does not view K-12 as an end in itself, but rather as the beginning of a pathway of mutually reinforcing learning opportunities that lead to apprenticeships, internships, and co-ops at Navy sites. Best-in-class K-12 outreach links more broadly based middle- and high-school activities with more selective, independently funded work-force experience programs. Such links are rarely created at arm's length. They require the kind of collaboration that is fostered by a community-based strategy:

- NAVSEA has established an Outreach Integrated Business Operations Team (IBOT) to coordinate all its outreach activities from K-12 through hiring and retention. Biweekly communications between senior managers are melding fragmented educational programs into an integrated work-force development portfolio.
- SSC Atlantic in Tidewater was instrumental in helping to establish the Hampton Roads STEM Collaborative, which brings together industry, military, and academia to work together to leverage participation and interest in STEM efforts in Norfolk and surrounding communities.
- The STEM Speaker Series at the Naval Air Warfare Center Weapons Division (NAWCWD), China Lake and Point Mugu, involves six S&Es participating in monthly presentations about what type of engineers work for NAWCWD, their personal experiences with college, their interests when they were in school, and how they got started. Approximately 600 students participate throughout the school year.

- NAVAIR North Island engineers are regular guest lecturers at San Diego State University and University of California, San Diego student branch meetings where they reach 40 to 70 undergraduate students at each lecture covering topics such as aircraft accident investigation, composite repair techniques, aircraft service life extension, reverse engineering, and 3-D printing.
- SPAWAR Systems Center Pacific has formally articulated a pathway-based approach to STEM recruitment from local communities in San Diego; Honolulu; and Charleston, S.C. This approach recognizes leadership potential, diversity of experience, and dedication as well as school ranking and GPA in the hiring process. It includes a dedicated effort to identify, encourage, and support high-potential students who might not otherwise be aware of the opportunities that SPAWAR has to offer.

## 2. Engage Leadership

Effective K-12 outreach grows out of a culture of community engagement that cannot take hold without high-level leadership. The past six years have seen a cultural shift as many SYSCOM leaders have taken action on multiple fronts. SYSCOM leaders have established career-enhancement incentives that encourage participation in STEM outreach, recognized participation through awards, provided additional financial resources, and raised the public profile of SYSCOM efforts in Navy communities.

- SSC Pacific has embedded participation in STEM outreach as a factor in personnel evaluation of new hires and has presented a special team award to almost 100 STEM professionals for their support of K-12 robotics activities.
- At the Naval Air Warfare Center Training Systems Division in Orlando, industry, government, and academia have come together to establish the Central Florida STEM Education Council.
- Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility convened a Wide Area Gathering in September 2013 to reaffirm the Navy's commitment to being a key STEM partner with the state of Hawaii.
- NAVSEA headquarters has launched a unified effort to engage its employees in STEM outreach, getting the word out to schools that Navy STEM professionals are available to support school-sponsored activities in the District of Columbia, Virginia, and Maryland.

## 3. Recruit Volunteers

The participation of S&Es in STEM outreach is the force multiplier that determines the number of students reached and teachers supported as well as the quality and duration of the learning opportunity. All participants -- whether their time is paid for during the workday or



contributed at no cost during off hours — are a self-selected coalition of the committed. Recruitment taps the curiosity, enthusiasm, and professionalism of STEM professionals whose personal return on investment propels that of the Navy. Local empowerment provides the flexibility to match S&E interests and availability with outreach opportunities. As a result, participation has increased significantly every year at every SYSCOM site.

- At the Space and Naval Warfare Systems Center Pacific in San Diego, 314 volunteers contributed 9, 293 unpaid hours in their communities.
- The Naval Surface Warfare Center Carderock Division commenced its NDEP-supported STEM initiatives in August 2008 with 10 S&E mentors; that number has grown to 45 mentors in 2013. The willingness of S&Es to be engaged in outreach programs is driven by the workplace climate and the steadfast support of Carderock Division's commander and technical director.
- The Naval Surface Warfare Center Dahlgren Division briefs and screens first-time S&Es to match volunteers with opportunities where they are most likely to be effective.
- NSWC Panama City has found that its STEM professionals attract significant numbers of friends and family who support Navy outreach events as volunteers.

#### 4. Focus on Inquiry and Design

K-12 educators and STEM employers recognize that teaching driven by high-stakes, multiple-choice tests does not equip students with the critical-thinking and problem-solving skills they need to be successful. Every SYSCOM lab has its own mix of activities tied together by common programmatic threads such as robotics, materials science, and math. The Navy's portfolio of hands-on inquiry and design tools demonstrates the relevance of textbook learning and fills gaps generally missing in school curriculum. The link to practical application provides the impetus to pursue a STEM career for many students. Demand for such activities in Navy communities is high and, as noted above, will increase further as the Next Generation Science Standards are implemented.

- The Naval Undersea Warfare Center Newport Division has developed the acclaimed Undersea Technology Apprentice Program in which students re-engineer a basic SeaPerch vehicle into an underwater vehicle with an advanced computer processor-controlled drive system.
- The Naval Surface Warfare Center Crane Division STEM professionals use project-based learning modules tied to state science curriculum and serve as after-school tutors for math and science and as mentors for STEM extracurricular activities such as SeaPerch, FIRST, Science Olympiad, and Super Mileage Cars.

- SSC Atlantic hosted "Math Madness," an inaugural tournament for six middle-schools in the tri-county Charleston area that use DimensionU, a state-of-the-art video game-based pre-algebra and algebra learning tool.
- NSWC Carderock in West Bethesda has developed an autonomous underwater glider driven by a buoyancy engine rather than propellers. The SeaGlide has been used to engage students and support teacher training at local sites and in the Navy's collaboration with the Juneau (Alaska) Economic Development Council.
- NAWCTSD STEM coordinators organized a large portion of the I/ITSEC STEM Pavilion called "Project-Based Learning" (PBL). Teachers and parents were shown existing PBL programs from organizations such as SeaPerch, Orlando Science Center, Boston Museum of Science, FIRST Robotics, and Project Lead the Way that can be used in their schools to prepare and expose their students to exciting STEM careers.
- NSWC Dahlgren has partnered with the STEM Education Alliance at the College of William and Mary to provide research-driven professional development to teachers. The program equips participants to apply problem-based learning that is concrete, relevant, and aligned to standards.
- S&Es in NAVAIR's Science Enrichment Program (NSEP) spend time interacting with fifth-grade science students during hands-on experimentation on topics such as static





electricity, rocketry and propulsion, cryogenics, light and spectrometry, magnetism, solar energy, aerodynamics, and polymers.

- The Naval Surface Warfare Center Carderock Division's Detachment Norfolk incorporates calculator robots into learning modules for middle-school students. Students learn how to program hand-held calculators to answer engineering questions and make direct connections to the day-to-day activities of engineers.

## 5. Support Teachers

Educational research has repeatedly confirmed that a skilled teacher is the single most important factor affecting student outcomes in STEM and other disciplines. Only 31 percent of eighth-graders have math teachers who majored in math and 48 percent of eighth-graders have science teachers who majored in science (Change the Equation, 2013). Accordingly, effective STEM outreach must position the Navy as an asset, not a threat, to classroom educators. A commitment to supporting these educators is essential to gaining access to schools and for collaborating in after-school activities. Navy STEM professionals can bolster the confidence of out-of-field teachers, enhance the effectiveness of experienced teachers, and add their credibility as community advocates for STEM education. The co-training of teachers and Navy STEM professionals in inquiry and design is a signature feature of K-12 outreach at many Navy sites.

- The U.S. Naval Academy specializes in training STEM educators in project-based learning in engineering design, chemistry, physics, math, computer simulation,

biology, environmental science, and other disciplines. The Academy's innovative "STEM in a Box" curriculum modules are provided free to educators at summer workshops in Annapolis and around the country. Teacher training accounts for about 25 percent of hours logged in the Academy's outreach program.

- NSWC Carderock West Bethesda hosts weeklong STEM teacher institutes for elementary-, middle-, and high-school teachers as part of its partnership with Montgomery County schools. The daily activities were supplemented with laboratory tours.
- Since 2010, NRL-SSC has provided inquiry-based FOSS Science Modules for the Hancock County School District to help in their endeavor to move their science curriculum from traditional lecture-based teaching to inquiry-based learning. The investment has paid off. Hancock County School District has shown steady increases in the percentage of students scoring proficient and advanced on the state and federally mandated MST2, the Mississippi Science Test.
- NAWCTSD Orlando has sponsored professional development for 25 local educators from 18 participating schools in the Museum of Science Boston's nationally-recognized program *Engineering is Elementary*.
- NAWCWD China Lake partnered with local organizations to provide approximately 75 teachers in the Sierra Sands School District with training that featured activities S&Es and teachers can use together that align with the state educational standards, teach real-life applications of STEM disciplines, and create a pipeline from K-12 to the professional STEM field.
- The Space and Naval Warfare Systems Center Atlantic (SSC Atlantic) in Charleston has supported extensive professional development using Materials World Modules as well as DimensionM math gaming software. Some local school districts in South Carolina have made implementation of these inquiry- and design-based activities a requirement in their schools.

## 6. Forge Partnerships

Partnerships provide an institutional framework for deploying Navy outreach resources and setting mutual expectations and priorities on both sides. The number and scope of partnerships vary by site and community. K-12 partnerships run the gamut from individual schools to districts, regions, and states. Individual sites have joined forces with institutions of higher education, other military services, the private sector, and the Department of Defense Education Activity to pursue shared objectives. In all cases, partnerships provide an essential element of continuity wherever the Navy has a long-term community presence.





### **School partnerships**

- The U.S. Naval Research Laboratory, Washington, D.C., has a five-year partnership with the award-winning Eleanor Roosevelt High-school, a STEM magnet school in Prince George's County, Md., that encompasses extensive support of robotics and the creation of a science café that links STEM with music.
- NAVAIR North Island has partnerships with elementary, middle, and high-schools across San Diego in addition to collaborative relationships with San Diego State University and the University of California, San Diego.
- NAWCTSD in Orlando has a 25-year partnership with the Blankner School (K-8) in Orange County, where NAWCTSD mentors spend at least one hour per week assisting students or providing lab tours and job-shadow opportunities.

### **District partnership**

- NSWC Carderock West Bethesda's partnership with Montgomery County Schools has led to the incorporation of ONR's SeaPerch program into the seventh-grade curriculum of Maryland's largest school district.

### **Multi-district partnerships**

- NSWC Carderock Detachment Norfolk has established five-year partnerships with Virginia Beach City Public Schools, Chesapeake City Public Schools, and Norfolk City Public Schools, enabling engineers to create and facilitate multiple hands-on, in-class learning modules, coordinate the Hampton Roads Summer STEM Academy, and facilitate multiple SeaPerch programs at area schools.
- NUWC Keyport and Puget Sound Naval Shipyard have forged a Remotely Operated Vehicle) partnership in the Puget Sound area that has increased tenfold from FY06 to FY13, now reaching more than 1,000 students in five school districts.
- The Naval Research Laboratory – Stennis Space Center (NRL-SSC) detachment in Mississippi has signed Educational Partnership Agreements (EPAs) with 11 local school districts, six private schools, and two community organizations.
- NSWC Dahlgren is partnering with seven schools in surrounding school districts. In addition, NSWC Carderock Division Dam Neck has joined forces in a year-round partnership with four school systems in the Hampton Roads area.

- The Space and Naval Warfare Systems Center Atlantic in New Orleans is developing EPAs with St. Tammany School Parish, Orleans School Parish, and the Algiers Charter and School Association.

### **State partnerships**

- SSC Pacific's partnership with the state of Hawaii led to the establishment of a robotics class at the Hawaii National Guard Youth Challenge Academy.
- The Naval Surface Warfare Center Panama City Division has entered into an EPA with the Science and Discovery Center of Northwest Florida to promote STEM activities throughout the community.
- Portsmouth Naval Shipyard has partnered with the University of New Hampshire Extension Service and the local chapters of the American Society of Naval Engineers in Maine to gain access to students with a curiosity about STEM fields.
- Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility signed an EPA with the Hawaii State Department of Education in June 2013 including provisions for grants, equipment loans, and the transfer of surplus material and equipment to the state's public schools.

### **DoDEA partnership**

- NAWCTSD Orlando's partnership with DoDEA will make its expertise in modeling and simulation available systemwide.

### **Cross-service partnership**

- NSWC Dahlgren and the Marine Corps Systems Command cosponsor a summer academy for students and teachers at the DoDEA school in Quantico, Va.

### **Joint Navy partnerships**

- SSC Pacific San Diego and NAVAIR North Island have partnered to provide engineering and science nights for the Hispanic community. These workshops provide panels where students and parents can ask questions about the challenges and rewards of studying STEM careers and participate in hands-on activities (all in Spanish).
- The Naval Surface Warfare Center Dahlgren Division (NSWCDD) and Surface Combat Systems Center Wallops Island have entered into an agreement to extend STEM initiatives into the counties surrounding the Wallops Island facility in Virginia.



- NUWC Keyport Division has had an especially close and productive partnership with the Puget Sound Naval Shipyard and Intermediate Maintenance Facility for the past four years on an ever-expanding SeaPerch ROV outreach program. The program has grown from a pilot program in FY06, with four classes and 100 students, to encompass five school districts and more than 1,200 students in FY13.

## 7. Capitalize on Out-of-School Time

Out-of-school enrichment that provides a real-world focus for classroom teaching has multiple advantages for Navy sites. These include greater availability of S&E volunteers at no cost, the ease of avoiding negotiations for classroom access, and a degree of control over the activity that is not possible in school. The out-of-school activity that commands the most Navy attention during the school year is FIRST Robotics, a nationally recognized competition for students in grades 5-12 that celebrates the values of inquiry, design, teamwork, and gracious professionalism. Twenty-three Navy sites hosted summer STEM activities that provided 20 or more contact hours of learning experience per week. Twenty-three SYSCOM sites supported 193 FIRST Robotics teams during the 2013-14 season.

The U.S. Naval Academy STEM camps provide intensive, project-based learning for 800 students in grades eight to 11 in four one-week sessions every summer. About 20 faculty and 60 midshipmen (STEM majors) provide instruction and mentor the learning process.

- Fleet Readiness Center East engineers volunteered to provide hands-on assistance with students who are completing their design projects during the weeklong North Carolina State University Middle-school Engineering Camp. The camp serves 60 rising students in grades seven to nine and provides students with a fun and positive glimpse into various fields of engineering.
- NAWCWD China Lake and the China Lake Museum Foundation introduced about 50 local fifth- and sixth-grade middle-school students to the science of flight, rockets, and robots at the Summer Science Camp.
- Fleet Readiness Center Southeast S&Es lead incoming high-school freshmen in science labs and critical-thinking experiments during a two-week summer foundation course to prepare them for success in high-school-level math and science classes.
- The East Valley High-school Summer SeaPerch Program, sponsored by the Naval Surface Warfare Center Carderock Division Acoustic Research Detachment at Bayview, featured SeaPerch as a science class for approximately 30 students who had fallen behind in the preceding school year.
- As part of the Panhandle Area Educational Consortium, 39 high-achieving students from rural areas near the Naval Surface Warfare Center Panama City Division (NSWC PCD) came to the campus of Florida State University Panama City for a special four-day science camp. NSWC PCD developed the curriculum, provided training, and supplied S&E instructors for camp activities.
- Naval Surface Warfare Center Port Hueneme Division runs a semester-long Pre-Engineering Program twice a year in which 30 high-school students, 12 teachers, and 12 mentors participate. The program gives students the opportunity to apply math and science concepts in real-world engineering scenarios.
- NRL collaborated with D.C. mentors, NRL Sigma Xi chapter, and Toastmasters International to teach public speaking to more than 50 students as part of their SEAP summer research experience.





## 8. Stress Inclusiveness

The SYSCOMs fully grasp the imperative of developing a Navy STEM work force that reflects the face of America. Identifying, motivating, and supporting high-potential students from historically underrepresented groups is a top priority at every Navy site. Every site puts special emphasis on leveling the playing field for low-income students and engaging girls no later than in middle-school. “The number of girls and underrepresented minorities who participate in K-12 engineering-education initiatives is well below their numbers in the general population” (Katehi, Pearson, & Feder, 2009, p. 10).

- China Lake, Point Mugu and Patuxent River host middle-school girls at Expand Your Horizons, where S&Es provide hands-on workshops and introduce students to applications in math, science, and technology for traditional and nontraditional STEM careers.
- NAWCWD China Lake organized a workshop for approximately 800 fifth- through ninth-grade girls at the Brighter Horizons event, which was dedicated to helping women and girls excel in STEM education and careers.
- Fleet Readiness Center Southeast hosts a STEM Summer Camp for disadvantaged students in first through eighth grades.
- SSC Pacific is the first in San Diego to offer “Noche de Ciencia y Ingenieria en Espanol.” In FY13, four events were presented totally in Spanish for the benefit of Spanish-speaking families with the help of more than 60 bilingual volunteers who provide motivational talks and assisted with hands-on experiments for Spanish-speaking students and parents. They anticipate continued high demand in this area, since the K-12 community is nearly 50 percent Hispanic.
- S&Es from NAWCTSD Orlando supported the 2013 Central Florida STEM Day Fair for the third year in a row, interacting with 95 middle-school students from economically challenged families.
- Naval Surface Warfare Center Carderock Division Philadelphia works with local institutes of higher education and secondary education to support STEAM Powered (Science, Technology, Engineering, Arts, and Math) After-School Program, a 20-week program for underserved and minority community-based schools. STEAM uses the Navy S&E work force to focus on energy and robotics, sports science, and the science of the arts. During the 2013-14 academic year, SeaPerch activities will be integrated into these programs.

- Naval Undersea Warfare Center Newport Division promotes greater participation of girls, young women, and career-age women in STEM-related studies and careers through the Greenlight for Girls program and the STEM Girls Conference.
- The U.S. Naval Academy hosts “Girls Only STEM Days” that are focused on middle-school girls and their parents. More than 350 girls attended workshops on a wide range of subjects, as well as a series of career chats with female Navy scientists and engineers.

## 9. Share Know-How

Best-in-class STEM education requires a community of practice that fosters the dissemination of lessons learned, the sharing of know-how, and the scale-up of programs that work. The SYSCOMs have initiated monthly teleconferences of Navy site STEM outreach coordinators to foster increased collaboration.

- NAVSEA’s senior-level IBOT and NAVAIR’s management-led STEM Advisory Council have given great impetus to the sharing of information and know-how, including NAVAIR’s adoption of an electronic collaboration tool by STEM outreach coordinators at NAVAIR’s eight principal sites.
- SPAWAR’s adoption of a commandwide strategy of STEM outreach and recruitment has marked a breakthrough in aligning policy, programs, and practice in communities with widely varying educational settings and demographics.
- A core group of committed STEM practitioners from selected Navy sites including NSWC Carderock, NSWC Dahlgren, NUWC Newport, SSC Pacific, Naval Academy, and NRL Stennis have made personal commitments to create a sustainable community of practice.

## 10. Measure Impact

Program evaluation of the Navy’s STEM outreach and engagement initiatives is necessary to not only justify the expenditures of taxpayer dollars, but to ensure the STEM programs delivered are of high quality and effective. Measuring effectiveness is a Navy priority, which has developed a Metrics and Evaluation Strategy to govern its STEM portfolio, guided by DoD requirements. This strategy requires all Navy STEM projects—regardless of funding source, size, and scope—to collect and report a standard set of baseline metrics that help confirm that stated goals are being met.

For its larger investments, surveys and other reporting methods are used by the Navy to measure whether and how projects are changing attitudes and behavior of participants. For those programs with the highest level of investment, return on investment (ROI) calculations are under development. Finally, subject to availability of funds, the Navy has committed to



selecting one of its major STEM projects annually to conduct a major project evaluation using generally accepted evaluation methodologies. To ensure an unbiased and reliable evaluation effort, the Navy's STEM Coordination Office will be working with an external evaluator, who will be responsible for implementing this strategy.

## Conclusion

The Navy Model of K-12 STEM outreach is creating a culture of community engagement across the Navy's science and technology enterprise. The purpose of this engagement is to provide a gateway to Navy STEM careers, especially for outstanding students from historically underrepresented groups who live in areas where the Navy has a long-term presence. By design, the 10 components of the Navy Model are adaptive because local settings of STEM education and work-force development do not fit into a single mold.

This adaptive approach, developed by the SYSCOMs and funded principally by NDEP, has produced an unprecedented outpouring of volunteers and a sharp spike in demand for the engagement of Navy S&Es in their communities. These trends indicate that the SYSCOMs are on the right track to secure the Navy's STEM work force of the future.

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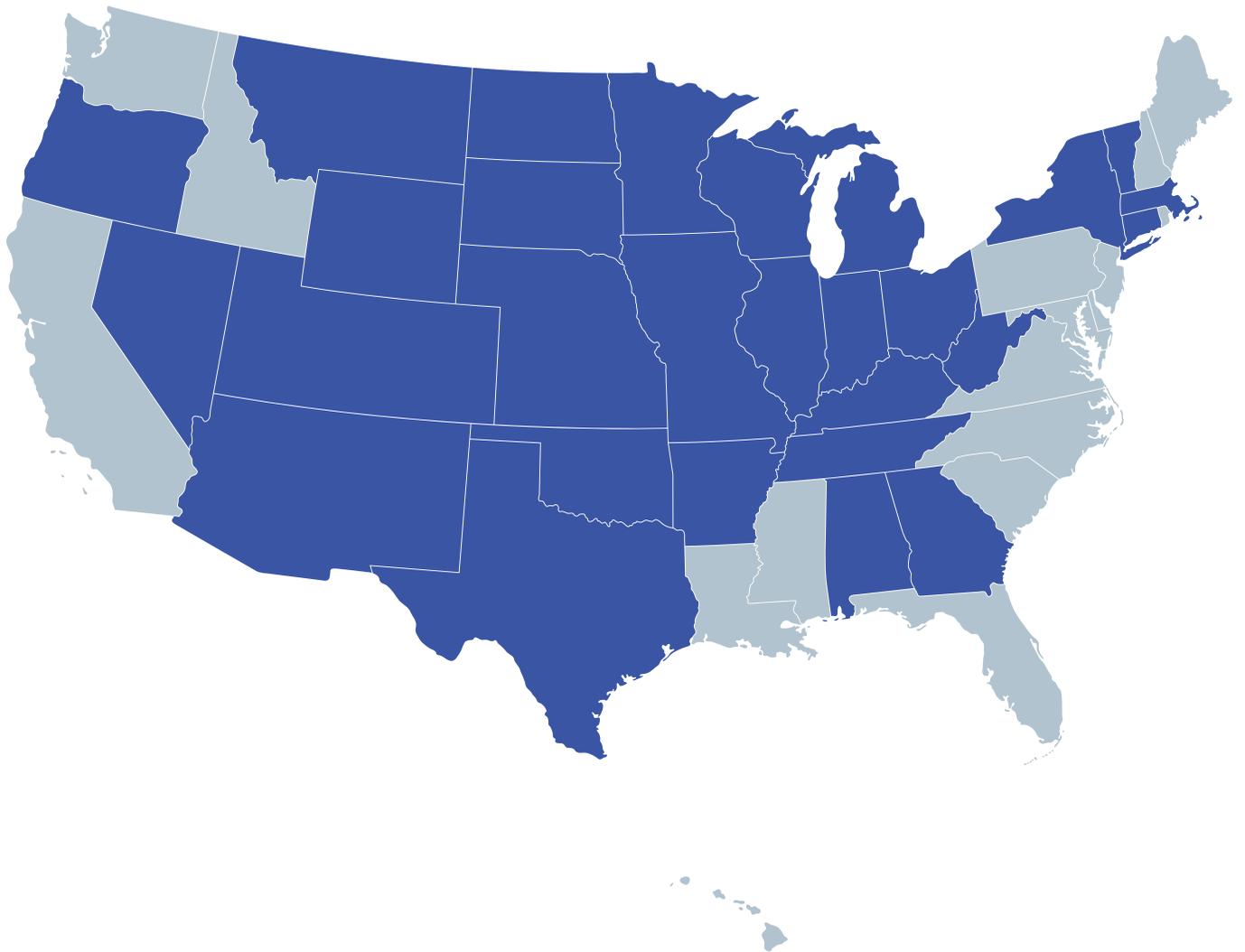






## PART 2: IMPLEMENTATION OF THE NAVY MODEL AT THE COMMUNITY LEVEL

Part 2 highlights implementation of the Navy Model at 31 sites in 17 states and the District of Columbia. Its purpose is to provide an overview of how Navy S&Es allocate their time at the community level. Significantly, the SYSCOMs are putting more effort into developing meaningful educational relationships rather than simply producing show-and-tell demonstrations.





# CALIFORNIA

## IN-SERVICE SUPPORT CENTER FLEET READINESS CENTER SOUTHWEST, NORTH ISLAND

Repair capability resides at FRCSW for more than 11,700 unique components used on Navy and Marine front-line tactical and support aircraft.

### A National S&T Asset

NAVAIR's In-Service Support Center (ISSC) North Island is located at the Fleet Readiness Center Southwest (FRCSW) Naval Air Station North Island, San Diego, Calif., known as the birthplace of naval aviation. The ISSC provides comprehensive support to the nation's aviation warfighters by overhauling, repairing, and modifying Navy and Marine Corps front-line tactical, logistical, and rotary-wing aircraft and their components. These include jetfighters; airborne battle-management aircraft; multi-mission aircraft; attack, general purpose, and heavy-lift helicopters; vertical take-off and landing aircraft; and electronic warfare aircraft.

For the F/A-18 Hornet, ISSC North Island is the Navy's lead facility for performing overhaul, repair, modification, and center-barrel replacement, a unique capability designed, engineered, and built at the facility. ISSC North Island is also the sole Navy repair site for the LM2500 turbine engine and overhauls aircraft catapult and arresting gear systems on all Pacific Fleet carriers. The depot field service provides rapid-response, on-site repair and modification of squadron aircraft anywhere in the world, ashore and aboard carriers at sea.

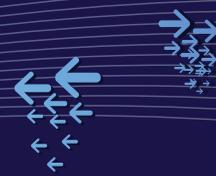
The Office of Naval Research designated FRCSW a Navy federal laboratory in November 2010. The ISSC at FRCSW employs more than 400 engineers and scientists who provide innovative sustainment-engineering solutions and participate in effective technology transfer between industry and universities. Both technology transfer and STEM outreach are important measures of a federal lab's success.

### STEM Climate

For more than 21 years, NAVAIR North Island has paved the way as a STEM community-outreach leader in San Diego. The

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	1991
Geographic Reach	San Diego metropolitan area
FY13 S&E Mentors & Coaches	50 S&Es 4 coaches 50 mentors
FY13 Schools Reached	7 elementary schools 2 middle-schools 4 high-schools 3 school districts
FY13 Personal Interactions	20 teachers 500 students in classrooms 2,000 students outside classrooms 2,000 hours (both paid and volunteer)
Other Partners & Catalysts	San Diego State University; Project Lead the Way; MESA (Mathematics, Engineering, Science Achievement); Society of Hispanic Professional Engineers (SHPE); SPAWAR SSC Pacific; Mexican American Engineering Society (MAES)

NAVAIR Science Enrichment Program (NSEP) enlists the talents of more than 40 volunteer engineers and scientists who reach out to thousands of students every year. NAVAIR North Island has partnerships with elementary, middle, and high-schools across San Diego in addition to collaborative relationships with San Diego State University and the University of California, San Diego. The primary focus of NSEP is to motivate and inspire fifth-grade students through interactive science workshops.



## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Adelante Mujer Latina Conference 2013.* We provided three engineering workshops (two in English and one in Spanish) to more than 300 mothers and their middle and high-school daughters as part of the Adelante Mujer Sweetwater Union High-school District Program. During these workshops, we provided inspirational testimonies regarding the great career possibilities and opportunities that STEM careers offer to young women.
- *Engineering and Science Dream Exploration Expo 2013.* NAVAIR North Island coordinated and hosted the first-ever Engineering & Science Dream Exploration Expo at the Sweetwater Union High-school Performing Arts Theater. During this event, more than 250 students from six San Diego high-schools experienced a high-energy day full of music videos highlighting the wonders of engineering and the powerful testimonies of various professional engineers from San Diego. The students also got to learn about the different fields of engineering including chemical, manufacturing, industrial, biomedical, aerospace, mechanical, civil, electrical, and computer.
- *Rady Children's Hospital Day of Science and Engineering.* Our NSEP team brightened the day of more than 25 young patients from our children's hospital. Six S&Es from North Island participated in this heartwarming event as they made science come alive to children and teen patients of the hospital. We witnessed sad faces transform to smiles and laughter as we amazed the young patients with science workshops in the subjects of electrostatic discharge (ESD), aerodynamics, rockets, and more. This event was coordinated with the hospital's education department and pediatric doctors and nurses.

### Classroom Activities

- *NAVAIR Science Enrichment Program (NSEP).* More than 30 S&Es mentored some 500 fifth-grade students throughout the 2012-13 school year. The mentors presented subjects in the areas of ESD, magnetism, solar energy, aerodynamics, polymers, structures, and much more. Five San Diego elementary schools participated in these workshops. Each workshop is approximately one hour long. We have five to six S&E mentors who participate in each event. Our average outreach per workshop is 30 students. These one-hour workshops include a 10-minute introduction of the S&Es, a 20-minute science presentation, and 30 minutes of a hands-on activity.

- *AIAA Student Branch Support.* NAVAIR engineers are regularly requested as guest speakers at both SDSU and UCSD student branch meetings reaching between 40 and 70 undergraduate students at each lecture. Lecture topics cover the gamut from aircraft-accident investigation, composite repair techniques, aircraft service life extension, and reverse engineering and 3-D printing. This outreach is important to attract high-caliber engineers into STEM careers within the federal government.

### Outside Classroom Enrichment Activities

- *MESA Shadow Day.* Ten college students from San Diego City College, Southwestern Community College, and San Diego State University spent six hours shadowing S&Es to gain insights about STEM careers.
- *Engineering and Science Night (in Spanish).* In partnership with SSC Pacific San Diego, SHPE, and MAES, we continue to participate in engineering and science nights for the Hispanic community. During these workshops, we provide student/professional panels where students and parents can ask questions about the challenges students face and the rewards for studying careers in science and engineering. We also provide other inspirational presentations, speakers, and hands-on activities (all in Spanish).
- *SDSU Aerospace Engineering Department Capstone Design Project Support.* Annually for the past 15 years, the SDSU alumni within the Air Vehicle Department at FRCSW has provided SDSU Aerospace Engineering Senior Design Project teams with a behind-the-scenes tour of aircraft overhaul and repair activities at FRCSW to provide critical insight into aircraft structural layout and systems installations as they consider design ideas for their capstone project: Conceptual Design for a Navy Jet Trainer or Close Air Support Aircraft. At the end of the semester, typically two NAVAIR engineers serve as project judges along with several other professionals from the local aerospace industry.

### Mentorship and Internship Activities

- *Summer Internships.* Twelve S&Es served as mentors for seven students from various California universities and colleges who were hired as NAVAIR interns for the summer. All were assigned engineering projects and exposed to different engineering fields and disciplines within the In-Service Support Center/Fleet Readiness Center Southwest. They also participated in aircraft and facilities/laboratory tours and rotational assignments.

- *FIRST Robotics.* Ten S&Es mentored more than 60 middle- and high-school students in support of FIRST Tech Challenge and FIRST Robotics Competition and VEX Robotics. The S&Es also provided pre-season workshops in the areas of basic design and safety. The mentors and students brainstormed, designed, and built robots for competition. Our robotics mentoring efforts reached four high-schools and one middle-school.
- *UCSD Team Internship Program.* Each year we work with local a university, UCSD, to select a multidiscipline undergraduate engineering team to work 15 weeks during the summer as full-time student interns to develop a solution to a real-world engineering challenge. Most recently, the UCSD TIP team working with our engineering mentors developed a model-based instruction (MBI) template and evaluated it here at FRCSW. This MBI approach will allow us to deliver digital work instructions on a tablet device rather than traditional 2-D data via paper and blueprints.

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# CALIFORNIA

# NAVAL AIR WARFARE CENTER WEAPONS DIVISION CHINA LAKE AND POINT MUGU

NAWCWD’s vision is to be the leader in providing innovative, integrated, and dominant warfighting effects for our Naval, Joint, and coalition forces.

### A National S&T Asset

The Naval Air Warfare Center Weapons Division (NAWCWD) at China Lake and Point Mugu is a leader in research, development, acquisition, test, and evaluation for weapons and warfare systems, including guided missiles, free-fall weapons, targets, support equipment, crew systems, and electronic warfare in support of the Navy and Marine Corps. NAWCWD also plays a prominent role in weapons armament and technology, investigating advanced weapons and systems, complex software integration on tactical aircraft, energetic materials, and weapons subsystems. NAWCWD also specializes in aircraft weapons integration.

Some of the latest defense technologies have been developed at NAWCWD China Lake and Point Mugu, including unmanned aerial vehicles (UAVs), micro-munitions and laser-guided bombs operated from small UAVs, improvised explosive device countermeasures, GPS-guided munitions, electronic warfare, and biofuels. “Spike,” a tiny, 5-pound, shoulder-launched guided missile that is man-portable, UAV-capable, and well-suited for robotic systems, also was developed at China Lake.

### STEM Climate

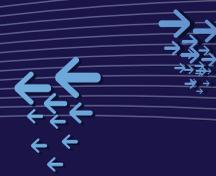
Through senior leadership commitment, involvement, and accountability, NAWCWD strives to increase efforts to secure a diverse, results-oriented, and effective work force by developing a flexible and inclusive work environment that draws upon work force education, strategic outreach, targeted recruitment, and retention. Special emphasis is placed on increasing engagement in STEM programs to provide related awareness, collaboration, and support activities at schools in adjacent communities.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2010
Geographic Reach	Kern and Ventura counties
FY13 S&E Mentors & Coaches	2 site coordinators 253 S&Es
FY13 Schools Reached	4 school districts 9 elementary schools 7 middle-schools 8 high-schools
FY13 Personal Interactions	200 teachers 2,976 students in classrooms 4,688 students outside classrooms 277 paid classroom hours
Other Partners & Catalysts	California State University Channel Islands; Cerro Coso Community College; China Lake Museum Foundation; Maturango Museum; American Association of University Women; Project ACCESO; High Desert Leapin’ Lizards

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Exploration of Science, Technology, Engineering, and Math (STEM) Careers EXPO Ventura County.* The STEM Expo shows approximately 1,500 middle- and high-school students who are attending the Ventura County Science Fair how their interest in STEM subjects can lead to career opportunities with regional employers.



- *STEM Day.* S&Es set up eight sciences, technology, and/or engineering displays for approximately 1,200 students. S&Es staff each display to explain points of interest and answer questions. Most displays include short demonstrations and/or hands-on engagement.
- *Science Carnival.* Three hundred volunteers introduced 1,600 K-12 students, their parents and/or family members, to 80 interactive S&E activities. The goal was to show students, parents, and family members that S&E can be fun.

## Classroom Activities

- *Advancement Via Individual Determination (AVID).* S&Es make monthly classroom visits to eighth-grade AVID classes to help students prepare for college-prep curriculum at the high-school level with hands-on demonstrations or projects to encourage STEM careers. AVID students are encouraged to enroll in rigorous courses, such as algebra, and seek enrollment in four-year colleges.
- *STEM Speaker Series.* Six S&Es participate in monthly presentations about what type of engineers work for NAWCWD, their personal experiences with college, their interests when they were in school, and how they got started. Approximately 600 students participate throughout the school year.
- *Lego Mindstorms Robotics.* Six S&Es lead three six-week programs for approximately 60 fifth-grade students. The kits contain software and hardware to create small, customizable, programmable robots.
- *MaKey MaKey Great Inventors Program.* Project ACCESO (Achieving a Cooperative College Education Through STEM Opportunities) at the California State University Channel Islands has purchased three 3-D printers, four MaKey MaKey kits and five open source arduinos. NAWCWD employees, along with five Channel Islands STEM students; one computer-science faculty member; high-school teachers in technology, engineering, and math; and the Project ACCESO coordinator, Sandy Birmingham, will all be part of the design and implementation. This program is ultimately about teaching students the design and engineering processes.

## Outside Classroom Enrichment Activities

- *Expanding Your Horizons (EYH).* Together with the Ridgecrest Women of Math and Science, Inc., NAWCWD hosts 150 sixth- through eighth-grade girls at an event with more than 50 S&Es holding hands-on workshops. Participants are introduced to applications in math, science, and technology for traditional and nontraditional STEM careers.

- *Brighter Horizons.* S&Es led a workshop at the Brighter Horizons event held by the American Association of University Women at California State Lutheran College. This program was dedicated to helping women and girls excel in STEM education and careers. Approximately 800 girls from fifth and ninth grade participated in various workshops throughout the day.
- *Young Engineers & Scientists (YES!).* Together with the YES! Committee, 50 S&Es hosted 125 sixth- to eighth-grade boys in a day filled with hands-on experiments. Participants were introduced to applications in math, science, and technology for traditional and nontraditional STEM careers.

## High-School Project Mentoring and Internship Activities

- *High-school Senior Project Mentoring.* About 15 S&Es serve as mentors to approximately 40 high-school students for three months. Students design projects based on competition requirements such as Ten80 Student Racing Challenge (RC design), U.S. Imagine Cup competition (video game design), Team America Rocketry Challenge, and MATE ROV competition. Upon completion of projects, students compete in regional challenges.
- *Summer Science Camp.* For the fourth year, five NAWCWD employees and five China Lake Museum Foundation volunteers use a science-camp format to introduce middle-school students to new ways of looking at STEM subjects. About 50 local fifth- and sixth-grade students attended Summer Science Camp at Murray Middle-school and learned about the science of flight, rockets, and robots.

## Teacher and S&E Training

- *Building Partnerships in STEM Region 8 — After-School Programs.* NAWCWD partnered with local organizations to provide approximately 75 teachers with a framework for STEM partnerships with NAWCWD based on “Moving Beyond the Bell After-School Program” in the Sierra Sands School District. Training discussed the process for developing teacher-S&E partnerships to teach real-life applications of STEM disciplines and create a pipeline from K-12 to higher education and the professional STEM field. A demonstration session featured types of activities S&Es and teachers can use together that align with the state educational standards.

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# FLORIDA

# FLEET READINESS CENTER SOUTHEAST JACKSONVILLE

FRCSE has been providing engineering support and repair to Naval aviation for over 70 years.

## A National S&T Asset

The mission of the Fleet Readiness Center Southeast (FRCSE), in Jacksonville, Fla., is to maintain capability for and perform a complete range of depot-level rework operations on designated weapon systems, accessories, and equipment, including aircraft, engines, aviation-system components, and ground-support equipment. FRCSE manufactures parts and assemblies as required, provides engineering services for the development of hardware design changes, and furnishes technical and professional services on aircraft maintenance and logistics problems. The aircraft program incorporates phased depot maintenance and planned maintenance intervals repair, conversion, and modernization. The aircraft modification program offers turnkey services from design and installation to documentation and flight-testing. FRCSE possesses complete engine overhaul capabilities. The center also provides intermediate and depot-level repair for the structural, mechanical, avionics, and engine-component programs ranging from miniature to sizable electronic and mechanical parts found in aircraft, engine, and weapon systems.

## STEM Climate

FRCSE's STEM outreach program has been enthusiastically welcomed by the local community and heavily supported by the center's leadership. A very committed group of scientists and engineers dedicate their time and talent to awakening science and math interest among young people.

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Regional Science Fairs.* S&Es provide judging and mentoring to K-12 science-fair participants. High-caliber entries advance to state science-fair competitions.

## NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2010
Geographic Reach	Duval and Clay counties
FY13 S&E Mentors & Coaches	2 site coordinators 25 S&Es 10 mentors
FY13 Schools Reached	2 school districts 3 elementary schools 1 middle-school 2 high-schools
FY13 Personal Interactions	25 teachers 500 students in classrooms 50 students outside classrooms 500 hours (both paid and volunteer)
Other Partners & Catalysts	Communities in Schools

## Classroom Activities

- *NAVAIR Science Enrichment Program (NSEP).* S&Es spend a full day interacting with fifth-grade science students on various scientific topics. Interactions include demonstrations of scientific principles and hands-on experimentation. Topics for experimentation include static electricity, rockets and propulsion, cryogenics, structures and forces, light and spectrometry, and digital circuits.

## Outside Classroom Enrichment Activities

- *Engineer for a Day.* Students spend an entire day shadowing an engineer and learning about the work of NAVAIR engineers and scientists.

- *Summer Intern Program.* Select high-school and college students intern with our labs to gain hands-on experience in a professional engineering environment. Work assignments are commensurate with level of study.

### **Mentorship and Internship Activities**

- *STEM Summer Camp.* This multiday Title 1 school camp is for students from disadvantaged areas who want to attend a camp dedicated to science and robotics. The camp exposes students in first through eighth grades to science experiments and Lego robotics kits.
- *STEM Orientation.* This summer-school program in conjunction with Communities in Schools provides incoming high-school freshmen with a two-week foundation course to prepare them for high-school-level math and science. NAVIAIR Jacksonville S&Es lead students in science labs and critical thinking experiments in order to foster the basic elements for success in high-school math and science. We also hope to instill our love of engineering, math, and science in hopes of encouraging students to pursue careers in engineering and science fields.

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## FLORIDA

# NAVAL AIR WARFARE CENTER TRAINING SYSTEMS DIVISION ORLANDO

In 1941, a Naval aviation officer championed the use of “synthetic training devices” to increase pilot readiness. Luis de Florez became a rear admiral and is renowned as a pioneer in flight simulation technology and virtual reality.

### A National S&T Asset

The Naval Air Warfare Center Training Systems Division (NAWCTSD) in Orlando, Fla., integrates the science of learning with performance-based training and measurement of training effectiveness to improve the performance of sailors and Marines. NAWCTSD is the Navy’s source for a full range of innovative products and services that provide complete training solutions, including training analysis, design, development, and full life-cycle support. One of NAWCTSD’s principal capabilities is research in technologies and improved methods for simulation and training. NAWCTSD continually engages the warfighter to understand performance challenges, solve problems, create new capabilities, and provide essential training support.

### STEM Climate

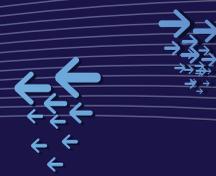
NAWCTSD has a long-standing connection to the educational aspirations of the central Florida community, reflected in its 25-year partnership with the Blankner School (K-8) in Orange County, where NAWCTSD has provided mentors, laboratory tours, job-shadow opportunities, and incentives for students. NAWCTSD also has a long-standing relationship with the University of Central Florida (UCF), providing internship opportunities for UCF students.

These efforts have evolved into STEM outreach to area schools, where NAWCTSD partners its scientists and engineers (S&Es) with teachers in classrooms, offers opportunities for professional development of science and math teachers, and involves students in STEM-related activities. Due in part to these efforts and those of many other central Florida stakeholders, the visibility of STEM is rising in central Florida. Area public-school systems have established county positions for STEM specialists, schools actively promote STEM to their student

### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2009
Geographic Reach	Brevard, Orange, Osceola, and Seminole counties
FY13 S&E Mentors & Coaches	2 part-time site coordinators 150 S&Es 13 mentors (robotics and Blankner School)
FY13 Schools Reached	2 K-8 schools 14 elementary schools 7 middle-schools 24 high-schools Total : 47 schools in 4 school districts
FY13 Personal Interactions	725 teachers 4,616 students 3,383 hours (paid and volunteer)
Other Partners & Catalysts	University of Central Florida; National Center for Simulation; Central Florida STEM Council; Florida High Tech Corridor Council; Team Orlando; DoD Education Activity (DoDEA)

bodies, and educators request NAWCTSD and industry support for STEM events. Industry, government, and academia have come together to establish the Central Florida STEM Education Council. The commanding officer and his representatives (such as STEM coordinators) serve as liaisons to key STEM organizations that include the Central Florida STEM Education Council, the Orlando Science Center, and the Promoting Regional Improvement in Science and Math project (PRISM).



## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Engineering Futures Forums.* In 2013, NAWCTSD engineers participated in several Engineering Futures Forums hosted by the University of Central Florida College of Engineering and Computer Science and attended by students from local middle and high-schools. Through personal experience and visual presentations, NAWCTSD engineers encourage students to consider an engineering career.
- *Science Fair Judging.* NAWCTSD engineers participated as judges in the Seminole County Regional Science, Math, and Engineering Fair, where the projects from 10 high-schools and 14 middle-schools were presented for judging. Additionally, two NAWCTSD engineers also served as judges at a local middle-school science fair, where scoring was based upon factors such as organization, use of language, research methods, originality, and scientific understanding. The projects exhibited an excellent level of understanding of the scientific method and creativity.
- *Student Tours.* The purpose of the I/ITSEC student tours is to allow students to experience first-hand, real-world training, simulation, and education solutions that will help bridge the gap between classroom theory and the real-world application of STEM subjects. NAWCTSD volunteer escorts led small groups of students through the exhibits to give them a complete understanding of how they can apply the STEM-related skills they learn in the classroom to highly successful careers in the training, modeling, and simulation industry.
- *SeaPerch Training at I/ITSEC.* During the week of the I/ITSEC Conference, NAWCTSD's STEM Outreach Program coordinated a SeaPerch STEM training event. Twenty-five educators from the Seminole, Orange and Brevard county school districts, Orlando Science Center, Citrus Council Girl Scouts, and teachers from "I/ITSEC's America's Teachers" were trained in the construction of a SeaPerch. Five NAWCTSD scientists and engineers also participated in the event and will help support the implementation of the follow-on SeaPerch programs at each of these organizations/schools in the central Florida area.
- *Project-Based Learning Booths at I/ITSEC.* NAWCTSD STEM coordinators organized a large portion of the I/ITSEC Science, Technology, Engineering, and Math (STEM) Pavilion called "Project-Based Learning (PBL)." This consisted of 14 exhibits to include organizations such as SeaPerch, Orlando Science Center, Boston Museum of Science, FIRST Robotics, National Center for Simulation, Driving Science, La Luz Academy, eCybermission, CyberPatriots, and Project Lead the Way. The

primary audience was invited teachers and parents to show them existing PBL programs that can be used in their schools to prepare and expose their students to all the exciting careers that are possible in modeling and simulation, applied mathematics, science, technology, and engineering.

- *2013 Florida Citrus Sports Camp Work Force Central Florida STEM Day Fair.* Supported by NAWCTSD for the third year in a row, this event serves middle-school youngsters from economically challenged families, a large percentage of whom are minority. They participate at no cost and are provided transportation and meals. Engineers staffed one of five STEM stations and interacted with 95 students (46 girls) in groups of approximately 15 to 25 students each.

### Classroom Activities

- *Teach-Ins.* Each November, in celebration of American Education Week, Orange and Seminole county schools hold a "Teach-In" for volunteers to speak with students about academics, careers, and the future in a fun and engaging way. This year, as in the past several years, NAWCTSD S&Es participated in this event and have inspired students through personal stories and entertaining presentations to consider STEM careers, particularly with the Navy.

### Mentorship and Internship Activities

- *FIRST Robotics Teams.* In FY13, S&Es supported FIRST Robotics Competition (FRC) teams at Merritt Island and Cocoa high-schools, FIRST Tech Challenge (FTC) teams at Lyman and Hagerty high-schools, and FIRST Lego League (FLL) teams at Sanford and Milwee middle-schools. During the FIRST season, mentors met with teams at least once a week and attended competitions with their teams. S&Es also assisted with organizing and judging robotics competitions hosted by supported teams. During the 2012-13 school year, S&Es mentored 10 teams.
- *Blankner School Partnership.* Throughout the year, several NAWCTSD employees mentor at-risk students of Blankner School (K-8). Mentors spend at least one hour per week assisting students. At the end of the year, eighth-grade students job-shadow a STEM professional. Approximately 25 students shadow NAWCTSD employees, have lunch with shadow partners, and attend modeling and simulation demonstrations.
- *Summer Internships for High School Students.* NAWCTSD participated in the Science and Engineering Apprentice Program (SEAP), which provides an opportunity for students to participate in research at a Department of the Navy (DoN) laboratory during the summer. Four local high-school students were paired with NAWCTSD mentors and worked alongside lab personnel on various projects.

## Teacher and S&E Training

- *Engineering Is Elementary.* Teacher training was sponsored by NAWCTSD through a Cooperative Agreement (CA) with the Orlando Science Center (OSC). OSC provided the training for 25 local educators from 18 participating schools with NAWCTSD scientists & engineers (S&Es) assisting with the selected project, "A Stick in the Mud."
- *SeaPerch Training.* NAWCTSD, in conjunction with the Central Florida YMCA, coordinated training of local public-school teachers in the building of a SeaPerch. Two NAWCTSD engineers were on hand to provide instruction on soldering, wiring, using a multi-meter, and other skills necessary for the construction of a SeaPerch.

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## MARYLAND

# NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, PATUXENT RIVER

NAWCAD Patuxent River was the first Navy laboratory to enter into an educational partnership agreement with a private school. Today, agreements are in force with nine private schools.

### National S&T Asset

The Naval Air Warfare Center Aircraft Division (NAWCAD) at Patuxent River, Md., is a national test and evaluation asset. It is a designated DoD Major Range and Test Facility Base — one of only 22 such facilities that have received this designation — and is considered critically important to the success of DoD acquisition programs. Additionally, NAWCAD Patuxent River is one of the country's two centers of excellence for rotary wing aircraft research, development, test, acquisition, and engineering, as designated by the 2005 Defense Base Realignment and Closure legislation. NAWCAD Patuxent River houses the U.S. Naval Test Pilot School. All U.S. Navy aircraft (manned and unmanned) are flight-tested at NAWCAD Patuxent River.

### STEM Climate

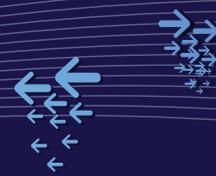
The STEM climate at NAWCAD Patuxent River is extremely positive. While scientists and engineers (S&Es) have long engaged with students and the school community, the base's official entry into STEM outreach started when the local county created a STEM Academy within its public-school system. The neighboring county is now implementing Project Lead the Way, focusing on STEM education. Additionally, each Maryland school district has been invited to identify two high-schools to be designated as Maryland Business Roundtable STEM Innovation Schools. NAWCAD Patuxent River has enlisted the help of hundreds of subject matter experts (that is, Navy scientists and engineers) to help mentor, coach, demonstrate, train, and tour. The S&Es also developed complementary material that could be used when visiting classrooms or within Navy laboratories when students visit on tours. Today, more than 300 S&Es engage in STEM outreach.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2007
Geographic Reach	Southern Maryland counties of St. Mary's, Charles, and Calvert
FY13 S&E Mentors & Coaches	1 site director, 2 site coordinators 142 S&Es 25 coaches/mentors
FY13 Schools Reached	3 school districts 9 elementary schools 15 middle-schools 13 high-schools
FY13 Personal Interactions	43 teachers 705 students in classrooms 5,220 students outside classrooms 2,245 hours (paid), plus numerous volunteer hours
Other Partners & Catalysts	St. Mary's College of Maryland; College of Southern Maryland; University of Maryland; The Patuxent Partnership; Business & Education Community Alliance; growingSTEMs

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Expanding Your Horizons (EYH)*. The first Southern Maryland EYH STEM event, held in March 2013, was a huge success, with more than 50 participants and more than 100 S&Es involved. Middle-school girls attended a day of numerous hands-on STEM workshops, interacted with positive role models, and heard an inspiring keynote speaker. The mission of the initiative was to heighten the awareness of STEM and STEM-related careers to sixth- through eighth-grade girls, and to inspire them to become our future



work force. This initiative will continue in 2014 under an independent, locally created group: Science, Technology, Engineering, and Mathematics — Inspiring the Next Generation (STEM-ING), with expectations of nearly triple the number of students.

- *High-school Survivability Challenge.* For the seventh year, STEM Academy ninth-grade students will be working in teams to build an undetectable, impenetrable, and unbreakable aircraft from specified parts, to specified dimensions, as part of an engineering challenge that utilizes the Systems Engineering Lifecycle Process. Over the course of two months, they go through a mini System Requirements Review (SRR) and Preliminary (PDR) and Critical Design Reviews (CDR) with NAVIAIR S&Es, culminating in an Operational Test (OT) event to see which team's aircraft is the most survivable. The teams have their aircraft designs tested on base.
- *Calvert County Science and Engineering Festival.* The STEM coordinator for Calvert County wanted to inject more energy into the annual countywide science fair. She turned it into a Science and Engineering Expo and invited regional S&Es, including experts from NAWCAD Patuxent River, who provided technology demonstrations and interacted with students and parents.
- *Society of Women Engineers (SWE) Invent it! Build it! Expo.* This event was held at the Baltimore Convention Center in support of SWE and provided "Engineering. Go For It!" magazines to more than 1,500 youth, parents, and educators.

### Classroom Activities

- *Pax River Flight Academy.* NAWCAD, in collaboration with The Patuxent Partnership, established the Pax River Flight Academy, a state-of-the-art learning environment that provides middle- and high-school students with access to flight simulators, an air traffic control lab, and a mission command center. Students work through challenging assignments, or "missions," that enable them to acquire new skills and discover real-world applications for their math, science, engineering, physics, and computer skills.
- *In-Class Robotics.* S&Es worked with local schools and S&Es from nearby NSWC Indian Head Division to create an in-school robotics program that is more advanced than FIRST Lego League but not quite as competitive as FIRST Tech Challenge. This unique program affords students an opportunity to experience the technical, hands-on activities that are key to learning STEM principles while not requiring them to participate in after-school programs.

The in-class activities culminate in a regional robotics competition. Forty teams from five area schools participate.

- *Speaker's Bureau.* S&Es developed 22 STEM learning modules that can be taken into classrooms to help teachers reinforce and enhance classroom lessons with hands-on activities. Each package provides examples of how STEM disciplines are used in the real world. Subject areas include chemistry, physics, calculus, algebra, trigonometry, biology, computer science, and engineering.

### Outside Classroom Enrichment Activities

- *After-School Robotics.* S&Es support 15 extracurricular robotics teams in 10 area elementary, middle, and high-schools (FLL, FTC, FRC, and VEX teams). In addition to land-based robotics teams, S&Es support Great Mills High-school. Its after-school engineering club competes in the annual Association for Unmanned Vehicle Systems International's (AUVSI) student unmanned air systems competition.
- *Lab Tours.* S&Es developed 15 lessons that are age/grade appropriate for students visiting the facility. The lessons range from one to seven hours and are used to reinforce classroom curricula. Topics include optics, corrosion, thermal protection, and aircraft survivability. Students conduct experiments in Navy labs and gain an appreciation for the work done by S&Es.
- *STEM enrichment for Patuxent River NAS youth.* There are two youth facilities on station — one for younger youth and one for teenagers. The children of base workers, both military and civilian, attend summer-camp programs at these facilities. For the first time, the Educational Outreach Office implemented tours and hands-on activities each week for each group. The hands-on activities were created and taught by S&Es.
- *STEM @ Your Library.* NAWCAD Patuxent River sponsored growingSTEMS, a group of our S&Es, who developed a new program for youth ages 7 to 12. STEM @ Your Library consists of five hands-on STEM workshops to be taught one time each, at each of the three county public libraries. NAWCAD Patuxent River sponsored two of the five workshops: the Science of Flight and Excavating the Ocean Floor.

### Mentorship and Internship Activities

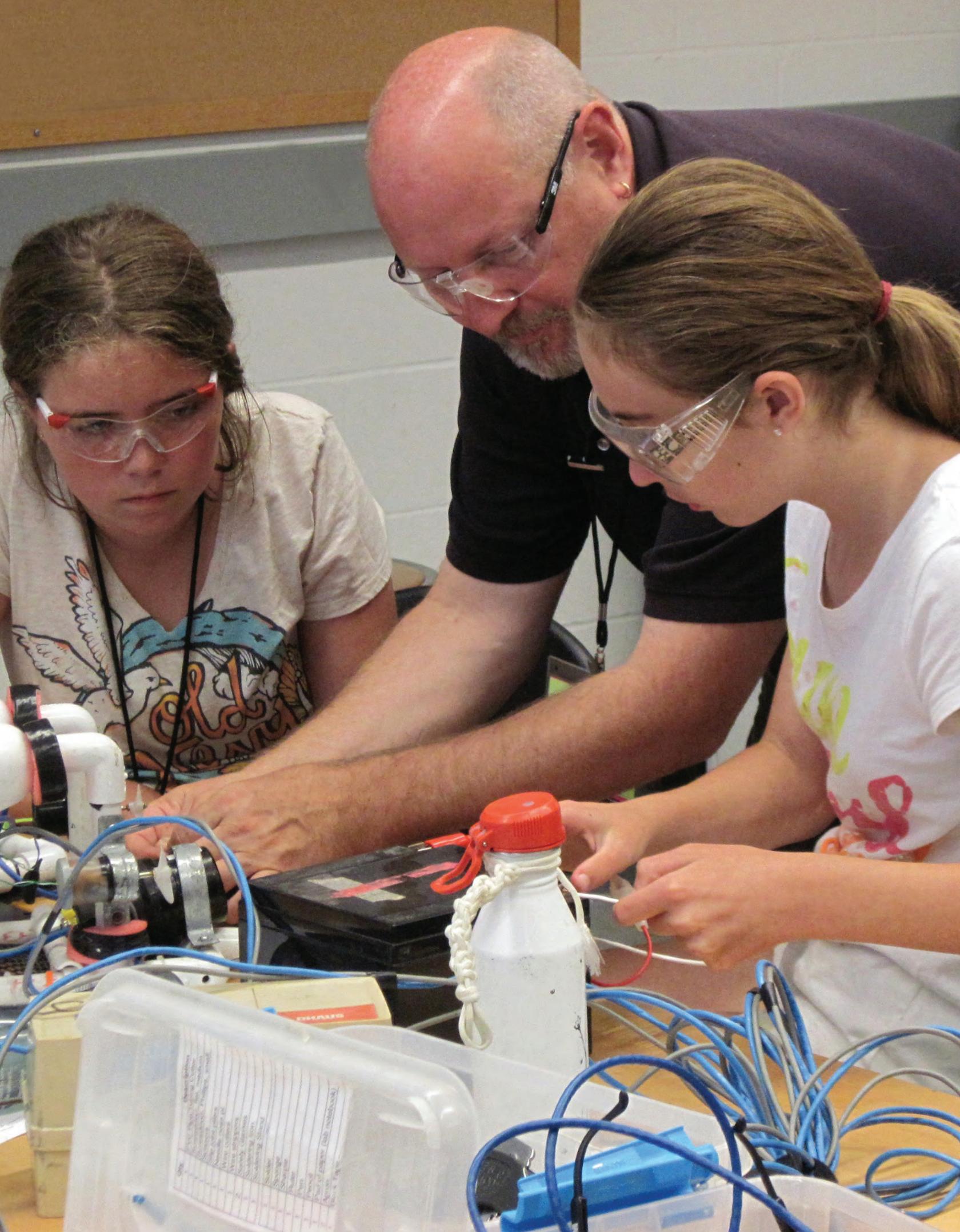
- *Calvert County Mentoring Program.* Calvert County has a formal mentoring program for high-school seniors. Enrollees are required to work with a mentor at a local business or organization. NAWCAD Patuxent River offers opportunities for students to volunteer one day a week,

for three to four hours, over the fall or spring semesters. Students work closely with an S&E mentor and experience a professional STEM environment.

- *STEM Voluntary Internships.* Students at the local STEM Academy are required to complete an internship in order to graduate, and NAVAIR made the commitment to provide some of these opportunities. During the summer between 11th and 12th grade, students are required to work as interns. NAWCAD Patuxent River offers summer internship positions for this purpose. Students typically volunteer for 200 hours over an eight- to 10-week period and become fully immersed in technical projects.

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## NEW JERSEY

# NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, LAKEHURST

NAVAIR Lakehurst has a 12,000-foot dedicated test runway with a full-scale aircraft carrier catapult and arresting gear.

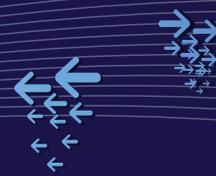
### National S&T Asset

The Naval Air Warfare Center Aircraft Division (NAWCAD) at Lakehurst is the world's only provider of full-spectrum support for aircraft launch, recovery, and support equipment for U.S. and Allied naval aviation forces at sea and Marine Expeditionary forces ashore. Facilities include the Catapult Complex, the Runway Arrested Landing Site, the Elevated Fixed Platform, the Jet Car Track Test Site, the Aircraft Platform Interface Laboratory, the Prototyping and Manufacturing Complex, and both the Electromagnetic Aircraft Launch System and the Advanced Arresting Gear test sites. Acquisition professionals provide full life-cycle management for 46 programs and products equating to more than 3,000 deployed systems. Located in Lakehurst, N.J., the facility is part of Joint Base McGuire-Dix-Lakehurst.

### STEM Climate

The K-12 STEM outreach program at NAWCAD Lakehurst attempts to reach and support all of its surrounding communities, with an emphasis on serving the underprivileged. The New Jersey Department of Education assesses and categorizes each school district into District Factor Groups, which measure the community's relative socioeconomic status (SES). NAWCAD Lakehurst's STEM outreach program serves primarily the lower one-third in SES. Implementation of NDEP-supported STEM initiatives began in 2009, with ever-increasing involvement anticipated and desired. Lakehurst continually looks to synergize its STEM efforts by expanding collaborations with other local and nationally supported programs and initiatives.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	1997
Geographic Reach	Central New Jersey
FY13 S&E Mentors & Coaches	2 site coordinators 171 S&Es 8 coaches 12 mentors
FY13 Schools Reached	9 school districts 4 elementary schools 3 middle-schools 10 high-schools
FY13 Personal Interactions	213 teachers 1,085 students in classrooms 5,575 students outside classrooms 4,950 paid and unpaid hours
Other Partners & Catalysts	Fairleigh Dickinson University; New Jersey Institute of Technology; Monmouth University; Ocean County College; Drexel University; Villanova University; Rowan University; Monmouth Junior Science Symposium; FIRST Robotics; SeaPerch National; National Defense Education Program



## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Monmouth Junior Science Symposium (MJSS).* This year's 51st annual symposium promoted high-school research and experimentation in the areas of engineering, life sciences, mathematics, computer science, medicine and health, physical sciences, psychology and behavioral sciences, and economics. With more than 100 students competing, prior to the two-day event Lakehurst's S&Es participated in reviewing and scoring research papers, evaluating presentations by the top-10 finalists, and the general poster competition. Lakehurst's STEM site coordinator and a member of the symposium's executive steering and planning committee, Gaetan Mangano, ran the judging as well as the paper-selection process. The military director, Capt. Brady Bartosh, attended the dinner banquet, where six top poster finalists were judged. The symposium is part of the national Junior Science and Humanities Symposia (JSHS) program, sponsored by the Department of Defense and administered in cooperation with nationwide colleges and universities.
- *NJ Regional SeaPerch Competition.* The year 2013 marked the inaugural NJ Regional SeaPerch Competition at Rowan University. Gaetan Mangano and Wil Borkowski of the Lakehurst Education Outreach Office coordinated the event with Rowan University's College of Engineering. Lakehurst decided to take the "plunge" and make SeaPerch a foundational part of their education-outreach program because it's hands-on, fun, and inspiring for a wide range of ages. When the splashing settled (in what happened to be a very tight afternoon of finals), Ocean County's Marine Academy of Technology and Environmental Science team won for the high-school division and Burlington County's 4-H Robotics Club won from the middle-school division. Each winner went on to compete in the National SeaPerch Competition and received a \$300 award from Lakehurst's Naval Civilian Managers Association. Lakehurst chose to bring the competition to Rowan because it provides an opportunity for students to learn about engineering and experience a university setting.
- *NJ Society of Professional Engineers Career Day.* Each year during the spring break, Rutgers University opens its doors to high-school students to attend Engineering Career Day, put on by the NJ Society of Professional Engineers. Lakehurst's John Melin, a NJSPE member, along with Gaetan Mangano, spoke in different lecture halls at Rutgers University to more than 400 curious high-school students interested in engineering. Students are provided an opportunity to hear about engineering from a wide range of companies and organizations. While John focused on

the engineering aspects of what Lakehurst does for naval aviation, Gaetan discussed the traits and temperaments of an engineer, discussing and handing out the Myers-Briggs personality classifications, and urged each student to better understand themselves and whether their own unique talents lent themselves to a career in a STEM-related vocation. Gaetan used the *Engineering, Go For It* magazine as a backdrop for all the wide varieties of technical discipline that engineering has to offer.

### Outside Classroom Enrichment Activities

- *Lakehurst Students Get a Show-and-Tell on Reverse Engineering.* The Manufacturing and Prototyping Division's reverse engineering lab recently began tours showing high-school students how the Navy is applying new technology to conquer an "old problem" of parts obsolescence. Students from Ocean County's Manchester High-school's robotics and physics programs and Monmouth County's Colts Neck's Junior ROTC program were given a "hands-on" tour of the reverse engineering lab. The demonstration provided them with a much-needed applied science "connection" of how basic math and science principles are used in industry and a real-life experience of what the future may hold for them in the field of engineering. Project engineer Jason Burns leads the tour and demonstration. Jason has an undergraduate and a master's degree in mechanical engineering from Drexel University and credits his early interest in engineering with his participation in the Physics Olympics program where he grew up in Cinnaminson, N.J.
- *Student Visits to Unique Lakehurst and Joint Base Facilities.* The outreach program provides tours throughout the year for elementary, middle-school, high-school and college level students, and faculty. The outreach program has been particularly helpful to the Fort Dix Youth Challenge Academy. This program provides underprivileged high-school dropouts with the opportunity to participate in a 22-week on-site program, designed as a "second chance" with both educational instruction and rigorous discipline. The boot-camp setting provides the "cadets" with the best opportunity to obtain a GED and kick-start their lives. Students visit Lakehurst to tour the historical Hangar One, which is home to the Navy's aircraft-carrier launch and recovery school and the Lakehurst Historical Society's museum and ready-room — several large rooms filled with the history of the Lakehurst site and memorabilia featuring naval aviation. Students are afforded other unique tours to the N.J. Police Urban Search and Rescue training facilities, the Army's helicopter communications facility, the vocational culinary school, the manufacturing and prototyping facility, and the jet car track test site.

Ten S&Es support the visit and tours for the 180+ Youth Challenge students that come to Lakehurst yearly.

### Mentorship and Internship Activities

- *Tireless FIRST Robotics Mentorship.* Lakehurst's Dr. James Hing and Matthew Defelice devoted more than 150 off-duty hours on weeknights and weekends to support their respective FIRST Robotics teams. In 2012, Matthew's Zero Gravity FTC Team 2180 from the Hamilton Township school district in Mercer County advanced to the World Championship Competition. This year, Dr. Hing's Storm Robotics FRC Team 2729 from Lenape Regional School District in Burlington County took home their first regional win and advanced to the World Championship Competition in St. Louis. Both mentors have worked tirelessly in support of STEM education outreach and both feel reward enough that they can make a difference in the lives of the many students they reach each year.
- *Director of Engineering Featured in Diversity Careers magazine.* Kathleen Donnelly, Lakehurst's engineering director for the Support Equipment and Aircraft Launch and Recovery Equipment Department, was asked by *Diversity Careers* magazine to be a part of their spring 2013 minority-college issue. The article features how Kathleen began her career as a Navy civilian engineer and talks about why a career with the federal government can be highly rewarding and productive for ambitious students coming out of college today.

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# NORTH CAROLINA FLEET READINESS CENTER EAST CHERRY POINT

When the assembly and repair depot opened at the end of 1943, the workload focused on famed World War II aircraft, including the F4U Corsair fighter and the B-25 Mitchell and B-26 Marauder bombers.

## National S&T Asset

The Fleet Readiness Center (FRC) East at Cherry Point, N.C., specializes in support of Marine Corps aircraft, engines, and components. The facility is the only source of repair within the continental United States for many jet engines and rotary wing engines, as well as vectored thrust turbofan engines. FRC East is a Vertical Lift Center of Excellence in support of Vertical/Short Takeoff or Landing (V/STOL) aircraft (AV-8B Harrier II and V-22 Osprey). Among many other areas of responsibility, the facility also provides services for rotary wing aircraft (AH-1 Cobra, UH-1 Iroquois, H-46 Sea Knight, and various H-53 helicopters). FRC East also performs in-service repair for the EA-6B Prowler, H-2 Seasprite, H-3 Sea King, H-60 Seahawk, and C-130 Hercules. In addition, FRC East is the depot maintenance manager for logistics for unmanned aerial vehicles and remotely piloted vehicles. FRC East at Cherry Point repairs more than 17,500 aircraft components.

## STEM Climate

The STEM climate at FRC East Cherry Point continues to grow stronger every year. Senior-level management remains supportive of STEM outreach programs and continues to bring younger engineers into the coordination of outreach efforts. The quantity of job-shadow events and tours continues to grow each year with the ever-growing support of engineers who participate in Engineering Week at local middle and high-schools as well as individual engineering job-shadow events.

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Swansboro High-school FIRST Robotics Club Demonstration.* Club members demonstrated their 2012 robot to engineering interns as well as new-hire engineers. Their

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2010
Geographic Reach	Craven, Carteret, Pamlico, Onslow, Jones counties
FY13 S&E Mentors & Coaches	2 site coordinators 45 S&Es 35 mentors
FY13 Schools Reached	1 school district 3 elementary schools 10 middle-schools 7 high-schools
FY13 Personal Interactions	25 teachers 1,600 students in classrooms
Other Partners & Catalysts	North Carolina State University; NC STEM East; East Carolina University

robot advanced to the FIRST Robotics Competition quarterfinals in May 2012 in Raleigh, N.C. The team consisted of 20 high-school students and six adult mentors, including engineers from Cherry Point. The robot design and construction had to be completed in a six-week period on nights and weekends. The robot could navigate a basketball court, pick up basketballs, shoot basketballs into a net, and balance on a bridge. It operated in both autonomous mode (hands-off) and in a semiautomatic mode using a remote wireless joystick.

### Classroom Activities

- *Classroom Visits.* Engineers spend approximately two hours each month at the Havelock Middle-school STEM lab to help students on engineering modules and projects. Their

video teleconferencing system is used to interact with other middle-school classes in the area working similar projects. Engineering mentors of Kenan Fellows Program teachers attended a float test for their Mayflower boats that were designed utilizing a full-fledged engineering design process. This process involved design considerations, materials, brainstorming, design comparisons, and modifications after initial testing.

- *Engineering Week.* Thirty-two engineers volunteered to visit elementary, middle, and high-schools during Engineering Week to help show students what engineering is and how day-to-day activities are influenced by engineering. A total of 20 schools were visited in eastern North Carolina and engineers gave 30 presentations to approximately 1,600 students.

### Mentorship and Internship Activities

- *North Carolina State University (NCSU) Middle-school Engineering Camp.* The camp serves 60 rising students in grades seven to nine for a week in July. The camp provides students with a fun and positive glimpse into various fields of engineering by using hands-on, creative investigations and real-world building activities. Approximately 10 engineers volunteered to provide hands-on assistance with students on their design projects throughout the week. Engineers volunteer to work with the students during this weeklong camp and are from various engineering disciplines, to include mechanical, aerospace, and electrical engineers at FRC East.

### Teacher and S&E Training

- *Kenan Fellows Program.* Two local teachers (Kenan Fellows) worked side-by-side with FRC East engineers to obtain a fresh perspective on what engineers at Cherry Point do. They then implemented ideas for new projects to use in their classrooms. Participating teachers are recognized leaders at Early College EAST High-school engineering club and Ben D. Quinn Elementary School in Craven County.

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# CALIFORNIA

# NAVAL SURFACE WARFARE CENTER CORONA DIVISION

The “Top Gun” range in Nevada is one of the tactical air training ranges around the world with systems designed, operated, and maintained for the Navy and Marine Corps by NSWC Corona.

### A National S&T Asset

The Naval Surface Warfare Center, Corona Division, in Norco, Calif., has been a leader in the Navy’s research, development, test, and evaluation process by providing independent assessment for nearly 50 years. Today, NSWC Corona is the Navy’s premiere independent assessment agent responsible for gauging the warfighting capability of Navy ships and aircraft by assessing weapons and integrated combat systems’ performance, readiness, quality, and supportability throughout the system’s entire life cycle. It also provides critical warfighter support to the Navy and Marine Corps as the range systems engineering agent helping sustain training around the world and serves as the Navy special interface gage technical agent and the measurement and calibration engineering agent to ensure measurement accuracy for today’s precise, high-tech combat and weapon systems.

As one of the Navy’s newest federally designated laboratories, the base is home to the Joint Warfare Assessment Lab, the Measurement Science and Technology Lab, and the Daugherty Memorial Assessment Center, dedicated to Petty Officer 1st Class Steven P. Daugherty, who was killed by an IED in Iraq while supporting a SEAL team mission.

### STEM Climate

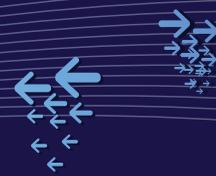
While NDEP-supported STEM initiatives officially began in 2010 following the Navy’s formal designation of NSWC Corona as a federal lab in January 2010, our strategic investment in STEM education outreach started more than a decade earlier. NSWC Corona is located in the Riverside and San Bernardino counties region, the center of Southern California’s culturally, economically, and ethnically diverse area known as the “Inland Empire.” Our K-12 student population of nearly 1 million — and 33,000 teachers across some 1,000 schools — is more than 75 percent minority. Fifty colleges and universities are within 50 miles of the base, several of which are designated as minority-serving institutions with which we are formal education partners.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2000
Geographic Reach	Southern California’s Inland Empire region (San Bernardino and Riverside counties)
FY13 S&E Mentors & Coaches	1 site coordinator 18 S&Es
FY13 Schools Reached	15 school districts with 100 schools. Most are middle-schools, but outreach at college and career fairs focuses on high-schools.
FY13 Personal Interactions	5,000 students 40 teachers
Other Partners & Catalysts	Riverside and San Bernardino county offices of education; Science and Technology Education Partnership; Girl Scouts; Sea Cadets; California State Polytechnic University, Pomona; California State University, Los Angeles; California Baptist University; Riverside Community College District; University of California, Riverside; U.S. Naval Academy

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *The Navy in Norco Science Experience at the 12th Annual STEP Conference.* The event featured five naval technology-themed exhibits that reached about 4,100 students, teachers, and adults and included SeaPerch, thermal imagery, lasers, GPS ground-tracking systems, and remote-controlled aerial-drone displays.



- *SeaPerch ROV.* Participants took the controls of the SeaPerch underwater remotely operated vehicle and navigated it through the water. The SeaPerches were co-demonstrated with local Sea Cadet units.
- *Thermal Inspiration.* The Navy's infrared camera, which provides a vibrant display of colors calibrated to known temperatures, was featured.
- *Laser Light Experience.* A patented Navy scientist created the ultimate laser show to demonstrate how to combine three different wavelengths or colors and then separate them out again.
- *iTracker.* Participants were outfitted with backpacks containing GPS tracking equipment to go out on a scavenger hunt while others tracked their progress remotely.
- *Navy STEM Drone.* Attendees piloted the remote-controlled drone equipped with a camera to provide a bird's-eye view as it climbed and dove around. The Navy STEM drone is a quadcopter AR.Drone branded with Navy STEM messages to demonstrate new and emerging Navy unmanned vehicle technologies to students and adults.
- *15th Annual Space Day.* About 1,600 students from several middle-schools in Riverside enjoyed hands-on activities such as rocket launches, rover races, robot demonstrations, rocket simulations, and naval technology.
- *2nd Annual Inland Empire Science and Engineering Fair Expo.* Naval scientists served as counselors for students and teachers alike as they explored ideas and projects for the upcoming science-fair competition cycle.
- *Measurement Science and Technology Lab.* State-of-the-art metrology, calibration, fiber optics, and laser laboratories were demonstrated to dozens of engineering students from local high-schools and universities.
- *Gage Toolmakers Shop.* Demonstrated to high-school students the importance of exact measurements and tolerances, and what accurate measurement means to our nation's warfighters, by making precise machine gages on state-of-the-art computer-controlled milling machines.

### For Information

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*"I congratulate NSWC Corona for their pioneering efforts in science and technology education outreach. Attracting the best and brightest for America to secure our place in industry and national defense should be our highest priority."*

— Former astronaut Buzz Aldrin

### Mentorship and Internship Activities

- *SeaPerch.* Built and deployed three SeaPerch vessels to demonstrate scientific principles in an interactive and engaging way to reach local students during our USS California Science Experience. Supported the inaugural Inland Empire SeaPerch Summer Camp with sailors and engineers who coached students as they built and competed in the SeaPerch challenge.

# CALIFORNIA

## NAVAL SURFACE WARFARE CENTER PORT HUENEME DIVISION

Port Hueneme Division focuses its technical capabilities on Next Generation In-Service Engineering, which involves direct connectivity to the fleet on a global basis and the immediate availability of round-the-clock access to products, services, and fleet-support capabilities.

### A National S&T Asset

The Naval Surface Warfare Center Port Hueneme Division (NSWC PHD) maintains technical expertise at locations across the United States: engineering and logistics at Port Hueneme, Calif.; search radar engineering at Virginia Beach, Va.; and live fire testing at White Sands, N.M. NSWC PHD is recognized as the Navy's Center of Excellence for In-Service Engineering, Test and Evaluation, and Integrated Logistics Support for surface warfare combat and weapon systems. Since its inception in 1963, NSWC PHD has been supporting the combat and weapon systems of the U.S. fleet by providing highly skilled personnel and state-of-the-art facilities to lead the development and support of Navy surface ship warfare systems throughout their life cycles.

### STEM Climate

NSWC PHD, part of Naval Base Ventura County, is located between Los Angeles to the south and Santa Barbara to the north. The division has a long history of working closely with both the Oxnard School District (elementary and intermediate schools) and the Oxnard Union High-school District (high-schools) in various STEM activities. NSWC PHD actively engages in scholastic engineering-development programs that bring students and community leadership into partnerships to promote career-path opportunities by encouraging STEM learning and exploration. The schools within the region serve an ethnically diverse population.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

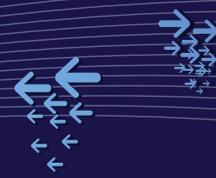
- *Ventura County Science Fair and School Science Fairs.* Science fairs provide the opportunity for hundreds of students to interact with engineers from NSWC PHD and receive feedback on their projects. It also allows engineers to explain the importance of STEM education and how students' studies can lead to promising career opportunities in many engineering disciplines.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	1998
Geographic Reach	Mostly Ventura and Santa Barbara counties
FY13 S&E Mentors & Coaches	2 site coordinators 57 S&Es
FY13 Schools Reached	28 schools
FY13 Personal Interactions	287 students 17 teachers
Other Partners & Catalysts	Society of Women Engineers; Society of Hispanic Professional Engineers; American Society of Naval Engineers; California State University, Northridge; California State University, Los Angeles; Santa Barbara City College

- *National Engineers Week.* PHD hosts an engineering competition for students from schools in the local area. This is an opportunity for students to interact with engineers from NSWC PHD while learning the importance of math, science, technical skill, and teamwork.

#### Classroom Activities

- *Portfolio Day.* A group of S&Es spent a day at E.O. Green Junior High-school meeting with students in a one-on-one setting and asking questions about portfolios that document their work during the year. Students are able to ask questions about careers in S&T fields and receive feedback and recommendations for improvement in their portfolios.



## Outside Classroom Enrichment Activities

- *Engineer Job Shadowing.* Sixteen high-school seniors with aspirations to become engineers participated in a four-week program at NSWC PHD, with more than 12 S&Es acting as coordinators and mentors. As members of Hueneme High's Engineering and Design Career Path (EDCP) Academy, they got a first-hand look at engineering professionals and how they do their jobs. Students were exposed to many engineering disciplines, including mechanical, electrical, computer, energy, and environmental engineering.
- *SeaPerch Program.* Twenty fifth- through eighth-graders, two teachers, four civilian mentors, and two military mentors participated in rolling out our SeaPerch Program. This program teaches students basic skills in ship and submarine design while encouraging them to explore naval architecture and marine and ocean engineering principles.

## Mentorship and Internship Activities

- *Pre-Engineering Program.* Thirty high-school students, 12 teachers, and 12 mentors participate twice a year in NSWC PHD's Pre-Engineering Program. The semester-long program gives students a chance to apply math and science concepts in real-world engineering scenarios.

## For Information

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## FLORIDA

# NAVAL SURFACE WARFARE CENTER PANAMA CITY DIVISION

Located in the northern Gulf of Mexico, NSWC PCD offers nearly year-round testing of Naval equipment in both shallow and deep-water environments.

### A National S&T Asset

The mission of NSWC Panama City Division is to conduct research, development, test and evaluation, in-service support of mine warfare systems, mines, naval special-warfare systems, diving and life-support systems, and amphibious/expeditionary maneuver warfare systems. Science and technology specialties of NSWC PCD include off-board sensor modules for use on unmanned vehicles conducting underwater intelligence, surveillance, and reconnaissance. Other missions and responsibilities that occur primarily in coastal (littoral) regions may be assigned by the commander of the Naval Surface Warfare Center.

### STEM Climate

NSWC PCD has engaged in STEM activities throughout its 67-year history. When NDEP began supporting outreach activities in 2008, it provided a great stimulus to the region's K-12 educational programs. NSWC PCD spearheaded the creation of the STEM Institute at Florida State University's Panama City campus. NSWC PCD and the STEM Institute continue to engage in activities that support STEM professional development for teachers and the creation of new classroom instructional materials and curricula. NSWC PCD has entered into an Educational Partnership Agreement with the Science and Discovery Center of Northwest Florida to promote STEM activities throughout the community.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

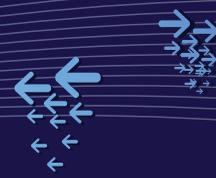
- *STEM Forum.* At the STEM Forum, held at Florida State University Panama City, the public is presented with a mini-laboratory showcase of NSWC PCD's mission and objectives, demonstrations of K-12 education modules supported by the lab in local school systems, announcement of internship opportunities, and a description of the forthcoming summer STEM Institute

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2007
Geographic Reach	southeast and northwest
FY13 S&E Mentors & Coaches	1 site coordinator 6 S&Es
FY13 Schools Reached	6 elementary schools 4 middle-schools 5 high-schools
FY13 Personal Interactions	3,771 students 189 teachers
Other Partners & Catalysts	Educational Partnership Agreement with the Science and Discovery Center of Northwest Florida. Contract with Florida State University Panama City STEM Institute

for elementary, middle, and high-school students. Recent forums have stressed the national need for a STEM-trained work force and the variety of educational programs that provide the skills required: certificate programs, associate degrees, and full undergraduate- and graduate-degree programs. The target audience is students and parents.

#### Classroom Activities

- *S&Es in the Classroom.* A cadre of S&Es visits classrooms to engage and work with students on the materials that are introduced to the teachers during the summer STEM Institutes. The most frequent interaction involves Lego Mindstorms robots (programming, operating, and preparing for local competitions). NSWC PCD has been aiding one of the new elementary charter schools in developing its fourth- and fifth-grade STEM curriculum.



## Outside Classroom Enrichment Activities

- *Engineering is Elementary*. A pilot program with three elementary schools using five different EIE modules was initiated in FY12.
- *Panhandle Area Educational Consortium (PAEC)*. Thirty-nine high-achieving students from rural areas near Panama City came to the campus of Florida State University Panama City for a special four-day science camp. NSWC PCD developed the curriculum, provided training, and supplied S&E instructors for camp activities.
- *MWR (Morale, Welfare, and Recreation) Science Week*. In conjunction with the Naval Support Activity Panama City summer day camp, NSWC PCD supported a one-week (half-days) science camp for middle-school students between the ages of 12 and 15. Students learned, in an interactive mode, principles of physical science, chemistry, biology and microbiology, and physics.

## Mentorship and Internship Activities

- *FIRST Lego League (FLL) and FIRST Robotics Competition (FRC)*. NSWC PCD engineers support an FLL team at a private school and an FRC team in a Bay County high-school. In cooperation with the Navy Experimental Dive Unit, a second FRC is also supported at another Bay County high-school.

## Teacher and S&E Training

- *Summer Science Institute*. Each year, NSWC PCD conducts a Summer Science Institute on the Florida State University Panama City campus. The institute consists of a week of professional development for teachers and the S&Es who will assist during the regular camp. During the next phase, a one-week camp for rising eighth-graders and a one-week camp for rising ninth-graders is held.
- *STEM Camp Professional Development*. In FY13, 20 new teachers were introduced to new materials for the Summer STEM Institutes. Restoration Bay was the central theme for the STEM camp in 2013. Students and instructors learned how to make environmental measurements to characterize water quality, identify life forms — plant and animal — and mitigation techniques following ecological events. Also included in the program were Lego Mindstorm-simulated restoration missions and building electronic sensors.

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## HAWAII

# PEARL HARBOR NAVAL SHIPYARD AND INTERMEDIATE MAINTENANCE FACILITY

The workers at Pearl Harbor Naval Shipyard resurrected the U.S. Pacific Fleet after the attack on Pearl Harbor in December 1941 and refloated and repaired 15 of the 18 major ships that were damaged.

### A National S&T Asset

The primary mission of Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY & IMF) is to provide regional maintenance, at the depot and intermediate levels, to keep surface ships and submarines in the U.S. Pacific Fleet "Fit to Fight." The shipyard is the largest repair facility between the U.S. West Coast and the Far East. Hawaii's regional maintenance center provides excellence in environmentally responsible ship repair, maintenance, overhaul, and alteration of U.S. Navy vessels. The shipyard occupies about 148 acres, with 139 buildings and 43 other structures (piers, wharves, dry docks, and utilities, etc.). One of the shipyard's four dry docks can be used either as a single dry dock or split in two by an intermediate caisson to accommodate two submarines simultaneously.

The shipyard's motto is "No Ka Oi" — which [loosely] means "striving to be the best" in Hawaiian.

### STEM Climate

As the largest industrial employer and the largest employer of engineers in the state of Hawaii, PHNSY & IMF is extremely supportive of STEM initiatives, as demonstrated by its participation in numerous STEM outreach events and activities. Leadership fully understands the need for, and encourages the expansion of, STEM education in Hawaii. The future success of PHNSY & IMF is tied directly to the successful attraction of Hawaii's youth to engage in STEM courses of study and go on to be employed in Hawaii in industries that require STEM education and expertise.

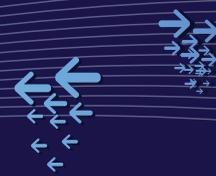
In September 2013, a Wide Area Gathering was hosted by Rear Adm. R.L. Williams, commander, Navy Region Hawaii (CNRH) and Naval Surface Group Middle Pacific (MIDPAC), to reaffirm

### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2009
Geographic Reach	Hawaii
FY13 S&E Mentors & Coaches	1 site coordinator 20 S&Es
FY13 Schools Reached	1 elementary school 1 middle-school 1 high-school
FY13 Personal Interactions	106 students 10 teachers
Other Partners & Catalysts	University of Hawaii at Manoa College of Engineering; University of Hawaii-West Oahu; Hawaii State Department of Education; Space and Naval Warfare Systems Center Pacific Hawaii

the Navy's commitment to being a key STEM partner with the state of Hawaii. Primary educators — including elementary, intermediate, and high-school principals — had a chance to meet some of their STEM counterparts at Joint Base Pearl Harbor-Hickam, one of whom was Rear Adm. Williams' STEM "lead," Capt. D.B. Osgood, commander of PHNSY & IMF. PHNSY & IMF will be working with other naval and Department of Defense (DoD) activities in Hawaii to establish new relationships and strengthen existing ones with the state's primary and secondary educators.

Throughout the year, PHNSY & IMF has hosted quarterly shipyard tours for high-school and college students, as



well as public- and private-sector dignitaries. Most recently, the chancellors of the University of Hawaii's West Oahu and Honolulu Community College campuses were also provided a tour of PHNSY & IMF in the ongoing effort to showcase the accomplishments of one of this country's national assets. PHNSY & IMF stands steadfast in support of STEM for the state of Hawaii.

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *SeaPerch Competition.* Navy divers participated as role models and mentors in the competition.

### Outside Classroom Enrichment Activities

- *West Oahu STEM Center of Excellence.* The development of this center is being led by Dr. Rockne Freitas, the University of Hawaii West Oahu chancellor, with inputs provided by a working group composed of public- and private-sector representatives. The vision of the center is to provide a common venue for the growth of STEM education and opportunity within the state of Hawaii, from kindergarten to college. Another key element of the center's vision is to address the state's overarching need for work force technical development and to prepare the next generation of technologically capable personnel to address the dynamic future that lies ahead.
- *2014 RIMPAC VEX Robotics Competition.* Efforts are under way to establish the first VEX Robotics Competition to be held during the in-port period of the Rim of the Pacific (RIMPAC) multinational biennial exercise in 2014. Based on the World VEX Robotics Competition (VRC), this event will bring together sailors from RIMPAC participating nations and VRC high-school teams in the spirit of competition and fellowship. This is an opportunity for these sailors to share their naval experiences with, while being mentored by, their high-school colleagues. PHNSY & IMF has the lead in coordinating this event, with commitment and support from the commander, U.S. Pacific Fleet (COMPACFLT); the commander, Navy Region Hawaii (CNRH)/commander, Naval Surface Group Middle Pacific (MIDPAC); Space and Naval Warfare Systems Command (SPAWAR); SPAWAR Systems Center-Pacific; Friends of Hawaii Robotics; and key local robotics supporters. The results of this competition will be announced at the World VRC which will take place in July, closely following the RIMPAC VEX Robotics Competition.

### Mentorship and Internship Activities

- *Robotics Scholarship Program.* Established in 2009 by the commander of NAVSEA and PHNSY & IMF, this scholarship program assists high-school students who have

demonstrated at least two full years of commitment to FIRST Robotics team activities and competitions. The scholarship funds up to four years of college tuition toward an engineering degree at UH COE for one graduating high-school senior year each year, including a paid summer intern opportunity in the shipyard's engineering department for scholarship recipients. Upon graduation, the students accept a job either with the shipyard or another local national defense organization.

- *FIRST Robotics Competition.* During the 2013 season, three shipyard mentors volunteered to support a local high-school robotics team, one shipyard mentor volunteered at a Mobile Machine Shop to assist multiple schools during the build season and competition, and the shipyard commander served as a judge at the FIRST Robotics Competition (FRC) regional at the University of Hawaii at Manoa in early April.
- *FIRST Lego League.* Two shipyard engineers are involved year-round, and three other shipyard engineers work with robotics students at two elementary schools. Twelve shipyard volunteers supported Hawaii's 2013 State Lego League Championship.
- *SeaPerch and Marine Advanced Technology Education (MATE).* Shipyard divers continued their safety oversight support for local schools through the SeaPerch and MATE programs, which culminate with an underwater robotics competition held at a pool aboard Joint Base Pearl Harbor-Hickam.
- *Future Robotics Programs Support.* During the 2013-14 school year and thereafter, PHNSY & IMF volunteers will continue their STEM outreach in robotics through the VEX, FIRST, SeaPerch, Botball, and MATE programs.
- *National Defense Education Program.* PHNSY & IMF signed an Educational Partnership Agreement (EPA) with the Hawaii State Department of Education in June 2013. The EPA is a triennial agreement that formalizes PHNSY & IMF's outreach with the state's public schools and includes provisions for grants, loaning equipment, and the transfer of surplus material/equipment.

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UNH TECH CAMP  
Jessie  
Barker  
UNH Tech Camper

Old Navy

# IDAHO

## NAVAL SURFACE WARFARE CENTER CARDEROCK DIVISION, BAYVIEW

Lake Pend Oreille is a deep, quiet body of inland water that provides a free-field, oceanlike environment uniquely suited for acoustic research.

### A National S&T Asset

Located on the south end of Lake Pend Oreille (1,150-foot depth), the Naval Surface Warfare Center Carderock Division Acoustic Research Detachment (ARD) at Bayview, Idaho, provides a unique experimental setting. Its advanced hardware and floating platforms support a wide variety of R&D programs ranging from the measurement of flow-induced boundary layer fluctuations on sonar domes to the calibrations of full-scale surface ship sonar transducers. The site's technical programs contribute to the development of advanced submarine and sonar designs. ARD has a large-scale structural model of the SSN-21 class submarine, which is used extensively for sonar dome development and submarine silencing and target strength-reduction experiments.

### STEM Climate

The STEM climate in eastern and northern Washington has improved over the last few years. More schools are expressing interest in SeaPerch as well as other STEM activities. Public/private programs such as Don't Fail Idaho (<http://www.dontfailidaho.org>) and Washington STEM (<http://www.washingtonstem.org>) are attempting to raise the bar for K-12 education, producing more kids with STEM interests. As further attention is brought to the educational shortcomings of the area, there should be plenty of opportunity for the Navy to expand its STEM offerings and influence.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

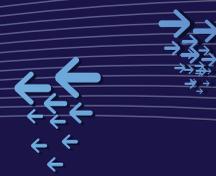
- *East Valley High-school Summer SeaPerch Program.* The summer educational program for this school featured SeaPerch as a science class for those students who had fallen behind in the preceding school year. Approximately 30 kids participated in the program. In July we set up the portable pool at the school so the kids could explore the use of their ROVs.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2011
Geographic Reach	A geographically dispersed area in eastern Washington and northern Idaho
FY13 S&E Mentors & Coaches	1 site coordinator 12 S&Es
FY13 Schools Reached	3 middle-schools 3 school districts
FY13 Personal Interactions	554 students 26 teachers
Other Partners & Catalysts	Eastern Washington University; American Society of Mechanical Engineers; Inventors Association of Idaho; Bird Aviation Museum

- *Third Annual Inland Northwest SeaPerch Challenge.* This year approximately 80 students from three schools and a private club attended ARD's SeaPerch Challenge at the aquatics center at Eastern Washington University.
- *Cheney Middle-school Q&A.* What is it like to be an engineer and a submariner? This one-hour session was presented to 20+ students.

#### Outside Classroom Enrichment Activities

- *Kalispel Tribal Career Training Center.* An ARD engineer gave a presentation outlining the importance and advantages of a STEM education. Approximately 130 kids were reached during this event.



## Mentorship and Internship Activities

- *Newport High-school Engineering Club.* An engineer from ARD mentored the engineering club at the high-school, introducing the students to various physical concepts and aiding them in constructing robot kits as well as the SeaPerch ROV.
- *St. Anthony's After-School Group.* An ARD engineer mentored this after-school group to show the students the various physical concepts aiding them in constructing the SeaPerch ROV.
- *Eastern Washington University Senior Design.* Over multiple years, the seniors at EWU will be redesigning the subsystems of ARD's weather buoy to improve its performance and longevity while they gain practical experience in engineering.

## Teacher and S&E Training

- *FY13.* One new teacher and two private individuals were trained to administer SeaPerch to their groups.

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# INDIANA

# NAVAL SURFACE WARFARE CENTER CRANE DIVISION

NSWC Crane is the third largest Navy installation in the world, occupying 100 square miles onshore.

### A National S&T Asset

The Naval Surface Warfare Center Crane Division (NSWC Crane) provides acquisition engineering, in-service engineering, and technical support for sensors, electronics, electronic warfare, and special-warfare weapons. As the largest multiservice facility within the DoD for electronic warfare and information operations, NSWC Crane's EW/IO Center is critical to the success of many military operations, including those that use electromagnetic energy to control the electromagnetic spectrum. The Strategic Missions Center delivers technical solutions to detect threats; provide a layered, integrated missile defense; and offers global strike capability. NSWC Crane's Special Missions Center provides rapid-response solutions focusing on agility, maneuverability, individual weapons, munitions, and technical training to equip the most elite warriors for the combat environment.

### STEM Climate

NSWC Crane's goals for STEM outreach are to facilitate STEM programs in local schools; motivate students, parents, and teachers to engage in STEM learning; cultivate an innovative, technically excellent STEM work force; and attract a technically excellent STEM work force in the future. The schools within NSWC Crane's region are in primarily underserved rural counties. The STEM program reaches grades K-12, using material and personnel resources to augment science and math lessons in the classroom. STEM professionals use project-based learning modules tied to state science curriculum and serve as after-school tutors for math and science and as mentors for STEM extracurricular activities such as SeaPerch, FIRST, Science Olympiad, and Super Mileage Cars.

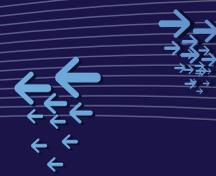
### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *WonderLab Demonstrations.* NSWC Crane and WonderLab have cultivated a special relationship over the years.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2010
Geographic Reach	Outreach concentrated in a 50-mile radius around Crane's expansive base; also reaches farther outlying areas such as Chicago, Indianapolis
FY13 S&E Mentors & Coaches	1 site coordinator 1 STEM teacher 73 S&Es serving as mentors, tutors, and coaches
FY13 Schools Reached	32 elementary schools 28 middle-schools 48 high-schools 20 school districts
FY13 Personal Interactions	2,071 students 15 teachers
Other Partners & Catalysts	University of Southern Indiana; Indiana University; Vincennes University; Ivy Tech Bloomington; Indiana University; Purdue University Indianapolis; WonderLab (local science museum); Society of Women Engineers, Southwest Central Indiana Section; American Society of Naval Engineers; SeaPerch; Indiana STEM Initiative; Indiana Afterschool Network; National Defense Industrial Association; Project Lead the Way

WonderLab, located in Bloomington, Ind., is a local hands-on science museum for children. Throughout the year NSWC Crane has brought hands-on projects, such as water bottle rockets and Lego Mindstorms, to WonderLab for students who are not able to come to the base. During FY13 approximately 90 students were served in this program.



- *Linton TekTrek.* As part of the Project Lead the Way curriculum in Greene County, Ind., more than 80 students gather once a year in Linton to compete in a head-to-head engineering competition to put the skills they learned to the test. The students are asked to build various structures out of everyday household items and then test these structures. NSWC Crane participates by judging the competitions.
- *Wow! That's Engineering.* In an effort to change the current perspective of engineering and technology fields among girls, the Society of Women Engineers will celebrate Wow! That's Engineering!, honoring the achievements of women and girls as they develop and discover the future through technology. NSWC Crane partnered with the Southwest Central Indiana Section of the Society of Women Engineers and Ivy Tech to bring together this program that served 50 girls and their parents.

### Classroom Activities

- *Engineer in Training Program.* Crane has created a program in conjunction with the University of Southern Indiana that is aligned with state education standards. The students engage in a hands-on project-based learning module and then meet S&Es from NSWC Crane who talk about their careers. The day culminates with a tour of the facilities so students can see a real-life application of what they just learned. More than 600 students were served through this program in FY13.
- *Engineer in Classroom.* NSWC Crane has procured a number of science-demonstration kits that employees can check out and use in classrooms. Approximately 300 students were served through this program in FY13.

### Outside Classroom Enrichment Activities

- *Crane Tutors.* NSWC Crane employees regularly volunteer their time at local schools to tutor students struggling with math and science. More than 50 schools and over 150 students in the area are served by this program.
- *NJROTC Summer Camp.* During camp, 25 students from Indiana stay for three days at the barracks located at Crane. This year they learned teamwork and programming skills by working with Lego Mindstorms. They also take daily tours of NSWC Crane labs to see how STEM plays a role in the Navy.
- *Support of Regional Summer Activities.* Even when the school year has ended, the STEM support does not stop at NSWC Crane. NSWC Crane is very active in promoting STEM throughout the summer. Through such camps as

University of Southern Indiana's Girls Only STEM Camp, University of Indiana's Adventures in STEM Camp, and various community libraries' summer outreach programs, NSWC Crane has provided curriculum and materials to make their summer STEM learning experiences more memorable. During the summer of 2013 more than 320 students were served.

### Mentorship and Internship Activities

- *Science and Engineering Apprenticeship Program (SEAP) Internships.* In summer 2013, NSWC Crane hosted four high-school interns for eight weeks. They worked side-by-side with S&E mentors. Tours of the base and field trips gave them a broader understanding of Navy S&T areas.
- *SeaPerch.* More than 400 local students participated in SeaPerch last year. S&Es mentored a number of these teams. Indiana placed three teams in the top four positions at the national competition.
- *FIRST.* More than 160 students participate in various FIRST Robotics competitions each year at all levels (Jr. FLL, FTC, and FRC). Fifteen NSWC Crane mentors and coaches worked with these teams, along with additional S&Es from local contractors. In 2013, NSWC Crane supported nine FIRST teams sponsored by the National Defense Education Program. Four teams were sponsored by SAIC, a defense contractor.

### Teacher and S&E Training

- *Insect Workshop.* The rural setting of NSWC Crane affords unique opportunities, one of which is to study local insect life. NSWC Crane and NSA Crane were able to host a workshop for area teachers in which NSWC Crane's commanding officer's wife generously donated her time to instruct teachers on the identification of insects and construction of insect boards. Ten teachers from the local region attended this seven-day workshop.
- *Ohio Valley STEM Conference.* NSWC Crane participates in this one-day conference for regional STEM teachers held at University of Southern Indiana. NSWC Crane hosts a workshop on SeaPerch orientation for teachers instructing them on the SeaPerch program and various tips and tricks on SeaPerch ROV construction.

## STEM Equipment Lending Library

In an effort to increase STEM interest and proficiency, NSWC Crane and University of Southern Indiana have teamed together to bring a STEM equipment lending library to the region surrounding NSWC Crane. University of Southern Indiana has had a STEM equipment lending library for a number of years, but it was only available in the counties surrounding their region. In August 2013 NSWC Crane opened its satellite office, expanding the lending library by seven counties. This service offers lab equipment and instruction on the use of the equipment for free to local classrooms. The equipment consists of items that are usually too expensive for one school to purchase on their own. The teachers schedule the equipment for use for a period of one to two weeks; afterward, the equipment is checked back in for another class to use. In the short time the service has been offered to the expanded region four counties, five schools, 20 teachers, and over 250 students have been served.

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REMOVE BEFORE  
FLIGHT

ALWAYS WHO LEFT THEIR  
CLOTHES ON THE FLOOR

## MARYLAND

# NAVAL SURFACE WARFARE CENTER CARDEROCK DIVISION WEST BETHESDA

The laboratory at Carderock is the largest, most comprehensive ship research facility in the western world.

### A National S&T Asset

The Naval Surface Warfare Center Carderock Division (NSWCCD) in Bethesda, Md., is the full-spectrum research and development, test and evaluation, engineering, and fleet-support organization for U.S. Navy surface ships, submarines, military watercraft, and unmanned undersea vehicles. Technical leadership is provided in the areas of ship design and integration; hull forms and propulsors; structures and materials; signatures, silencing systems, and susceptibility; environmental quality systems; and vulnerability and survivability systems. The Warfare Center develops and applies naval architecture and marine engineering science and technology in support of the fleet. It provides solutions for the commercial maritime industry and addresses future fleet needs in the areas of new hull forms, unmanned vehicles, all-electric warships, increased stealth, improved survivability, reduced manning, human systems integration, and high-speed ships.

### STEM Climate

Local implementation of NDEP-supported STEM initiatives commenced in August 2008, with 10 S&E mentors. That number has grown to 45 mentors in 2013. An increasing commitment to STEM is evident both at NSWCCD and in local school districts. In the last four years, Carderock has signed educational-partnership agreements with Montgomery County Public Schools in Maryland and Fairfax County Public Schools in Virginia. The schools are eager to strengthen their STEM programs by bringing the resources of the Warfare Center into their classrooms. The willingness of S&Es to be engaged in outreach programs is driven by the workplace climate and the steadfast support of Carderock Division's commander and technical director.

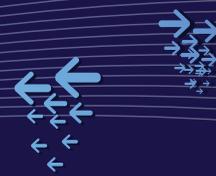
### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2009
Geographic Reach	Montgomery, Frederick, Prince George's, Howard counties, Md.; Fairfax, Loudoun, Prince William counties, Va.; District of Columbia
FY13 S&E Mentors & Coaches	1 site coordinator 9 program leads 45 S&Es
FY13 Schools Reached	18 elementary schools 50 middle-schools 10 high-schools
FY13 Personal Interactions	2,648 students 82 teachers
Other Partners & Catalysts	University of Maryland, College Park; Montgomery College; Museum of Science, Boston

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *D.C. FIRST Robotics Competition.* S&Es staffed the NDEP booth at the robotics event in May 2013. Interactive displays included calculator-controlled robots and SeaPerch and attracted over 1,000 FIRST competitors and visitors to the booth.



- *D.C. STEM Fair.* As part of a newly emerging partnership with D.C. Public Schools, eight S&Es brought hands-on activities, such as Bristlebot robots, SeaPerch, and calculator-controlled robots, to the second annual STEM Fair at Wilson High-school in the District of Columbia.
- *SeaPerch Regional Competition.* The 2013 Maryland Regional SeaPerch Competition was held at the U.S. Naval Academy in April 2013. The competition consisted of in-the-water maneuvering missions, engineering-design presentations, and math-related STEM activities. Fourteen S&Es judged the event.

### Classroom Activities

- *SeaPerch.* The SeaPerch program has been integrated into the curriculum in 12 Montgomery County middle-schools as part of the seventh-grade computer-aided design and robotics technology-education course. An average of four S&Es work in the classroom each week to provide support to the teachers as the students build the ROVs. Once the designs are completed, each school visits Carderock to test their ROVs in the towing tank, performing a mission to collect ping pong balls which simulate oil globs. During the 2012-13 school year, 985 students were part of the curriculum-based classroom SeaPerch program.
- *SeaGlide.* STEM professionals at NSWCCD have developed a small-scale underwater glider called SeaGlide. As the students build their glider from a plastic water bottle, they first learn about buoyancy and displacement. Then they are introduced to programming of an Arduino Pro Mini microcontroller. They build servo-driven buoyancy engines with 100cc syringes and a moveable mass to adjust buoyancy and pitch. They also design and build wings that enable the glider to move forward as it dives and rises in the water column. Building a compatible sensor package gives students the chance to take temperature and pressure data in authentic ocean, bay, or river environments.

### Outside Classroom Enrichment Activities

- *MATHCOUNTS.* Four S&Es work with two middle-schools to coach MATHCOUNTS teams during the school year.
- *4th Annual Math Competition.* NSWC Carderock Division's West Bethesda site hosted 192 middle-school students from Maryland, Virginia, and the District of Columbia for a math contest in January 2013. Students competed both as individuals and as a team and participated in laboratory tours and presentations. The afternoon "countdown" round was moderated by the division

commander. Forty-five S&Es support the competition, and division leadership present awards at the end of the day.

- *FIRST Lego League (FLL).* S&Es work with two elementary schools and two middle-schools to mentor FLL teams during the school year. The students participate in at least two FLL challenges, beginning with the regional FIRST competition and extending to the Naval Surface Warfare Center FLL Challenge, which is held in West Bethesda in the spring. More than 80 students participate in the program with 12 S&E mentors, who coach the students after school.
- *Curriculum-Enhanced Field Trips.* Classes participating in curriculum-enhanced field trips are introduced to engineering topics through hands-on activities such as Bristlebot robots, "Engineering Is Elementary" design units, calculator-controlled robots, and SeaPerch. The students also participate in a tour of Carderock's unique facilities, including the Maneuvering and Seakeeping Basin, the David Taylor Model Basin, and the Magnetic Fields Laboratory.
- *SeaPlane.* The SeaPlane Initiative is a program designed to generate naval aviation and aerospace engineering interests in middle- and high-school students. SeaPlane kits are brought to local schools for teams to build with the help of Carderock STEM professionals. NSWCCD invites the students to fly and test their models in one of the towing-tank facilities. The SeaPlane design is based on the NC flying boats, which — the NC-4 — was the first aircraft to fly across the Atlantic Ocean in 1919. The model NC-4 used in this outreach program was created by three high-school interns who worked with an NSWCCD engineering mentor throughout the academic year.
- *International Submarine Races.* NSWCCD hosts the International Submarine Races every two years. In June 2013, 23 teams of high-school and college students from North and South America, Europe, and the Middle East brought their human-powered submarines to West Bethesda for a weeklong competition in NSWCCD's David Taylor Model Basin. The event encourages students to explore the disciplines of naval architecture, marine and mechanical engineering, and mathematics.

### Mentorship and Internship Activities

- *Science and Engineering Apprenticeship Program (SEAP).* Twenty-six high-school students participate in the SEAP program at Carderock Division's Bethesda laboratories. Students are mentored by S&Es and present the results of their summer work at the end of the work period in August.

## Teacher and S&E Training

- *Summer STEM Teacher Institutes.* Two weeklong professional-development opportunities for teachers are held each summer. During the STEM Institutes in 2013, high-school teachers were introduced to Arduino microcontroller programming while getting the chance to tour the testing facilities and interact with S&Es. During the elementary-school institute, 24 third-grade teachers from Maryland, Virginia, and D.C. were introduced to the “Engineering Is Elementary” curriculum. They engaged in the engineering-design process to design and construct a process for making Play-Doh-like modeling compound and learned about the design and construction of bridges. The daily activities were supplemented with laboratory tours.

## Summer Camps

- *Alaska Underwater Glider Program.* In August 2013, three engineers and an educator led a weeklong residential underwater-glider camp in Seldovia, Alaska, at the NOAA facility at Kasitsna Bay. Twenty-one students and six teachers from all across the state participated in the program. The student/teacher teams built underwater gliders, learned Arduino programming, and flew their gliders in Kachemak Bay.

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Eric Silberg (SeaPlane)



## MARYLAND

# NAVAL SURFACE WARFARE CENTER INDIAN HEAD DIVISION

NSWC Indian Head has the largest concentration of Ph.D.s working in energetics and the highest number anywhere of synthesis chemists, detonation physicists, and formulation scientists.

### A National S&T Asset

The Naval Surface Warfare Center Indian Head Division (NSWC IHDIV) has progressed over its 125-year history from naval proving ground to an ordnance production station to its role today as a leader in the Navy's Energetics Enterprise. Energetics is a broad discipline embracing explosives, propellants, pyrotechnics, reactive materials, and high-energy chemicals and fuels and their application in propulsion systems and ordnance. NSWC IHDIV is located on a 3,500-acre peninsula along the Potomac River in southern Maryland. Operations are also conducted at detachments in Yorktown, Va.; McAlester, Okla.; and Colts Neck, N.J. The warfare center provides research, development, test and evaluation, and in-service support of energetics and energetic materials for warheads, propulsion systems, ordnance, pyrotechnic devices, and fuzing for the Navy, Marine Corps, and Joint Forces. The facilities and capabilities address all aspects of the energetics technical discipline, including formulation, test, and engineering of chemicals, propellants, explosives, related electronic devices, associated ordnance equipment, and special weapons support.

### STEM Climate

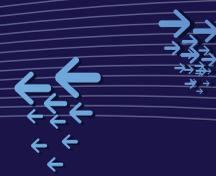
NSWC IHDIV is committed to enhancing STEM education in southern Maryland schools by providing students and educators with real-world examples of classroom lessons. The program facilitates collaboration between scientists, engineers, technicians, and teachers in the classroom and offers STEM activities to local students outside the classroom. Since NSWC IHDIV is the largest employer in Charles County, outreach is a significant means by which the warfare center is building a strong technical and professional pipeline. Currently, the STEM program reaches students in third through 10th grades and is conducted during in-school hours, after school, on weekends, and during summer breaks. The goal is to maintain the current level of outreach and to effectively reach as many students as possible throughout southern Maryland.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2009
Geographic Reach	Southern Maryland counties of St. Mary's, Charles, and Calvert
FY13 S&E Mentors & Coaches	1 site coordinator 22 S&Es
FY13 Schools Reached	10 elementary schools 15 middle-schools
FY13 Personal Interactions	875 students 36 teachers
Other Partners & Catalysts	College of Southern Maryland, Naval Air Warfare Center Patuxent River, Naval Surface Warfare Center Carderock Division, Chesapeake Bay Foundation, Naval EOD Technology Division Stump Neck, Boy Scouts of America

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Science Fair Judging.* S&Es served as science fair judges for seven elementary and middle-schools in Charles County; also served as judges for one local high-school in Charles County.
- *NDEP Charles County Culminating Event.* More than 60 middle and elementary school teams from Charles County schools participated in the annual robotics competition, Feb. 23 at North Point High-school, sponsored by the National Defense Education Program. S&Es mentored the teams over a period of 18 weeks in the areas of robotic



design, software programming, and research methods. The competition consisted of a technical/teamwork challenge, robotic missions challenge, and research presentation.

- *NDEP St. Mary's County Culminating Event.* More than 45 middle and elementary school teams from St. Mary's County schools participated in the annual robotics competition, May 15 at St. Mary's Ryken High-school, sponsored by NDEP. S&Es mentored the teams over a period of 16 weeks in the areas of robotic design, software programming, and research methods. The competition consisted of a technical/teamwork challenge, robotic missions challenge, and research presentation.
- *NDEP Charles County SeaPerch Competition.* Twenty teams from Charles County competed at Lackey High-school in this competition. The competition consisted of an underwater challenge as well as a research presentation. Awards were given to the top three teams.
- *NDEP SeaPerch Summer Camp.* The SeaPerch summer camp was held the week of July 15th at Thomas Stone High-school. The camp consisted of approximately 100 Charles and St. Mary's County middle-school students. The students were placed into teams that each built a SeaPerch. A mini competition was held at the end of the week. In addition, the students were given daily mini STEM exercises related to either physics or math — such as rockets, egg drop, balloon catapult, and paper-airplane designs.
- *NDEP Chesapeake Bay Foundation Trip.* Approximately 30 middle and elementary school students from Charles and St. Mary's counties went to Smith Island to learn more about the Chesapeake Bay ecosystem. While at Smith Island, the students took and tested water samples, caught and examined live fish and crabs, and examined local ecosystems.

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# NEW HAMPSHIRE and MAINE PORTSMOUTH NAVAL SHIPYARD

Portsmouth Naval Shipyard has been in continuous operation for more than 200 years, and 50 of the shipyard’s buildings are listed on the National Register of Historic Places.

## A National S&T Asset

Located on an island in the Piscataqua River estuary between New Hampshire and Maine, Portsmouth Naval Shipyard (PNS) is the most experienced naval shipyard in submarine design, construction, modernization, and maintenance and plays a key role in the very-deep ocean submersible and special-operations arenas. Today, the shipyard’s primary mission is the overhaul, repair, modernization, defueling, and refueling of Los Angeles- and Virginia-class nuclear-powered submarines.

PNS is also the Center of Excellence and planning yard for U.S. Navy submarine rescue assets and provides engineering services for scientific research, defense prototype testing, and other platforms.

The shipyard is the Ship Availability Planning and Engineering Center (SHAPEC) for Los Angeles- and Virginia-class submarines. In that capacity it develops the engineering instructions for all availabilities, regardless of which facility is performing the production work.

## STEM Climate

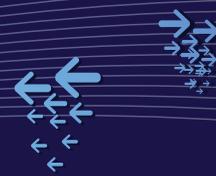
PNS employees are active members of the STEM outreach community along the seacoast of New Hampshire and Maine. During the last four years, the shipyard’s STEM outreach program has grown from reaching fewer than 50 students to making a difference for more than 1,500 students through group and individualized teaching and mentoring contacts. To expand our reach beyond our commuting area we have teamed up with the University of New Hampshire Extension Service. They have offices throughout the state and provide us with access to the 4-H students throughout the state — students with a curiosity about STEM fields. In Maine we have teamed with the local chapters of the American Society of Naval Engineers using SeaPerch to extend our reach beyond our commuting area.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2009
Geographic Reach	Mostly within 50-mile radius of Portsmouth, N.H., and Kittery, Maine
FY13 S&E Mentors & Coaches	2 site coordinators 546 S&Es
FY13 Schools Reached	5 elementary schools 17 middle-schools 20 high-schools 20 school districts
FY13 Personal Interactions	4,779 students 293 teachers
Other Partners & Catalysts	Maine Engineering Promotion Council University of New Hampshire (UNH) Society of Women Engineers; UNH Center for Coastal and Ocean Mapping; UNH College of Engineering and Physical Sciences

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *2nd Annual Seacoast SeaPerch Challenge.* Shipyard employees and sailors from PNS teamed up with other volunteers from the University of New Hampshire (UNH) Center for Coastal and Ocean Mapping (CCOM) and the UNH Extension Service (4-H) to sponsor the second Seacoast SeaPerch Challenge at UNH. This regional challenge is patterned after the National SeaPerch Challenge. The 14 schools and organizations that attended the event put on an amazing show during the morning’s competition at an indoor pool. After lunch all the teams were invited to the Jere A. Chase Ocean Engineering Building for a surprise challenge by engineers from the Massachusetts Institute of Technology - Sea Grant College (MITSG).



We told our contestants that the competitive portion of the SeaPerch Challenge was over, so it was time to collaborate with their fellow ROV pilots. In the 40 feet by 60 feet by 20 feet-deep engineering pool, a simulated oil rig was floating over a simulated oil well. While the students watched, fire erupted from the oil derrick. It began to tip to one side, fell over, and the platform itself then began to sink. Shortly after, the surface of the pool was covered with oil (actually 500 painted ping pong balls).

- *Maine Engineering Expo.* This is a unique opportunity to enlighten some 1,500 second- to 12th-graders to the world of science and the possibilities for scientific and engineering careers. Companies, organizations, and schools from all over the state of Maine get together annually to show off their equipment and STEM projects.
- *Mini Maker Faire at the Dover (NH) Children's Museum.* The Maker Faire movement started in 2006 in the San Mateo (San Francisco) area. It is gathering of individuals and organizations that includes "do it yourselfers" who want to show off their projects. We demonstrated the SeaPerch in our 1,000-gallon tank and were busy all day long. Approximately 1,200 people attended the event and there were more than 50 Makers from throughout New England.
- *Lone Tree Scout Reservation (Kingston, N.H.).* We spent a day with more than 100 Boy Scouts demonstrating the SeaPerch and talking about STEM Education and Opportunities.
- *Know the Coast Day (UNH, Durham, N.H.).* Hosted by the UNH Center for Coastal Ocean Mapping and Department of Ocean Engineering, the Know the Coast Day is a celebration of all things STEM. PNS employees spent the first day with hundreds of local students demonstrating the SeaPerch. The second day was open to the public and many families attended to investigate ocean engineering and exploration and marine biology.

## Classroom Activities

- *SeaPerch ROV Builds.* Engineers and craftsman guided almost 800 students in the construction of about 400 underwater remotely operated vehicles in classrooms during the 2012-13 school year.
- *SONAR In-Class Demonstrations.* Engineers explained sonar technology to third-graders in conjunction with their science lessons.
- *STEM Flashmob.* At Hamilton-Wenham High-school, PNS employees took over the sophomore class for a day. We held 10 different workshops from Making

Ice Cream, to Virtual Welding, Submarine Escape System Design, and Chromatography.

## Outside Classroom Enrichment Activities

- *Engineeristas Girls Tech Camp at UNH.* This all-girls tech camp doubled in size this year to 40 students. Women engineers from PNS again lead the sixth- and seventh-grade students in a mechanical-dissection workshop trying to figure out how everyday items actually work. This is regularly one of the most popular workshops in the camp because of our enthusiastic mentors.
- *UNH Tech Camp - SeaPerch Plus.* Our mentor team included PNS alum from MITRE Corp., our most experienced SeaPerch middle-school science teacher, and engineers from PNS.

For the previous tech camps we had always built a SeaPerch with the campers. This year we added the "plus" and changed the format for the weeklong adventure. This time we came with a bunch of built Perches, spare parts, baling wire, hoses, cameras, and duct tape. The students were challenged with a mission: Deliver survivability stores to a disabled submarine sitting on the bottom at 500 feet.

We spent the first morning brainstorming how to accomplish the task. The campers decided to split into sub-teams with specific tasks: one to provide video feed to the control station for the other pilots and a mobile video ROV to inspect the sunken sub, another to build a vehicle(s) capable of opening the hatch and to open the sail door, and a team to design/build a delivery system for the life-extending stores (a 16-ounce soda bottle containing nuts).

There were more challenges along the way. One team discovered that a typical Perch was capable of 38 grams of thrust. Unfortunately, the hatch mockup we had needed 900 grams to lift it in the air. So they devised an elegant Perch with a hook and a balloon piped to a bicycle pump. It worked great.

The video team provided feed to one large screen and three small screen monitors so the pilots could operate without getting too tangled.

In the end everything worked. The balloon Perch was needed to assist the mule Perch but working together all tasks were accomplished. The campers were then tasked with creating posters and presentations for their parents. The parents were impressed with everything



their children had accomplished a few short days. We also had the opportunity to talk with the NOAA ship Okeanos Explorer through the telepresence equipment at UNH. The Okeanos ROV pilots were diving at 3,000 meters off the New England coast. Through the telepresence our students could see the video feed from the Tether Management System, the ROV, and the pilot's control room on board. We compared notes and ROV challenges.

- *Expanding Your Horizons*. A STEM event in Stratham, NH, our team of 22 engineers plus three Navy women from the clinic ran eight workshops for 220 sixth-, seventh-, and eighth-grade girls. (This is our fourth year participating in this event.) EYH was able to expand the number of girls participating because of the number of workshops the shipyard conducted.
- *Marine Advanced Technology Education Center (MATE) Remotely Operated Vehicle Competition*. PNS sponsored a team with the UNH mechanical-engineering department. Our engineers are in the fifth year of mentoring a design-build team for the International MATE competition.

### Mentorships and Internships

- *Engineering Internships*. In 2013, PNS had more than 40 engineering interns onboard, most during summer break but others as part of their schools' integrated co-op programs. Students were given the opportunity to work as full-fledged engineers, earn seniority, and bring this experience back to their schools.
- *SMART Internships*. PNS has seven SMART interns and in 2013, two more came onboard as full-time employees. We now have four as full-time employees and three in college.
- *FIRST Robotics*. During the 2012-13 school year, PNS mentored the FIRST Robotics teams at Traip Academy in Kittery, Maine, and Dover High-school in Dover, N.H. In 2013-14 we have those teams plus three new teams, one FIRST Lego League team in Strafford, N.H., and two FIRST Tech Challenge teams in New Hampshire — one in Dover and one in Barrington.
- *International Submarine Races*. One PNS employee served as the sponsor and mentor of a team from the Seacoast School of Technology encompassing students from approximately 11 different schools in Massachusetts, New Hampshire, and Maine. The team competed in 2013; PNS is sponsoring and mentoring its second team, preparing for the competition in 2014.

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# PENNSYLVANIA

## NAVAL SURFACE WARFARE CENTER CARDEROCK DIVISION PHILADELPHIA

NSWC Carderock Division, Philadelphia, maintains the Navy’s presence at the old Philadelphia Naval Shipyard, the first Naval shipyard built in the United States and in continuous use by the Navy from 1801 to 1995.

### A National S&T Asset

The Naval Surface Warfare Center Carderock Division, Philadelphia — also known as the Naval Ship Systems Engineering Station (NAVSSSES) — is the Navy’s principal test and evaluation station and in-service engineering agent for all hull, mechanical, and electrical ship systems and equipment. NAVSSSES has the capability to test and engineer the full range of shipboard systems and equipment, from full-scale propulsion systems to digital controls and electric power systems. Its areas of technical leadership responsibility include machinery research and development; auxiliary and life-support systems; cargo, weapons, and hull systems; environmental and damage control systems; materials technology, machinery network, sensors, and data systems; propulsion and electrical machinery systems; and undersea vehicle sail and deployed systems.

### STEM Climate

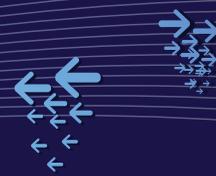
Local implementation of NDEP-supported STEM initiatives commenced in 2008. NAVSSSES works with schools in Philadelphia and in adjacent counties in the tri-state region of Pennsylvania, New Jersey, and Delaware. Schools range from inner-city to large suburban and small rural schools. The School District of Philadelphia administers 270 urban schools that are racially and ethnically diverse, with African-Americans and Hispanics comprising the two largest demographic groups. Chester County, in contrast, has the highest per-capita income in Pennsylvania. Bucks and Montgomery counties include small, rural school districts.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2008
Geographic Reach	Greater Philadelphia/Delaware Valley region, including the 14+ immediate counties in the tri-state region of Pennsylvania, New Jersey, and Delaware
FY13 S&E Mentors & Coaches	1 site coordinator 154 S&Es participating as mentors, co-teachers, judges, speakers, and facilitators
FY13 Schools Reached	>140 schools
FY13 Personal Interactions	4,070 students 169 teachers
Other Partners & Catalysts	American Society of Naval Engineers (ASNE), Temple University, Drexel University, Philadelphia University

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- Philadelphia Science Festival.** This event is a 10-day, communitywide celebration of science that takes place annually in April, featuring lectures, debates, hands-on activities, special exhibitions, and a variety of other informal science-education experiences for Philadelphians of all ages. NAVSSSES supports the festival at various



venues through sponsorship and in partnership with the Greater Philadelphia STEM Center. Participation includes staffing demos and exhibits conveying various scientific concepts such as power and energy and underwater robotics. Venues include the main carnival that features a massive display packed with demonstrations and exhibits on robotics, power, and energy, as well as a SeaPerch demonstration tank. Estimated traffic during the festival is approximately 3,000 children and adults.

## Classroom Activities

- STEAM Powered (Science, Technology, Engineering, Arts, and Math) After-School Program.* This is a collaboration between institutes of higher education (Greater Philadelphia STEM Center partners), secondary education, and the Department of Defense. The program is implemented in underserved and minority community-based schools in the nearby neighborhoods of the participating inner-city universities. The program recruits teachers and uses the Navy S&E work force in a 20-week after-school program focused on energy and robotics, sports science, and the science of the arts. During the 2013-14 academic year, SeaPerch activities will be integrated into these programs. Program capacity is four schools, 10 teachers, 200 students.
- Urban Youth Racing.* To encourage science and math learning and to provide cognitive-learning experiences for underrepresented elementary, middle, and high-school-level students, NAVSSES partnered with the Urban Youth Racing School to implement the Naval Engines Design Program. This is a seven-week cohort of classroom, laboratory, and hands-on learning for U.S. Navy shipboard propulsion and power-generating machinery including gas turbines, diesel engines, steam turbines, and machinery controls. The curriculum also includes modules on fuel and lube oils, 3-D modeling, and simulations in a computer-aided virtual environment. They also hold informational discussions and panel sessions on the Navy's green energy initiatives. The program was established three years ago and classes for approximately 25 students are held in November.
- 1,200 students benefited from the competition and more than 65 mentors paired up with the schools. The 2014 competition is in April, with winners receiving an invitation to a national competition held at the University of Southern Mississippi.
- Greater Philadelphia STEM Center Summer Camp.* This is a nonresidential, two-week camp designed to increase awareness of STEM and Navy careers as well as to positively influence attitudes toward science and math. Hosted primarily at university partners' locations, the students experience a college-campus environment. NAVSSES S&Es provide mentoring, and NAVSSES interns from the Science and Engineering Apprenticeship Program (SEAP) and Naval Research Enterprise Internship Program (NREIP) serve as near-peer "ambassadors." Military careers and perspectives also are introduced by uniformed members from the local Navy recruiting district. The first two-week camp, geared toward middle-school girls, is implemented in partnership with the Girl Scouts of Eastern Pennsylvania. The second two-week camp serves middle-school boys and girls. The 2013 summer camp served approximately 120 students.
- Girls and Mathematics Program.* This yearlong initiative encourages middle-school girls from the north Philadelphia area to study mathematics. It is implemented in collaboration with Temple University and cosponsored by the Mathematical Association of America-Tensor Foundation and the Mathematical Sciences Research Institute. The program serves 50 to 75 girls and features a summertime weeklong program and a weekend "Mathematics Circle," which is held throughout the academic year.
- SeaPerch.* NAVSSES provided mentors and judges for the Philadelphia SeaPerch Challenge, which was held April 26-27 at Drexel University. Thirty-six middle and 53 high-schools participated in the event, with a total of more than 1,200 students. NAVSSES supported the mentoring program (classroom/enrichment programs) that was held over five months prior to the event to support an in-the-water maneuvering mission, engineering design, and presentations.

## Outside Classroom Enrichment Activities

- Greater Philadelphia SeaPerch Challenge.* This flagship STEM outreach program at NAVSSES and in the region is a naval engineering-centric, three-month, design-build activity that culminates in a daylong competition. The Philly program provided the catalyst for the expansion of SeaPerch throughout the DoD community and also serves as the model for the national SeaPerch competition. There were twice as many registrations in 2013 than 2012, with 36 middle and 53 high-schools participating. More than

## Mentorship and Internship Activities

- Summer Internships.* NAVSSES provides many internship opportunities through the SEAP and summer-hire programs. Interns typically work individually or in teams on an engineering problem or investigation under the mentorship of S&Es. Upon completion of their tour, the interns must provide a brief of their work to their peers and to SSES employees.



## Teacher and S&E Training

- *SeaPerch Training.* This is a daylong training course on the building and related science of the SeaPerch vehicle. Teachers and advisers work hands-on to build SeaPerch ROVs while learning the construction techniques and the underlying science so they can teach these topics to their students.

## SSES Outreach Teaming

- *Advisory Board.* The SSES Stem Advisory Board was formed and consists of approximately 30 members; the board meets every three months to discuss future objectives and support needed. Also, members of the board are being empowered by assigning leads for each NAVSSES STEM program.
- *Technical Team.* The NAVSSES STEM Technical Team members are working to establish a strategic plan and vision for NAVSSES Philadelphia Outreach that aligns with Navy initiatives. The focus is to develop a plan that can link our programs and resources to develop an overall mission with metrics.

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## RHODE ISLAND

# NAVAL SURFACE WARFARE CENTER NEWPORT DIVISION

NUWC Newport Division is home to the Undersea Collaboration and Technology Outreach Center, a specialized facility for hosting STEM educational outreach activities and S&T events.

### A National S&T Asset

The Naval Undersea Warfare Center (NUWC) Newport Division is the Navy's full-spectrum research, development, test, and evaluation; engineering; and fleet-support center for submarine warfare systems and many other systems associated with the undersea battlespace. NUWC Newport Division provides the technical foundation that enables the conceptualization, research, development, fielding, modernization, and maintenance of systems that ensure the U.S. Navy's undersea superiority. The warfare center is responsible, cradle to grave, for all aspects of submarine warfare and related systems and for supporting evolving operational capabilities. Headquartered in Newport, R.I., NUWC Newport Division operates detachments in West Palm Beach, Fla., and Andros, Bahamas; and remote test facilities at Seneca Lake and Fishers Island in New York and Dodge Pond in Connecticut.

### STEM Climate

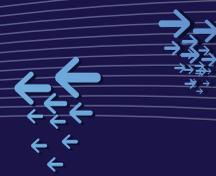
NUWC Newport Division is committed to enhancing STEM education in Massachusetts and Rhode Island schools to provide students and educators with real-world examples of classroom lessons. A National Defense Education Program-funded effort was established at NUWC Newport to mobilize efforts to place in area classrooms scientists and engineers who can provide students with hands-on, real-world experiences to reinforce classroom lessons and inspire students to pursue STEM careers. This program facilitates collaboration among scientists, engineers, technicians, and teachers to create unique learning opportunities and to assist educators in classroom learning and events. STEM programs reach students in fourth grade through the postgraduate level and are conducted in school, after school, on weekends, and during summer breaks.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2006
Geographic Reach	New Bedford, Mass. and Newport, R.I., public schools as well as schools in other cities in Massachusetts and Rhode Island
FY13 S&E Mentors & Coaches	1 site coordinator 160 S&Es
FY13 Schools Reached	23 elementary schools 16 middle-schools 8 high-schools
FY13 Personal Interactions	4,884 students 191 teachers
Other Partners & Catalysts	Undersea Science and Engineering Foundation; University of Rhode Island Inner Space Center; Newport Community School; Aquidneck Island Robotics (AIR) 4-H Club

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- Greenlight for Girls.** This program promotes greater participation of girls, young women, and career-age women in STEM-related studies and careers. Hosted at the University of Massachusetts Dartmouth with the help of NUWC outreach volunteers, the 60 girls turned blown fuses into crazy earrings and explored the forces of magnetic fields while painting their nails with magnetic nail polish.



- *STEM Girls Conference.* This workshop for girls from Providence introduced girls to Ohm's law, fuses, and electricity. The 30 students worked together to create earrings by soldering colored wire to blown and nonblown fuses.
- *Carney Academy Science Demonstration.* One hundred students from Carney Academy In New Bedford were hosted on-base for a series of educational and awe-inspiring science demonstrations designed to entertain and engage. Navy volunteers demonstrated a variety of scientific concepts including the states of matter, bubble physics, endo- and exothermic chemical reactions, robotics, and lasers to encourage interest and awareness in science and engineering careers.

### Classroom Activities

- *Engineering Club and SeaPerch Derby.* Engineering club gives middle-school students the chance to work on hands-on engineering projects. The 138 students focus on building SeaPerch vehicles with an underwater competition as the culminating activity. The SeaPerch Derby regional competition qualifies students for the annual SeaPerch National Competition.
- *Science Club.* This seven-week program gives 70 fifth-graders the opportunity to spend an hour each week doing fun, hands-on science experiments (four sessions each year). In addition, we lead a teacher training at Sea Lab Marine Science Education Center - New Bedford, giving the teachers the knowledge to run a science club-style "physics of toys" class, and ran a six-week class building telegraphs and discussing electromagnets.
- *MATHCOUNTS and Mathcatlon.* Sixty students participate in fun and challenging math programs and games that improve their foundational understanding of science, math, and engineering. Two unique programs are offered to middle-school teachers and students: MATHCOUNTS Competition Program and MATHCOUNTS Club Program. Students culminate the season with an annual Mathcatlon competition consisting of various math events.

### Outside Classroom Enrichment Activities

- *Sea Lab New Bedford.* Sea Lab is a marine science studies program funded through New Bedford Public Schools for the perpetuation of science. Historically, it is a six-week summer program serving academically serious students. It has evolved into a year-round program that reaches every single fourth- and fifth-grade student in New Bedford, as well as an intensive summer program for grades four through nine (2,698 students).

### Newport Success Story

One of the biggest success stories for NUWC Newport is its work at Sea Lab Marine Science Education Center in New Bedford, MA. Sea Lab allows visiting New Bedford schools to receive additional STEM education in regular field trips to the Sea Lab site. The district of New Bedford includes 17 public elementary schools, and the program at Sea Lab allows NUWC Newport volunteers to reach every single fourth and fifth grade class in the city of New Bedford over the course of the school year. In 2013, fifth-graders who had participated in the fourth grade program the year before have impressed volunteers in remembering who volunteers were, remembering the one-day robotics lesson from the year before, and began asking where they could find other similar programs in their school.

For the past three years creating a pipeline for STEM students at Sea Lab has been a major success in a high-risk area like New Bedford. Interest in the robotics, buoyancy, and engineering classes done for each fourth- and fifth-grader has allowed us to guide many of those students into more advanced SeaPerch programs. NUWC Newport's commitment is to continue this pipeline to guide more students into programs such as FIRST Robotics and the Undersea Technology Apprentice Program.

- *Science Fairs.* Judges from NUWC Newport attended 17 individual school fairs and both the Rhode Island State Fair and the Southeastern Massachusetts Regional Fair, involving approximately 1,650 students. STEM professionals also handed out the NUWC Innovative Science Award at both the state and regional fairs.

### **Mentorship and Internship Activities**

- *Aquidneck Island Robotics (AIR).* S&Es helped mentor all three levels of FIRST Robotics (FIRST Robotics Competition, FIRST Tech Challenge, and FIRST Lego League) in cooperation with AIR and New Bedford Public Schools. This, combined with the relatively new Vex Robotics Challenge, creates a pipeline for students to work at their own level and work toward the next higher-level program.
- *Undersea Technology Apprentice Program (UTAP).* During four-week sessions in summer 2012, 43 students from local partner schools worked part time alongside Navy S&Es to gain real-world experiences. Students also reengineered previously constructed SeaPerch vehicles to perform more advanced functions and then competed against each other at the end of the session. They developed an advanced drive system using a microcontroller. Students received a stipend for the program; one session is supported by the Undersea Science and Engineering Foundation with a grant from the van Beuren Charitable Foundation.

### **Teacher and S&E Training**

- *SeaPerch Teacher Training Programs at Newport, Philadelphia, and Orlando.*
- *SeaPerch Navy League Training Program.*

### **For Information**

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## VIRGINIA

# NAVAL SURFACE WARFARE CENTER CARDEROCK DIVISION DETACHMENT NORFOLK

Complex, high-performance watercraft for today's missions must be easily transportable and capable of operating in high seas and surf as well as shallow rivers and other demanding marine environments in all climates and conditions.

### A National S&T Asset

The Naval Surface Warfare Center Carderock Division's Detachment Norfolk—the Combatant Craft Division (CCD)—in Virginia Beach is the DoD's technical support center and primary source for watercraft design and system engineering. CCD provides synergistic integration of all watercraft design, engineering, and test and evaluation functions at two sites in one geographical area (Hampton Roads, Va.). CCD's capabilities include waterfront operations in support of both demonstration and in-service watercraft. A full-spectrum approach encompasses every aspect of watercraft design and technology from naval architecture, design, and engineering to survivability, transportability, human systems integration, test and evaluation, logistics, lifecycle management, and industrial support.

### STEM Climate

The main components of CCD's STEM outreach include SeaPerch projects at area middle-schools; in-classroom hands-on learning modules for elementary-school grades K-5 and middle-school grades 6-7; co-ordination/facilitation of the Hampton Roads Summer STEM Academy, and numerous mentoring events. Additionally, mentoring of a FIRST Robotics program at a local high-school is expanding in scope and feasibly will involve more schools in the next few years. Outreach efforts now extend to four regions in south Hampton Roads, with formal, long-term education-partnership agreements established in all four areas. Within the past year, CCD has become more involved with other local commands, the College of William and Mary, and Virginia Beach City Public Schools in collaborating to make best use of all available STEM outreach resources.

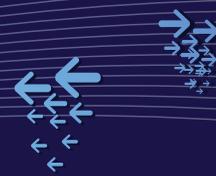
### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2009-10
Geographic Reach	South Hampton Roads area, Va.: Chesapeake, Norfolk, Portsmouth, Virginia Beach
FY13 S&E Mentors & Coaches	1 site coordinator 23 S&Es
FY13 Schools Reached	2 elementary schools 1 intermediate school (grades 3-5) 5 STEM Academy middle-schools 1 high-school 4 public school districts
FY13 Personal Interactions	1,363 students 152 teachers
Other Partners & Catalysts	CDSA Dam Neck; Norfolk Naval Shipyard; SPAWAR Systems Center Atlantic; College of William and Mary; Virginia Beach Technical and Career Education Center

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- Learning Modules.** During the school year, CCD S&Es work with a class of 20 to 28 students to apply curriculum strand information to engineering problems. Modules are in place for grades K-5. Typically, two learning modules are facilitated for every class within a grade level during the school year. The learning modules are developed by S&Es through collaboration with teachers. Annually, 650 to 850



elementary-school students interact directly with S&Es while participating in learning modules.

- *Calculator Robots.* Learning modules incorporating calculator robots are facilitated by CCD engineers for middle-school students. The modules provide the opportunity for students to learn how to program hand-held calculators and apply algebra knowledge to answer engineering questions. Direct connections are made between the lessons and the day-to-day activities of CCD engineers.

### Outside Classroom Enrichment Activities

- *STEM Career Conference.* About 1,500 middle-school students spend a full day exploring a variety of science and engineering careers. Students choose several sessions of interest and attend those throughout the day. S&Es from CCD provide hands-on activities for multiple sessions, immersing students in the boat design/modeling/testing process and providing insight on what naval architects do. Additional S&Es facilitate sessions on full-scale boat testing and evaluation, exposing students to the variety of ways science and engineering are used to evaluate the Navy's boats.

### Mentorship and Internship Activities

- *SeaPerch.* S&Es facilitate three SeaPerch programs at area schools: Two are after school; one is incorporated into the school day, an after-school program is transitioning to become part of the regular curriculum during the 2012-13 school year. Annually, 100 students participate, along with five teachers and eight S&Es.
- *Hampton Roads Summer STEM Academy.* One hundred middle-school students spend a full week immersed in all aspects of engineering as they collaborate with peers, teachers, and S&Es to create, test, demonstrate, and present solutions to four distinct engineering challenges. In 2012, CCD collaborated with three other local commands and the College of William and Mary to facilitate the event and provided six S&Es to serve as mentors, speakers, and design judges. While this event did not occur in 2013 due to the effects of sequestration, it is hoped that it will occur again in summer 2014.
- *FIRST Robotics Mentoring.* A CCD engineer provides mentoring to a Norfolk High-school FIRST Robotics team each year. CCD involvement in FIRST is increasing in anticipation of a district event in the local area in 2016.

### Teacher and S&E Training

- *Virginia Beach STEM Robotics Training.* An S&E recently attended the teacher training provided by Virginia Beach City Public Schools for teachers who will be leading STEM robotics clubs in the annual Virginia Beach STEM Robotics Competition. The clubs and competition are open to students in grades five through 12. Information learned in the training will be used to enhance the effectiveness of outreach resources in support of STEM activities within the Virginia Beach school system.
- *Teacher Training.* Mechanisms for providing teacher training at both the elementary and middle-school levels are being considered with the goal of providing hands-on learning modules at a greater number of schools than is currently possible. Potential mechanisms include quarterly teacher trainings for learning modules that will occur in the upcoming quarter- and multiple-day training sessions during the summer.

### For Information

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## VIRGINIA

# NAVAL SURFACE WARFARE CENTER DAHLGREN DIVISION

The Virginia demonstration project was an early pilot program, championed by former senator and Navy Secretary John Warner, to explore whether S&Es could effectively team with teachers in the classroom. The program formed the basis for the National Defense Education Program's K-12 efforts.

### A National S&T Asset

The Naval Surface Warfare Center Dahlgren Division (NSWCDD) is a shore command of the Naval Sea Systems Command. The laboratory, located on the northern neck of Virginia along the Potomac River, provides research, development, test and evaluation (RDT&E). It also provides analysis, systems engineering, integration, and certification of complex naval warfare systems related to surface warfare. Major technical capabilities include, for example, radar and electro-optic systems; surface warfare and surface combat systems engineering; missile systems integration, directed energy RDT&E; weaponization of surface and air unmanned systems; Marine Corps weaponry systems; electronic warfare; and chemical, biological, and radiological warfare defense systems and homeland security.

### STEM Climate

Local implementation of STEM initiatives commenced with the establishment of the Virginia Demonstration Project (VDP) in 2005. NSWCDD continues to run the very successful in-class and extracurricular VDP, which is a comprehensive, affordable, sustainable, and transferable steady-state model for STEM education that is compatible with the work force goals of the Navy. The program enables scientists and engineers (S&Es) to work with teachers and students in the classroom environment. Another central aspect of the program is the three summer camps that reach out to students in counties near the naval facilities at Dahlgren, Hampton Roads, and Quantico. In 2012, NSWCDD started a new outreach to K-12 students based on the Office of Naval Research's SeaPerch program. In 2013, NSWCDD added an additional K-12 outreach. The model for this new outreach is similar to the VDP summer academies but is shorter in duration (one day of activities) and adds a tour of NSWCDD facilities for the students. Both of these efforts were funded by

### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2005
Geographic Reach	King George, Spotsylvania, Stafford, Caroline, Orange, Westmoreland, Richmond, Lancaster, North Hampton, North Uمبرland, Accomack counties, Va.; Somerset County, Md.
FY13 S&E Mentors & Coaches	1 site coordinator 155 S&Es
FY13 Schools Reached	25 middle-schools 2 high-schools 2 elementary schools
FY13 Personal Interactions	4,936 students 146 teachers
Other Partners & Catalysts	SCSC Wallops Island, University of Mary Washington, DoDEA, College of William and Mary

Section 852 funds and have allowed NSWCDD to extend its outreach into rural areas in Virginia. Additionally, NSWCDD and Surface Combat Systems Center Wallops Island have entered into an agreement to extend STEM initiatives into the counties surrounding the Wallops Island facility.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Railgun Tours.* One hundred sixty science students toured the railgun facilities in FY13. The tour lasted about an hour and included discussion of the Navy's role in development,

testing, and fielding of combat systems and the S&T underlying development of a complex weapon. Basewide tours were provided to 20 students as part of the summer-camp pilot. NSWCDD also held a “Bring Your Child to Work Day” and provided tours to more than 100 students as part of that function.

### Classroom Activities

- *VDP STEM Dahlgren In-school Program.* The 2012-13 in-school portion of the NDEP VDP involved 40 Dahlgren S&Es working alongside middle-school teachers in five neighboring school systems, totaling 18 middle-schools. The curriculum, developed by the College of William and Mary, is based on either a coral-reef scenario or a land-mine scenario. The seventh- and eighth-grade students learn and engage critical-thinking skills to build and program Lego Mindstorms robots to accomplish tasks associated with the different scenarios. A typical implementation plan provides two S&Es per school, each with 40 hours of funding.

### Mentorship and Internship Activities

- *VDP STEM Dahlgren Academy.* This is a four-day event hosted at King George Middle-school. The academy reaches 103 students from Dahlgren, Fredericksburg, King George, Spotsylvania, and Stafford middle-schools. Each of 16 teams has two mentors — one S&E and one middle-school teacher. A junior mentor program provides nine high-school students with an opportunity to grow as leaders and participate in a more advanced robotic activity. STEM activities include: team building/planning/presentations, tower design/construction/testing, water rocket testing/data analysis, nine robotic Navy-focused missions, STEM career discussions, life-science activity, and lab demonstrations. This year the academy held a successful “Parent Half-Day Event,” where parents could see first hand what their children were experiencing and receive STEM career information for future reference.
- *STEM Quantico Academy.* In June 2013, the Quantico STEM Academy concluded its third successful weeklong event at the DoDEA Quantico Middle/High-school on Marine Corps Base Quantico. This year, 44 students participated, ranging from rising sixth-graders to rising ninth-graders.
- *VDP STEM Hampton Roads Academy.* We had four S&Es work with 75 students for four days at a summer camp at Corporate Landing Middle-school. Students attending the camp solved real-life engineering problems.
- *FIRST Coaching.* A James Monroe High-school robotics team coached by NSWCDD S&Es — the Robo Jackets

— participated at the FIRST Virginia Regional Robotics Competition held from March 2012 and made it to the quarterfinals. The Kilroy team associated with the Commonwealth Governor’s School had a team of 30 students from schools across the area and competed in several of the FIRST competitions across the Eastern Seaboard. NSWCDD personnel continue to support these FIRST teams as mentors and coaches.

- *SeaPerch Regional Competition.* NSWCDD hosted the first regional SeaPerch competition for schools in the new SeaPerch outreach. The competition was held at the University of Mary Washington in June 2013.
- *One-Day Summer-Camp Pilot.* NSWCDD conducted a one-day summer-camp pilot with 20 students, five mentors, and three teachers at Orange County’s Locust Grove Middle-school. The event included constructing a spaghetti tower, a simple electric motor, an art robot, and a water rocket. NSWCDD also provided base tours for the students and teachers.

### Teacher and S&E Training

- *STEM Professionals in Classrooms.* In FY13 NSWCDD continued to train teachers and mentors to support the VDP in classroom activities. In VDP, first-time S&Es are also trained on the program, robotics, and ethics with one-and-a-half-day training sessions coupled with the school systems’ professional-development training. For experienced S&Es, climate and ethics training is conducted separately.
- *VDP Dahlgren STEM Academy.* Prior to the Dahlgren Academy, the planning team conducts a three-day training event for mentors and a two-day training event for junior mentors. Each mentor receives a mentor manual to assist in conducting STEM activities during the academy. Training involves hands-on with each STEM activity, ethics, how-to mentoring, STEM careers, the art of inquiry, and mentor team-building exercises.
- *STEM Quantico Academy.* NSWCDD personnel also trained mentors prior to the Quantico summer academy and the Orange County summer-camp pilot. The Quantico academy also holds the three-day training event for mentors and one day for junior mentors.
- *One-Day Summer Camps.* NSWCDD provides a day of training for teachers and mentors involved in the one-day summer camps.
- *SeaPerch Outreach.* NSWCDD provides a day of training for teachers and mentors prior to the SeaPerch in classroom

and after-school builds. In FY13 NSWCDD expanded outreach into Virginia's Northern Neck and Eastern Shore areas. Additional teachers in Colonial Beach, Westmoreland, Richmond, and Orange counties received SeaPerch training. Instruction for first-time schools included schools from Accomack, North Hampton, Northumberland, Caroline, and Westmoreland counties. An eight-hour class was provided by NSWCDD for SeaPerch mentors and teachers. Teachers will be incorporating SeaPerch into their science and math classes in FY14.

## **For Information**

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# WASHINGTON

# NAVAL UNDERSEA WARFARE CENTER KEYPORT DIVISION

Puget Sound is one of the world’s largest inland seas with four natural, interconnected deep-water basins in which depths average 600 feet.

### A National S&T Asset

The Naval Undersea Warfare Center (NUWC) Keyport Division is on the Hood Canal Basin on the western side of Puget Sound in Washington State. Keyport is a shore command of the Naval Sea Systems Command and one of two divisions of the NUWC (the sister command is in Newport, R.I., which is also the site of NUWC headquarters). Keyport supports the U.S. Navy Pacific Fleet with advanced technical capabilities for test and evaluation; in-service engineering, maintenance, and industrial base support; material readiness; and obsolescence management for undersea warfare, including submarines, surface ships, torpedoes, mines, land-attack systems, and fleet-training systems.

NUWC Keyport is the Navy’s major repair facility for torpedoes and the site of the first 3-D precision underwater tracking range in the world. Keyport detachments are in Ford Island and Pearl Harbor, Hawaii; San Diego; and Guam. Fleet testing and logistics sites are in Nanoose, British Columbia, and Hawthorne, Nev. NUWC Keyport’s newest addition is the Naval Sea Logistics Center in Mechanicsburg, Pa.

### STEM Climate

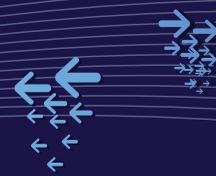
The community adjacent to NUWC Keyport Division is suburban and rural and includes a local Native American population. The socioeconomic environment ranges from very affluent to very poor, each presenting varying educational needs. NUWC Keyport Division has engaged in extensive STEM outreach since 2006, with a focus on underwater remotely operated vehicles (ROVs) because of the close alignment of these teaching tools with the local defense mission and Navy S&Es’ subject matter expertise. NUWC Keyport Division has an especially close and productive partnership with the Puget Sound Naval Shipyard and Intermediate Maintenance Facility on an ever-expanding SeaPerch ROV outreach program.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2006
Geographic Reach	Kitsap County
FY13 S&E Mentors & Coaches	1 site coordinator 69 S&Es
FY13 Schools Reached	11 schools
FY13 Personal Interactions	704 students 14 teachers
Other Partners & Catalysts	Puget Sound Naval Shipyard & Intermediate Maintenance Facility; BAE; Pennsylvania State University; Raytheon; National Center for Manufacturing Sciences; Transient Personnel Unit-Bremerton

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Demonstrations to Local Clubs, Events, and Meetings.* S&Es regularly make presentations or demonstrations at local events and fairs to promote STEM and spread awareness of STEM career opportunities.
- *Second Annual Kitsap County ROV Competition.* NUWC Keyport and Puget Sound Naval Shipyard & IMF hosted a SeaPerch competition in June 2013 as part of the joint SeaPerch/ROV Program. Fifty-five teams of middle- and high-school students competed.



## Mentorship and Internship Activities

- *SeaPerch/ROV Program.* Personnel from two commands are acting as one to provide for the SeaPerch/ROV program to area students. NUWC Keyport and Puget Sound Naval Shipyard & IMF have teamed up for the past four years to increase the number of STEM volunteers in local school districts and increase student participation in the program. Assisting the two Navy commands are personnel from BAE, Pennsylvania State University, Transient Personnel Unit at Bremerton, and the National Center for Manufacturing Sciences. Partnering school districts include 19 junior high and high-schools, as well as elementary schools from the five school districts in the county. Plans are to continue to grow.
- *FIRST Robotics.* Eight engineers and technologists mentored Central Kitsap School District students in the FIRST Robotics program during FY13.

## For Information

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## WASHINGTON

# PUGET SOUND NAVAL SHIPYARD AND INTERMEDIATE MAINTENANCE FACILITY

Puget Sound Naval Shipyard pioneered an environmentally safe method of deactivating and recycling nuclear-powered ships.

### A National S&T Asset

Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) is focused on providing customers with quality, timely, and cost-efficient maintenance, modernization, and technical and logistics support for surface ships, submarines, and aircraft carriers. PSNS & IMF has sites in Bremerton, Bangor, and Everett, Wash.; San Diego; Boston; Japan, and wherever its workers go to fix ships. The Bremerton site is comprised of property bordered on the south by Sinclair Inlet, on the west by Naval Base Kitsap, and on the north and east perimeters by the city of Bremerton. The Bremerton site is the Pacific Northwest's largest naval shore facility and one of Washington state's largest industrial installations. The Bangor site is the largest command at Naval Base Kitsap.

### STEM Climate

PSNS & IMF's STEM outreach program depends on the time and talents of shipyard engineers and technicians (E&Ts) who work generously and with enthusiasm at STEM events and as mentors and professional role models to students of all ages and in a variety of educational settings. The E&Ts are the underlying reason for the success of the growing SeaPerch/ROV program, in cooperation with the Naval Undersea Warfare Center Keyport Division. The program now reaches throughout the local educational system and keeps growing.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

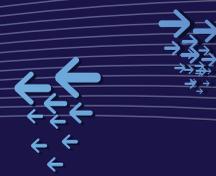
- *Kitsap County Water Festival.* E&Ts designed and constructed an acrylic-glass model dry dock to show five school districts of fourth-grade students how a dry dock works.

#### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2007
Geographic Reach	Kitsap County school districts, including Bremerton School District
FY13 S&E Mentors & Coaches	1 site coordinator 171 S&Es
FY13 Schools Reached	2 elementary schools 5 middle-schools 2 high-schools
FY13 Personal Interactions	2,992 students 112 teachers
Other Partners & Catalysts	NUWC Keyport Division (SeaPerch/ROV program); Olympic College; BAE; Pennsylvania State University; Transient Personnel Unit-Bremerton; NCMS

An apprentice class also designed and constructed a pump and valve board complete with clear piping to show students how manipulating valves or pressure affects the overall system. This is an annual event.

- *STEM Festivals.* E&Ts volunteer after-hours to support local STEM festivals with hands-on exhibits for students and their families. Exhibits help show how science and math can be fun and used in the real world. In 2013, the coordinators planned and successfully hosted the first annual West Sound STEM Showcase, a free event filled with more than 50 hands-on STEM exhibitor-booth activities for students and their families. Coordinators are planning to continue the West Sound STEM Showcase as an annual event.



- *Second Annual Kitsap County ROV Competition.* In cooperation with NUWC Keyport Division, PSNS & IMF hosted a SeaPerch competition in June 2013 as part of the joint SeaPerch/ROV Program. Fifty-five teams of middle- and high-school students competed. The partnership plans to host the competition on an annual basis.

### Outside Classroom Enrichment Activities

- *GEMS - Girls Engaged in Math and Science.* Hosted by Olympic College, more than 500 middle-school girls came to campus for a day of STEM activities. Four female engineers hosted a class on electrical circuits culminating with the construction of Bristlebot toothbrush robots.
- *EYH - Expanding Your Horizons.* Hosted by Seattle University, more than 200 middle-school girls came to the campus for a day of STEM activities. Three female engineers hosted a class on electrical circuits with the construction of Bristlebot toothbrush robots.

### Mentorship and Internship Activities

- *Elementary Science Mentorship.* Eight E&Ts mentor students at Naval Avenue Early Learning Center and West Hills STEM Academy in elementary science classrooms once a week throughout the school year.
- *SeaPerch/ROV Program.* NUWC Keyport Division and PSNS & IMF teamed up during the past four years to administer and grow this program. Partnering school districts include two elementary, 12 junior high, and eight high-schools from five school districts. The program has grown from a pilot program in FY06, with four classes and 100 students, to encompass five school districts and more than 1,200 students in FY13.
- *FIRST Robotics.* Nine E&Ts mentored Bremerton School District students in the FIRST Robotics program. Employees provided more than 500 hours of technical assistance to FIRST Lego League and FIRST Robotics Competition teams throughout the year.

### Teacher and S&E Training

- *STEM Professionals and Teachers.* More than 40 E&Ts and teachers spent more than six hours working together to network and learn how to best implement the SeaPerch/ROV program into their classroom curricula. Hosted by coordinators from PSNS & IMF and the NUWC Keyport Division, the training allowed new E&Ts and teachers to learn from those who have already implemented the program and provided an opportunity for experienced STEM professionals and teachers to gain new ideas.

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# WASHINGTON, D.C.

## NAVAL SEA SYSTEMS COMMAND HEADQUARTERS

NAVSEA’s genesis was in 1794 when Commodore John Barry, overseeing the construction of a 44-gun frigate, was charged with ensuring that all business “harmonized and conformed” to the public’s interest.

### A National S&T Asset

Headquarters for the Naval Sea Systems Command (NAVSEA) is located at the Washington Navy Yard in Washington, D.C. NAVSEA is the largest of the Navy’s five systems commands and accounts for one-quarter of the Navy’s budget. NAVSEA comprises command staff, headquarters directorates, affiliated program executive offices (PEOs), and numerous field activities, including two warfare centers — the Naval Surface Warfare Center and the Naval Undersea Warfare Center. With 33 activities in 16 states, NAVSEA engineers build, buy, and maintain ships, submarines, and combat systems that meet the fleet’s current and future operational requirements.

NAVSEA strives to be an efficient provider of defense resources for the nation and plays an important role in the Navy enterprise. As a provider command, NAVSEA is responsible for attaining the optimum mix of manpower and resources to properly equip the fleet. NAVSEA also establishes and enforces technical authority to ensure that combat systems are engineered effectively and operate safely and reliably.

### STEM Climate

NAVSEA’s Student Engagement and Outreach Integrated Business Operational Team (IBOT) coordinates STEM activities throughout the organization. Through this mechanism, NAVSEA supports naval science and engineering in K-12 schools; encourages a diverse group of high-school and college students to pursue science and engineering disciplines by leveraging internships, scholarships, and student employment opportunities; and provides project-based educational activities.

In addition to the STEM coordination function, NAVSEA is actively engaged in mobilizing its own technical work force in educational-outreach activities in school districts in the District of Columbia, central and northern Virginia, and suburban Maryland. The region is densely populated with a

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2012
Geographic Reach	Washington, D.C.; Prince George’s County, Md.; Orange County and Loudoun counties, Va.
FY13 S&E Mentors & Coaches	1 site coordinator 128 mentors and volunteers
FY13 Schools Reached	2 elementary schools 18 middle-schools 5 high-schools 3 charter schools
FY13 Personal Interactions	950 students 71 teachers
Other Partners & Catalysts	U.S. Navy Museum, Washington, D.C.

representative mix of high-performing and under-performing schools. NAVSEA’s focus is on STEM outreach to economically disadvantaged students in the region.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *PEEP (Primary Engineering Education Program)*. Personnel assist in a reading and science/engineering activity for K-2 students in which they read a story about a science or engineering principle and then participate in a related fun, hands-on experiment.

- *WeDo Robotics.* Volunteers help teachers introduce robotics to K-3 students in which they build, program, test, and operate a simple robot.

### Internship and Mentorship Activities

- *FIRST Robotics.* S&Es coach students participating in FIRST Lego League (FLL), FIRST Robotics Competition (FRC), and FIRST Tech Challenge (FTC) in elementary, middle, and high-schools. Volunteers coach FLL teams at The SEED School of Washington, D.C., a public charter school; Potomac Landing Elementary School in Maryland; and Rolling Ridge Elementary School, Stone Hill Middle-school, and Eagle Ridge Middle-school in Virginia. Volunteers coach FRC teams at Oxon Hill High-school in Maryland and KIPP DC and the Columbia Heights Education Campus (Lincoln Multicultural Middle-school, Bell Multicultural High-school, and Multicultural Career Intern Program) in D.C. Volunteers coach FTC teams at Locust Grove Middle-school, Prospect Heights Middle-school, and Orange County High-school in Virginia. NAVSEA volunteers have worked with Virginia FIRST to organize and host FTC regional competitions along with volunteer judges.
- *STARBASE Atlantis.* S&Es bring STEM activities to students from economically distressed neighborhoods in D.C. wards 7 and 8.
- *SeaPerch.* S&Es mentor students from Virginia public schools on building and operating submersible remotely operated vehicles.
- *Math Tutoring.* Personnel volunteer as tutors at Turner Elementary School and The SEED School of Washington, both in D.C.

### Teacher and S&E Training

- *LET'S GO Boys and Girls STEM Program.* Personnel attended training sessions for teachers, mentors, and volunteers participating in LET'S GO STEM programs at Eagle Academy Public Charter School.

### For Information

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# CALIFORNIA

## SPACE AND NAVAL WARFARE SYSTEMS CENTER PACIFIC SAN DIEGO

Space and Naval Warfare Systems Center Pacific engineers in San Diego invented an electrical device that, when implanted in the sole of a shoe, converts the motion of walking into enough electricity to power portable devices.

### A National S&T Asset

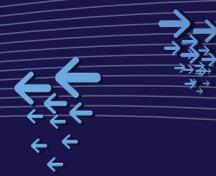
The Space and Naval Warfare Systems Center Pacific (SSC Pacific) is headquartered in San Diego, with other sites at Pearl Harbor, Hawaii; Barrigada, Guam; Yokosuka, Japan; Philadelphia; Stuttgart, Germany; and Bahrain. SSC Pacific is the Navy's research, development, test and evaluation, engineering, and fleet-support organization for C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance). Many SSC Pacific personnel are permanently stationed with the U.S. Pacific Command to support its operations with systems engineering functions.

In addition to its primary C4ISR mission, SSC Pacific San Diego's complementary core competencies include ocean surveillance and engineering; marine environmental quality technology; microelectronics research, development, and fabrication technologies; and the Navy's Marine Mammal Program.

### STEM Climate

Since SSC Pacific in San Diego became committed to STEM outreach as a corporate responsibility, the center's STEM involvement has continued to grow, with 314 volunteers contributing 9,293 unpaid hours in their communities. Moreover, this spirit of volunteerism is beginning to entrain many university students and STEM professionals from local industry. SSC Pacific's leadership has led by example — volunteering as coaches and speakers and providing oversight for myriad outreach projects such as FIRST Lego League Qualifying Tournament; Girls' Day Out; Summer Academies; Noche de Ciencia e Ingeniería en Español; Imagine More; science fairs and festivals; and our summer internship programs.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2008
Geographic Reach	Primarily San Diego and Los Angeles areas; some outreach in Philadelphia and Norfolk
FY13 S&E Mentors & Coaches	1 site coordinator 2 assistant site coordinators 2 FIRST coordinators 314 S&Es (total) 64 FIRST coaches 39 mentors (SeaPerch, GetMAGIC, Summer Internships, etc.)
FY13 Schools Reached	22+ elementary schools* 31+ middle-schools* 42+ high-schools*  *most schools visited multiple times; 65+ recurring visits
FY13 Personal Interactions	384+ teachers 3,726+ students in classrooms 7,751+ students outside classroom 807+ paid hours; 9,293+ volunteer hours. Total hours: 10,100+
Other Partners & Catalysts	University of California, San Diego; San Diego State University; Southwestern Community College; FIRST; SeaPerch; Girl Scouts; San Diego County Board of Education; San Diego Science Alliance; Society of Women Engineers, UCSD CREATE



SSC Pacific in San Diego is building a robust K-12+ pathway that reflects the demographics of its K-12 community (which is nearly 50 percent Hispanic) and leads to future STEM employment, preferably at SSC Pacific.

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *High Tech Fair.* The tech fair is an annual opportunity to enlighten thousands of seventh– through 12th -graders about the world of science and engineering and attendant career possibilities. In FY13 our center provided 10 S&Es who shared hands-on demonstrations with some 2,700 students (and their parents). Local television covered SSC Pacific robotics demonstrations.
- *Science and Engineering Festivals.* Eighteen volunteers interfaced with 1,200+ students at the 2013 San Diego Science & Engineering Festival. Additionally, our S&Es reached an additional 300 students in festival-related classroom events.
- *Noche de Ciencia y Ingenieria en Español.* To our knowledge, this is the first and only science and engineering event in San Diego presented totally in Spanish for the benefit of Spanish-speaking families. In FY13, we hosted four events with the help of more than 60 bilingual volunteers, including students and professionals from the Society of Hispanic Professional Engineers (SHPE), Latinos in Science and Engineering (MAES), and NAVAIR. Volunteers are bilingual presenters who assist with demonstrations, provide motivational talks, and assist with hands-on experiments for Spanish-speaking students and parents. Through panel discussions information is provided about college financial aid and the academic pathway to pursuing a STEM degree. Volunteers have often started in a similar community so they are able to share their genuine story. We expect our efforts in this area to continue to grow as there is a high demand within our community.

### Classroom Activities

- *Language Academy Middle-school.* This is a STEM partnership lasting more than four years. In FY13 STEM professionals from our center made 29 visits to the school to work with the math teacher to develop and implement a “Math Fun” course that shows the relevance of math to science and the real world.
- *Preuss School at UCSD.* Classroom visits, science night, extended mentorships, and summer internships marked

this year of collaboration with middle- and high-school students. In FY13, S&Es started a pilot program, “Get Magic,” which provided more than 400 hours of mentorship. This program included electronic and face-to-face interactions between five university women, five SSC Pacific women engineers, and six middle-school girls from Preuss. The school was so impressed that it has instituted the program, which is now called “Imagine More.”

- *Thinking Outside the Box.* This hands-on presentation was developed with help from teachers and educators from the San Diego Unified School District and has been given in some 30 classrooms in FY13. This year we have been asked to translate it into Spanish and anticipate a large number of presentations for the upcoming year.

### Outside Classroom Enrichment Activities

- *Girls’ Day Out.* The center participates in these events each year on local university campuses for middle-school girls and their parents. Events feature female S&Es as keynote speakers and provide campus and lab tours and activity stations designed to promote interest in STEM learning and careers. Female college students provide team leadership during the half-day event. Each year the student organizations are assuming more responsibility for the success of the program. In FY13, we reached 132 K-12 young women through the 63 university students and 22 STEM volunteers.
- *Expanding Your Horizons.* Since our participation in the program in 2008, each year five or more STEM professionals spend a day with more than 100 middle and high-school girls on the University of San Diego campus providing a series of one-hour lectures and demonstrations.
- *Science Nights.* Five science and engineering fairs were brought to middle-schools through the volunteer efforts of 33 STEM professionals from our center. Typically, six or more hands-on demonstration stations are included. Most of the logistic support is now provided by the school, with parents (after training) assisting at the demonstration tables.
- *Girl Scouts.* STEM has moved to a major priority for the Girl Scouts organization. SSC Pacific personnel have been instrumental in the development of activities and programs for girls. During the summer of 2013, 10 SSC Pacific STEM professionals developed and supported an Engineering Day as part of a STEM Day Camp for more than 100 K-12 girls from underrepresented communities.

## Mentorship and Internship Activities

- *St. Mary's Academy.* Partnership includes after-hour get-togethers, summer internships, and hosting parents of summer interns at the facility for a day. Four to 10 students spend two months at the lab for summer internships, which include classes in MATLAB (a high-level technical computing language used by S&Es), weekly seminars, and ship tours. In FY13, four students participated in the summer internship program. Through this relationship, the first St. Mary's graduate entered the UCSD Jacobs School of Engineering in fall 2013.
- *Science and Engineering Apprenticeship Program (SEAP).* In FY13, 26 high-school students participated in this eight-week summer internship at the center. Each of the students has a mentor and is provided opportunities to learn MATLAB, attend weekly seminars and lectures, tour facilities and ships, and provide a final poster of their work.
- *Local FIRST Robotics.* This program started in 2009 with STEM professionals from SSC PAC in San Diego coaching nine local teams. Over the last four years, it has grown to supporting 64 teams. A series of brown-bag lunches are provided to involve the work force in all aspects of the competition — coaching, judging, assisting as referees, and tournament preparation. In FY13, the center cohosted the 4th Annual Eastlake High-school FIRST Lego League qualifying tournament. This program has developed from an event that has drawn dozens of participants to one where more than 500 students and parents turn out. Joining them were the commander of SPAWAR, Rear Adm. Brady, the executive directors from SPAWAR and SSC Pacific, Pat Sullivan and Carmela Keeney, nearly 50 of our center's STEM professional volunteers, and the Navy Band.
- *National FIRST Robotics.* The success of our local FIRST Robotics efforts led NDEP to request us in 2010 to lead a national robotics program embracing STEM professionals throughout the Army, Air Force, and Navy. The national FIRST program has experienced a near exponential growth (in FY13 there was an 81 percent increase in grant requests). Currently we support 43 DoD sites/bases, with 318 teams/DoD mentors in 24 states reaching out to slightly more than 4,100 students.

## Teacher and S&E Training

- *SeaPerch.* Numerous training sessions are held for teachers and STEM professionals on how to build SeaPerch robots and integrate them into curriculum in the San Diego and Los Angeles areas. In FY13, 50 teachers, 50 students, and Navy professionals in Los Angeles were trained. In San Diego, 20 teachers and 10 STEM professionals were trained.

The first national competition qualifying tournament was coordinated and executed by SSC Pacific. Nineteen teams and more than 75 students, teachers, and parents attended the event. Volunteer support came through 10 STEM professionals as well as 30 local Navy personnel.

- *Local FIRST Robotics.* Training workshops were held to inspire more SSC Pacific STEM professionals to participate in one of the FIRST programs as a coach or mentor. Other workshops were held during the FIRST seasons to bring coaches and mentors together to ensure our personnel provided the best program for the students on the FIRST teams.
- *Bite of Science.* National program which brought 15 teachers and two STEM professionals together for an evening of interactions during an informal dinner. Presentation materials, as well as supplementary resources related to session topics, were provided to teachers to use in their classrooms.

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SPAWAR



THE HAWK COLLECTIVE

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CHESAPEAKE VIRGINIA

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# HAWAII

## SPACE AND NAVAL WARFARE SYSTEMS CENTER PACIFIC, HAWAII

Hawaii's public school system, established in 1840 by King Kamehameha II, is the oldest U.S. public school system west of the Mississippi River.

### A National S&T Asset

The Space and Naval Warfare (SPAWAR) Systems Center (SSC Pacific), based in San Diego with detachments in Hawaii and other locations, is responsible for development of command, control, communications, computers, intelligence, surveillance and reconnaissance, and information technology essential for carrying out naval operational missions.

### STEM Climate

SSC Pacific in Hawaii became an NDEP-supported STEM site in June 2008, positioning the laboratory to assist Hawaii's state initiative to strengthen its mostly service-based economy by bringing more technical job opportunities to the islands of Oahu, Maui, Kauai, and Hawaii by supporting local public, private, and charter schools with STEM activities in the expectation that nurturing aspiring scientists and engineers now will create a pool of future STEM professionals in the state.

Since its program began, SSC Pacific Hawaii's education-outreach program has supported more than 10 high-schools, 8 middle-schools, and 12 elementary schools in addition to the Hawaii National Guard Youth Challenge Academy and the Marine Corps Forces Pacific Youth Center.

The outreach program's participation include mentoring and demonstrations in robotics (FRC, FTC, FLL, Mindstorm, VEX, micro-robotics, and SeaPerch), alternative energy and Material World STEM learning modules, Tabula Digita's DimensionU, and other stand-alone and in-class activities and events, such as science shows, Astronaut Lacy Veach Day of Discovery, science fairs, and career-day sessions.

SSC Pacific Hawaii's program focuses primarily on schools located in Leeward Oahu District, the largest school district in Hawaii and the district in which our office is geographically situated. Our population is the most culturally and ethnically diverse in the nation with the Leeward area home to every socioeconomic group. The year since SSC Pacific Hawaii began

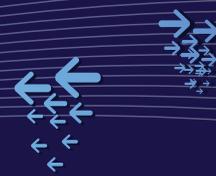
NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2008
Geographic Reach	Hawaii islands of Oahu, Maui, Kauai, Hawaii
FY13 S&E Mentors & Coaches	75 S&Es, 27 other DoD S&Es* 25 coaches** 50 mentors***
FY13 Schools Reached	9 elementary schools 4 middle-schools 7 high-schools 6 school districts
FY13 Personal Interactions	195 teachers 670 students in classrooms 2,500 students outside classroom PD: 2,200 hours; Volunteer hours: 5,000, Total: 7,200 hours
Other Partners & Catalysts	University of Hawaii, Carnegie Mellon University, State of Hawaii Department of Education, Hawaii Academy of Science, Hawaii National Guard, Maui Economic Development Board, BEST, AUVSI, IEEE, SWE, HKN, USPACOM, Pearl Harbor Naval Shipyard, Marine Corps Forces Pacific, NAVSEA, ONR, U.S. Coast Guard

\*Total number of laboratory scientist & engineer volunteers

\*\* VEX and FIRST Robotics team coach(es)

\*\*\*Other robotics and programs, etc.

its STEM outreach efforts has seen increased participation in the Leeward District's Waipahu and Pearl City complex area schools by more than 800 percent and impacted more than 15,000 students.



## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Astronaut Lacy Veach Day of Discovery.* One of the biggest science events in the state, SSC Pacific Hawaii hosted an exhibit allowing its S&Es to interact with more than 500 students in elementary and middle-school.
- *Kamehameha Middle-school Career Fair.* Founded by a trust held by Princess Bernice Pauahi Bishop, it is the oldest school system in the nation in which the mission is to educate Native Hawaiian children. SSC Pacific Hawaii hosted an interactive booth and speaker sessions at their middle-school career fair allowing about 960 students to learn first-hand exactly what engineers do on the job.
- *WoW! That's Engineering! Day.* Sponsored by the Society of Women Engineers, SSC Pacific Hawaii assisted by hosting an exhibit booth to get the 200 girl attendees interested in and excited about STEM topics.
- *Science Fairs and Technology Days.* SSC Pacific Hawaii hosted exhibits and demonstrations at various science fairs across the island of Oahu, including the Hawaii State Science and Engineering Fair as well as smaller district science fairs. Also, SSC Pacific Hawaii hosted technology demonstrations at various schools to assist the teacher in explaining the real-life relevancy of a selected STEM topic to the students.

### Classroom Activities

- *Materials World Modules.* Assisted in conducting Materials World Modules experiments for science classes in Waipahu High-school Pre-Engineering Academy.
- *Career Fair Sessions.* SSC Pacific Hawaii hosted hands-on information sessions at the career fairs of six different middle and high-schools.

### Outside Classroom Enrichment Activities

- *Kaneohe Marine Corps Base Youth Center.* Helped maintain the DimensionU math skills building video game for use by community youth.
- *SSC Pacific Code H Open House.* SSC Pacific Hawaii hosted several open-house events throughout the year catering to children of all ages from pre-K through college. These open-house events featured a variety of different, exciting projects our S&Es have worked on and hands-on, inquiry-based activities to demonstrate the real-life relevance of STEM topics.

## Collaboration with U.S. Coast Guard

For the past four years, SSC Pacific in collaboration with the U.S. Coast Guard provided workshop to teachers, mentors, and students about underwater robotics through SeaPerch to drum up excitement and interest in this field. This led to standing up 11 teams of students from five elementary and three middle-schools. Consequently, these efforts were showcased in the SeaPerch Hawaii Challenge, the first regional SeaPerch competition to be held in Hawaii, in May 2013. This event, championed by Capt. Bryan Dailey of the U.S. Coast Guard, drew 120 students from 12 schools in grades five through eight.

With two mass build seminars and numerous visits by SSC Pacific personnel to schools to provide problem-solving, a total of 17 SeaPerch robots were successfully deployed. These robots competed for different awards such as Best Overall, Obstacle Course, Deep Dive, and Best Presentation. "I wouldn't have been involved in science and math if it weren't for this," said Grace Nastase, 11, whose Mokapu Elementary School fifth-grade team took second place. Clearly, SeaPerch robotics has and will continue to have dramatic impacts on Hawaii's youth. SSC Pacific personnel were on hand at the competition to serve as judges and celebrate the achievements of the students and program.

## Mentorship and Internship Activities

- *Robotics Mentoring.* Provided mentors for the VEX, FRC, FTC, FLL, and SeaPerch teams from more than 10 different schools. Most notably, SSC Pacific Hawaii cohosted Hawaii's first regional SeaPerch tournament.
- *NREIP Internship.* SSC Pacific Hawaii hosted two electrical-engineering student internships from the University of Hawaii at Manoa during the summer.

## Summer Activities

- *Lehua Elementary School Summer Robotics Academy.* Sponsored and provided mentors for this summer academy, which included 30 students from seven different schools. Also facilitated relationships between Pearl City High-school and Pearl City Highlands Intermediate School students to create a more seamless robotics pathway for students as they transition to different schools.

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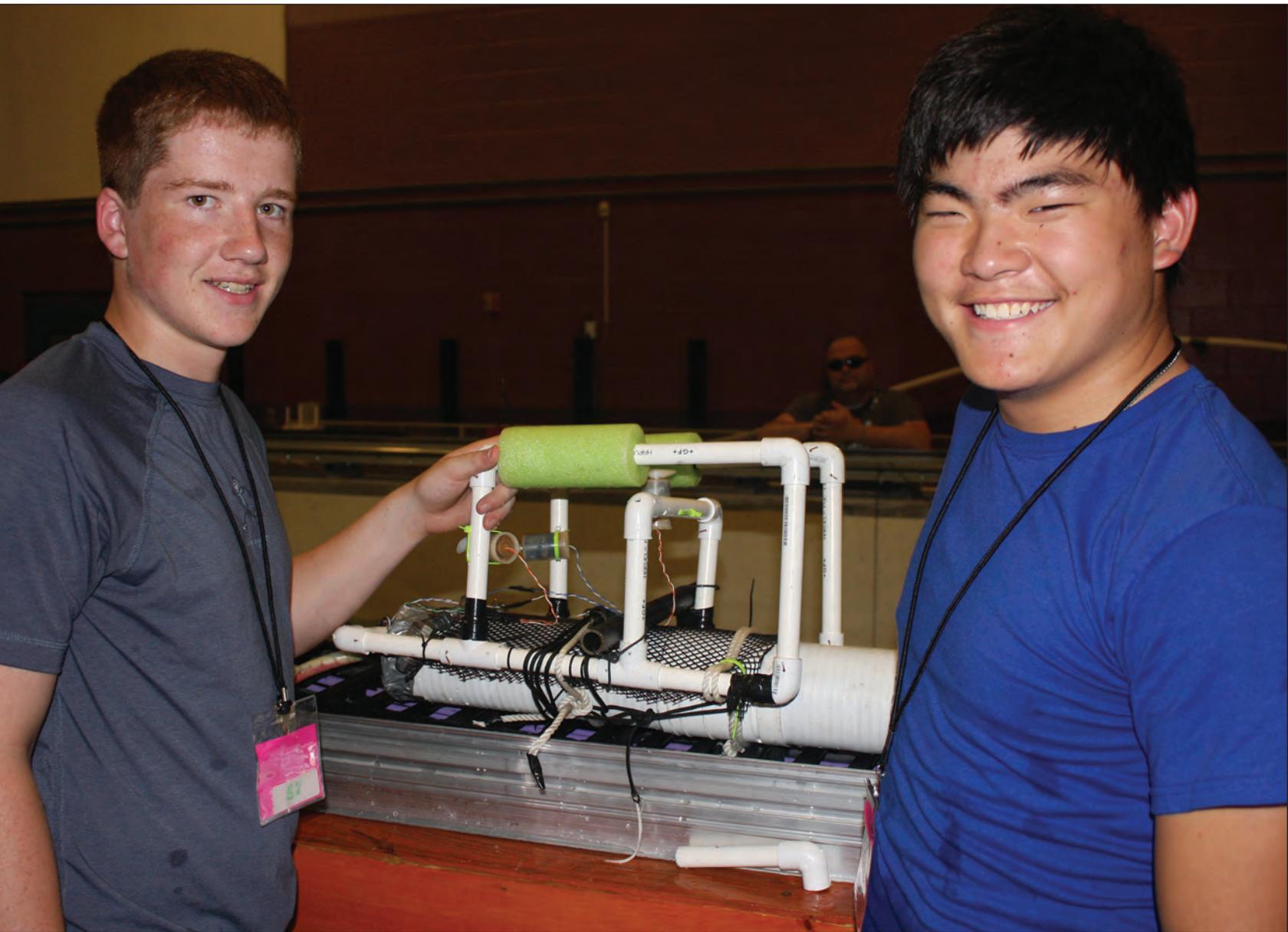
## Micro-Robotics

Initially inspired to participate in SSC Pacific's outreach team's efforts, Uriel Wong, a computer scientist, has fast become one of the most dedicated and active members of SSC Pacific's STEM outreach team. In the first year of his involvement in the program he has led multiple micro-robotics workshops, mentored multiple students for the Science Olympiad competition and Science Fair projects, and mentored many robotics teams in SeaPerch, FLL, FTC, Robofest, and MATE. Additionally, Wong is always the first one to volunteer for hosting exhibits at large events and has spent countless hours of his own time developing a robot that can solve a Rubik's Cube and another that can move and balance itself.

When asked why he continues to participate in the program, Wong stated that STEM outreach seems "to have allowed me to remember why I wanted to become an engineer. It also became very rewarding to see how much of an impact we can have on the younger generation. Prior to getting involved, I surely didn't realize how much we have to offer to students and the community." Wong's standout efforts have spanned multiple schools and grade levels.

In 2013, Wong initiated multiple FLL and FTC rookie teams with two schools in the Leeward and Honolulu school districts on Oahu.

Wong is an example of how graduates of these schools are willingly giving back to their communities.



# LOUISIANA

## SPACE AND NAVAL WARFARE SYSTEMS CENTER ATLANTIC, NEW ORLEANS

A 20,806 square-foot data center on Lake Pontchartrain houses an open architecture information technology hub that provides a virtual computer hosting environment for 37 different data systems.

### A National S&T Asset

The Space and Naval Warfare Systems Center Atlantic (SSC Atlantic) in New Orleans is a detachment of SSC Atlantic, headquartered in Charleston, S.C. The detachment is responsible for the development of technology used to collect, transmit, process, display, and manage information essential to successful military operations. These capabilities allow Naval and Joint decision-makers to carry out their operational missions and protect their forces. SSC Atlantic provides C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance), domain knowledge, information dominance, and engineering support for the Navy, Marine Corps, and Joint Commands throughout the Atlantic Fleet's area of responsibility.

### STEM Climate

SSC Atlantic in New Orleans kicked off its STEM outreach program late in 2011 through collaboration with the Naval Research Laboratory at Stennis Space Center in nearby Mississippi, Naval Air Station Joint Reserve Base Belle Chase, National WWII Museum, Red Stick Robotics, and the University of New Orleans. SSC Atlantic in New Orleans STEM program has been involved with local community schools participating in programs such as MATHCOUNTS, SeaPerch, FIRST Robotics, VEX Robotics, Project Lead the Way, and a number of science fairs. The program targets at-risk youths in the New Orleans area as focus areas for their efforts. Educational Partnership Agreements are being developed with St. Tammany School Parish, Orleans School Parish, and the Algiers Charter and School Association.

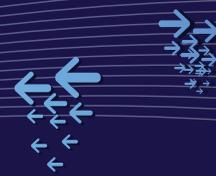
### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Career Fairs/Lab Tours.* S&Es participated in several career fairs and school tours of labs.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2011
Geographic Reach	New Orleans
FY13 S&E Mentors & Coaches	24 S&Es 6 coaches 1 mentor
FY13 Schools Reached	2 elementary schools 3 middle-schools 7 high-schools 2 school districts
FY13 Personal Interactions	148 teachers 60 students in classrooms 7,872 students outside classroom 673 hours (both paid and volunteer)
Other Partners & Catalysts	Red Stick Robotics NRL – Stennis Space Center National WWII Museum University of New Orleans Tulane University

- *MATHCOUNTS Competition.* S&Es volunteered as mentors, judges, and scorekeepers.
- *FIRST Lego League (FLL).* S&Es volunteered as mentors, judges, and scorekeepers.
- *FIRST Robotics Competition.* S&Es volunteered as mentors, judges, and scorekeepers.
- *VEX Robotics Competition.* S&Es served as judges and event volunteers.



- *BEST Robotics Competition.* S&Es served as mentors, judges, and event volunteers.
- *SeaPerch.* S&Es served as judges and event volunteers.

### Classroom Activities

- *STEM Presentation.* S&Es provided classroom instruction and briefing to junior high-school science class promoting STEM activities.

### Outside Classroom Enrichment Activities

- *Advisory Activities.* S&Es serve on the Louisiana State Curriculum Committee on Robotics and University of New Orleans Electrical Engineering Advisory Council.
- *Gulf Coast Regional SeaPerch Competition.* S&Es participated in the first SeaPerch underwater robotics program in Biloxi, Miss.
- *Greater New Orleans Science and Engineering Fair and the District VIII Science Fair.* S&Es served as judges.
- *National WWII Museum Robotics Challenge.* S&Es served as judges and assisted in organization of the event.
- *National IT Shadow Day.* Each SSC Atlantic location participated in bringing high-school students on site to tour labs and learn about STEM career opportunities.

### Mentorship and Internship Activities

- *FIRST Robotics.* S&Es coached several local high-school robotics teams.
- *FIRST Lego League.* S&Es coached several middle-school robotics teams.
- *VEX Robotics Competition.* S&Es coached a local high-school robotics team

### Teacher and S&E Training

- *Climate and Ethics Control.* The College of William and Mary provides annual training for teachers and S&Es before each school year begins.
- *Lego Mindstorms NXT/FIRST Robotics Training.* The College of William and Mary provides S&Es and teachers with tips for a successful robotics season by exploring classroom lessons and programming exercises.

- *Tabula Digita/DimensionU.* S&Es and teachers participate in training for the math-based gaming software.

### For Information

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# SOUTH CAROLINA SPACE AND NAVAL WARFARE SYSTEMS CENTER ATLANTIC, CHARLESTON

A new 20,220 square-foot, state-of-the-art data center at SSC Atlantic Charleston consolidates more than 100 Navy data centers to better meet the Navy’s cybersecurity, IT, and operational requirements.

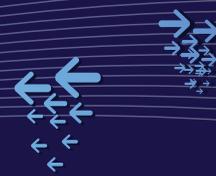
## A National S&T Asset

The Space and Naval Warfare Systems Center Atlantic (SSC Atlantic) is headquartered in Charleston, S.C., and has permanent detachments in New Orleans and Norfolk, Va. SSC Atlantic provides full-service engineering and acquisition to rapidly deploy sustainable, survivable, and interoperable C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance); IO (information operations); EIS (enterprise information services); and space capabilities that enable knowledge superiority for the Navy, Marine Corps, and Joint Commands throughout the Atlantic Fleet’s area of responsibility. These activities help meet the nation’s demands for uninterrupted vigilance, fail-safe cybersecurity, adaptive response, and engineering excellence by delivering secure, integrated, and innovative solutions to Naval and Joint organizations and national agencies.

## STEM Climate

SSC Atlantic in Charleston began NDEP-supported STEM outreach in 2009 to promote STEM education and career opportunities for future scientists and engineers. The command engages academia and local businesses to carry out STEM initiatives. In FY13, SSC Atlantic - Charleston continued to support community STEM initiatives and nurture more collaboration with local school districts, colleges/universities, and assist the South Carolina Department of Education with Cyber Security Career and Technology Education pilot programs. SSC Atlantic leadership, Capt. Mark Glover, was very active through several speaking engagements in serving as a role model by inspiring and encouraging students, in Charleston and the surrounding area, to pursue STEM careers and majors. The command continues to foster its diversity goals by making special efforts to reach populations that are underrepresented in STEM careers.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2009
Geographic Reach	Charleston and surrounding area (Berkeley, Charleston, Colleton, & Dorchester counties)
FY13 S&E Mentors & Coaches	449 S&Es, coaches, mentors
FY13 Schools Reached	94 elementary schools 44 middle-schools 31 high-schools 4 school districts
FY13 Personal Interactions	345 teachers 265 students in classrooms 7,001 students outside classroom 9,662 hours (both paid and volunteer)
Other Partners & Catalysts	Berkeley County Charleston County Colleton County Dorchester District 2 National Society of Black Engineers Lowcountry STEM Collaborative The Citadel – STEM Center of Excellence College of Charleston Society of Women Engineers SC HBCU Consortium Department of Energy



## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Tri-County DimensionU Competition.* Twelve teams from Charleston-area middle-schools competed with math gaming software. Twenty S&Es volunteered to judge, gaming network setup, scoring, and troubleshooting for competition.
- *Cyber Forensics.* S&Es conduct demonstrations at several high-schools.
- *South Carolina Career and Technology Education (CATE).* S&Es serve as members of the advisory board and support the pilot program of cybersecurity courses taught at the Lowcountry Tech Academy.
- *MATHCOUNTS Competition Judging.* S&Es volunteer as mentors, judges, and scorekeepers.
- *ISR Technology Demonstrations.* S&Es use unmanned ground vehicles and AR.Drone to demonstrate ISR concepts to classroom students.
- *Trebuchet Competition.* S&Es competed as a team in a medieval catapult competition against Google and other organizations in addition to supporting local elementary-through high-school teams testing the building and accuracy of design.

### Classroom Activities

- *You Can Do It Rubik's Cube.* S&Es engaged middle-school students to learn problem-solving, understanding algorithms, and following directions by learning to solve the Rubik's Cube.
- *Bell Jar Activity.* S&Es participated in the Bell Jar Activity with sixth- and seventh-grade students and share air pressure with students using balloons and marshmallows.
- *Social Networking Activity.* Sixth- through eighth-grade remedial math students were taught graph theory and social-networking analysis in a fun and exciting way.

### Outside Classroom Enrichment Activities

- *National IT Shadow Day.* Each SSC Atlantic site participated in bringing high-school students on-site to tour labs and be inspired to become STEM professionals.
- *National Society of Black Engineers (NSBE).* SSC Atlantic Charleston became "champion" for NSBE and assisted with the reinstatement of a chapter in the Charleston area.

SSC Atlantic employees make up 90 percent of chapter members. Programs are aligned with the center's STEM outreach program. For example, the chapter sponsored "A Walk For Education" in the low-income area of Charleston, providing role models and college information to students.

- *NSBE Junior Chapters.* NSBE members initiated two junior chapters for aspiring engineers at local high-schools in Charleston.
- *Career Fairs.* S&Es conducted several career fairs in local elementary, middle, and high-schools within a gymnasium open-forum environment.
- *STEM Girls Day Out.* S&Es planned and provided mentors for the event hosted at a local college to empower and inspire rising eighth- and ninth-grade girls to pursue STEM degrees and careers.
- *SMART Nights/Math-Science Nights/Technology Nights.* Approximately five S&Es volunteer at local elementary and middle-schools to provide information about STEM to students and parents.
- *Palmetto Cyber Security Summer Camp.* The Cyber Security Summer Camp incorporated two tracks: a train-the-trainers program for teachers and a cyber warrior program for students. The goal of the student program is not only to create excitement in STEM emphasizing cyber security but to equip students with knowledge, skills, and abilities to make them exceptional future cyber warriors in cyber technology.

### Mentorship and Internship Activities

- *Science & Engineering Apprenticeship Program (SEAP).* Eight high-school students participated in an eight-week summer internship working in the lab with S&Es, working on STEM projects, attending S&T colloquium presentations, touring labs and project areas, attending cyber security workshops, and presenting their own project to lab S&Es.
- *Palmetto Cyber Defense Competition.* S&Es mentored local high-school cyber clubs and volunteered as red-team participants at the Citadel Military College for the high-school competition.
- *FIRST Robotics.* More than 100 volunteers provided over 4,000 hours mentoring teams, training coaches, and running FIRST events.
- *SeaPerch.* S&Es volunteered for the local competition.



## Teacher and S&E Training

- *DimensionM Training.* Sixteen teachers and one S&E were trained on the math gaming software and teacher modules. One local county has made it a requirement in their district.
- *Material World Module Training.* Teachers and S&Es were trained to implement the nanoscale modules in their classrooms. One local county has made the modules a requirement for all middle-school science classes.
- *FIRST Robotics Training.* S&Es and teachers were trained to mentor and coach 46 robotics teams.
- *Palmetto Cyber Security Summer Camp Teacher Training.* Five area teachers were trained in various areas of cyber security in preparation of using skills learned in their classrooms.

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## A Walk for Education

The NSBE Junior Chapter at Stall High-school (SPAWAR SC Atlantic-sponsored), along with the NSBE Alumni Chapter, conducted “A Walk For Education” at the football game on Friday night, Oct. 11.

At halftime more than 100 high-school students and alumnus walked the football field emphasizing the importance of pursuing higher education. These are students who have demonstrated an interest in STEM careers, and more than 50 of them signed a pledge card that states they plan to pursue higher education. SSC Atlantic employees as well as employees from local businesses (NSBE Alumni Chapter) were on-site speaking to students and serving as role models to encourage students to pursue STEM careers. Stall is a Title 1 school with 73 percent economically disadvantaged students and 87 percent minority students. This initiative is a part of SSC Atlantic’s diversity and STEM strategy to reach underserved students and encourage them to pursue STEM careers. NSBE is also the affinity group that SSC Atlantic champions for helping us achieve our diversity goals.





# Information Dominance

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**REFUEL 1A**

**B** A day without laughter is a day wasted.

Friday

Math 6

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Mrs Lamb

## VIRGINIA

# NAVAL SURFACE WARFARE CENTER CENTER ATLANTIC, NORFOLK

Complex, high-performance watercraft for today's missions must be easily transportable and capable of operating in high seas and surf as well as shallow rivers and other demanding marine environments in all climates and conditions.

### A National S&T Asset

The Space and Naval Warfare Systems Center Atlantic (SSC Atlantic) Tidewater is a detachment of SSC Atlantic, headquartered in Charleston, S.C. The detachment is responsible for the development of technology used to collect, transmit, process, display, and — most critically — manage information essential to successful military operations. These capabilities allow Naval and Joint decisionmakers to carry out their operational missions and protect their forces. SSC Atlantic in Tidewater provides C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance), domain knowledge, information dominance, and engineering support for the Navy, Marine Corps, and Joint Commands throughout the Atlantic Fleet's area of responsibility.

### STEM Climate

SSC Atlantic in Tidewater began its NDEP-supported STEM initiatives in early 2011 under the umbrella of SSC Atlantic's STEM outreach program. The STEM program in Tidewater is an effort between the laboratory and other Hampton Roads organizations interested in encouraging young people to consider careers as future scientists and engineers. SSC Atlantic was instrumental in helping to establish the Hampton Roads STEM Collaborative, which brings together industry, military, and academia to work together to leverage participation and interest in STEM efforts in Norfolk and surrounding communities.

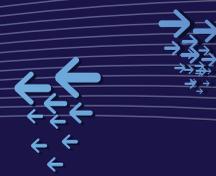
### NAVY LOCAL IMPACT AT A GLANCE

STEM Program Launched	2011
Geographic Reach	Hampton Roads, Va.
FY13 S&E Mentors & Coaches	40 S&Es 14 coaches/mentors
FY13 Schools Reached	1 elementary school 4 middle-schools 7 high-schools 7 school districts
FY13 Personal Interactions	10 teachers 1,100 students in classrooms 25 students outside classroom 100 hours (both paid and volunteer)
Other Partners & Catalysts	Portsmouth Public Schools Norfolk Public Schools Virginia Beach City Public Schools College of William and Mary

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *AFCEA Joint Warfighters Conference, Virginia Beach Convention Center.* S&Es staffed two booths and interacted with thousands of business people and government officials.



- *Warriors to Work Career Fair.* STEM and HR representatives in Virginia Beach spoke with dozens of wounded warriors to educate them about the government job-search process.
- *Woodrow Wilson High-school Annual STEM Expo.* S&Es staffed a booth and interacted with hundreds of students, educators, business people, and government officials.
- *Blair Middle-school/Camp Allen Elementary Career Fair.* S&Es staffed a booth and interacted with hundreds of students, educators, business people, and government officials.
- *Hampton Roads STEM Summit.* This was an effort to bring together STEM professionals, businesses, and government entities in Hampton Roads to forge collaborations that will support STEM outreach in local school districts.

### Classroom Activities

- *STEM Career Fair.* S&Es delivered STEM career presentations using Microsoft PowerPoint and Scratch (<http://scratch.mit.edu/>).
- *STEM Lunch Buddy Program.* STEM volunteers read to students during lunch time and/or assisted with delivering engineering lessons.
- *Remotely Operated Vehicles.* S&Es demonstrated ISR technologies in classrooms with the Spykee robot and AR.Drone.

### Outside Classroom Enrichment Activities

- *National IT Shadow Day.* Each SSC Atlantic location participated in bringing high-school students on-site to tour labs, interact with STEM professionals, and learn about STEM careers.
- *Norfolk Public Schools Science Fair.* SSC Atlantic STEM outreach volunteers judged various sixth- through eighth-grade science projects at Nauticus/Naval Museum

### Mentorship and Internship Activities

- *3rd Annual Hampton Roads Summer STEM Academy.* SSC Atlantic Tidewater has hosted the summer academy for the past three years in collaboration with SSC Atlantic; NSWC Combat Direction Systems Activity, Dam Neck; NSWC Carderock Division; Norfolk Naval Shipyard; and the STEM Education Alliance of the College of William and Mary. Activities included boat and bridge building, robotics, and public speaking.
- *FIRST Robotics.* S&Es coached local FIRST Robotics teams.

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# MARYLAND UNITED STATES NAVAL ACADEMY

The U.S. Naval Academy STEM program is unique in its national and global impact, reaching youth from all 50 states and Department of Defense Education Activity schools abroad.

## A National S&T Asset

The United States Naval Academy (USNA) is the undergraduate college of the Naval service, preparing 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, midshipmen graduate with bachelor of science degrees and reserve commissions as ensigns in the Navy or as second lieutenants in the Marine Corps. Graduates serve at least five years on active duty as Navy or Marine Corps officers, and many obtain future leadership positions. The USNA faculty includes civilian and military scientists and engineers.

## STEM Climate

The USNA STEM program provides opportunities to underrepresented populations and engages K-16 students and teachers across the country and abroad. A wide variety of STEM activities are used to promote sustainability through instructor ownership. The strength of the program originates with its faculty, the Navy's educators who derive the outreach curriculum from their current classroom and critical research areas, and its midshipmen, trained as near-peer facilitators in the outreach process. By aligning with the Naval Academy mission and the urgent national need, the USNA STEM program has been able to leverage activities with federal and corporate sponsors and demonstrate to a broad audience, including USNA midshipmen and graduates, the importance of technology to our national defense. Involvement in STEM outreach prepares midshipmen participants for various intellectual and innovation challenges and allows them opportunities to demonstrate leadership in classroom and informal education activities. In FY13, emphasis was placed on sustainability of programs, empowering the educators through teacher training, leveraging resources, and building networks.

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

- *Tiger Woods Foundation Conference.* Workshops with hands-on activities to stimulate interest in STEM majors

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2009
Geographic Reach	National and International programs. Local programs with Maryland, Virginia, D.C., and Baltimore
FY13 S&E Mentors & Coaches	1 site coordinator, 4 co-coordinators, 45 S&Es, 25 tech support personnel, 300 midshipmen, 10 mentors
FY13 Schools Reached	800 schools reached across 50 states via outreach to K-12 students and teachers, partnered with International DoDEA schools
FY13 Personal Interactions	770 teachers 350 students in classrooms 13,700 students outside classroom 29,000 hours (22,000 provided by midshipmen)
Other Partners & Catalysts	Office of Naval Research, AUVSI, Boy Scouts, Girls Scouts, Maryland Space Grant Consortium, University of MD, USMA, NLUS, NOAA, Patriots Technology Training Center, Boys and Girls Clubs, Tulsa Alliance for Engineering, NJROTC, DODEA, NAVSEA, OSD Corrosion, USNA Foundation

and careers. Participants rotated through sessions on fluids, design, and naval systems and engaged in related competitions.

- *Mesa STEM Days.* Mini-festival atmosphere created for about 400 Maryland elementary and middle-school students, each of three days, as they rotated through activities including demos and workshops on fluids, materials characterization, sound waves, flight, chemistry, gears, energy, robotics, and programming.

- *San Diego Science and Engineering Festival.* USNA hosted a multitable booth with hands-on activities (design, materials, math puzzles, fluids, ROV trials, forensics). Midshipmen and faculty interacted directly with 1,500 students.
- *Howard County Science and Engineering Festival.* USNA hosted a multitable booth with hands-on activities (robotics, fluids and physics, design activities, forensics). Midshipmen and faculty interacted directly with 500 students.
- *Science Fair Judging.* USNA faculty evaluated science-fair projects at county, state, national, and international levels, judging more than 500 students in elementary, middle and high-school.

## Classroom Activities

- *STEM Mini-Camps.* High-schools from different regions across the country (Atlanta, Philadelphia, Houston, and others) were invited to send small groups of students to visit USNA overnight or for a long weekend. The students toured the technical labs and spent time engaged in interactive science and engineering activities (performing experiments in the wind tunnel, learning to use the electron microscope to look at nanoparticles, programming robots, solving cryptographic puzzles). About 280 students from six sites participated in 2013.
  - *STEM Advanced Program for Middle-Schoolers.* Two-week sessions offered in fall, spring, and summer with multiple in-depth topic areas taught by USNA faculty, held in the evening for local middle-schoolers. The program consists of advanced studies in mathematics, computer applications, oceanography, astronomy, and engineering design.
  - *STEM SeaPerch Program with Local Schools.* National ROV program sponsored by ONR and AUVSI involved teacher training as well as build sessions with students and campers. Showcases were held in May in collaboration with school/club STEM programs and included 50 Maryland schools and approximately 600 children. Students launched their ROVs in the USNA tow tanks and rotated through hands-on activities in the engineering labs. The Maryland Regional Competition drew 108 middle and high-school teams and was held in collaboration with ONR and NSWC at USNA.
- *astronauts to learn of the newest technical developments.* Students had the opportunity to meet the astronauts personally.
  - *Girls Only STEM Days.* These are focused on middle-school school girls and their parents. More than 350 girls attended workshops on a wide range of subjects, as well as a series of career chats with practicing Navy women scientists and engineers. A parallel parent program was offered on topics such as health and nutrition, planning for college, financing a college education, and leadership.
  - *STEM Days/Encounters.* Numerous visits by local elementary, middle, and high-schools which included theme-based activities, design challenges and competitions, team-building, tours of labs and research areas, and networking with professional engineers and scientists.
  - *Remote STEM Events.* Arrangements vary per site. One event in collaboration with the USS Midway was an overnight featuring USNA midshipmen leading interactive STEM sessions in hydraulics, robotics, mechanics, and fluids, held on board for 40 high-school students.
  - *Army-Navy Bridge Competition.* A spinoff of the national West Point Bridge Competition, USNA and USMA host a middle-school variation, attracting hundreds to the academies' websites. The contest features internet access to a mission and software to build a bridge to withstand specified conditions. Finals were hosted at USNA this year for four teams and their teachers.
  - *FIRST Robotics Program and Regional Competition.* Midshipmen mentored several local teams. USNA hosted the Regional High-school FIRST Robotics Competition for 28 teams and more than 200 students. USNA also hosted a FIRST Lego League competition for more than 30 K-8 teams.
  - *NESA Merit Badge Jamboree.* Faculty assisted the USNA Eagle Scouts in providing 14 interactive merit-badge sessions in nucleonic, ocean engineering, radio communications, and more. Three hundred fifty scouts attended sessions to complete the necessary requirements to earn two technical merit badges each.

## Outside Classroom Enrichment Activities

- *Astronaut Forum.* Thirty local students from 12 area high-schools met with STEM midshipmen to discuss the future of space travel and attended a convocation of NASA

## Mentorship/Internship Activities

- *USNA STEM Camps.* Science and engineering faculty have developed an intensive, project-based learning curriculum for students in grades eight through 11. Each session is one week in duration with 200 to 250 students per session. Three sessions were held in 2013 and the camp theme was

“Extreme Technology: Annapolis Edition.” Campers from diverse backgrounds and from each state in the country as well as abroad participated in a wide range of activities. They included identifying victims in a bioterrorist attack, optimizing hull design, building electronic circuits and control systems, learning facial recognition, studying cryptography and cyber security, exploring alternative energy, running 3-D simulations, investigating materials and mechanical design, testing the effects of extreme weather, seeing the physics of light, and modeling flight and rocketry.

About 40 faculty and 95 midshipmen (STEM majors at USNA) provided instructional information and facilitated the learning process. To date, 52 midshipmen have come to USNA via Summer STEM Camp and 97 percent of the precollege attendees surveyed plan to major in a STEM subject. A one-week variation for 30 to 40 middle-school girls and eight to 12 high-school girls as counselors has been offered since 2007, each year with a different theme. The camps cover topics such as biomedical engineering, flight, engineering design, robotics, and environmental engineering.

- *Internships.* About 15 high-school students participated in a variety of paid and unpaid internships including ONR SEAP, Project Lead the Way, and USNA internships. Students were mentored by a faculty member in a science or engineering research area.
- *Spring Break STEM Trips.* Midshipmen and faculty traveled to Pine Ridge, S.D., Moorcraft, Wyo., Tulsa, Okla., and Barrow and Anchorage, Alaska, to provide portable and modular STEM in a Box curriculum to hundreds of teachers and students as well as motivational discussion about the value of a STEM education.

## Teacher and S&E Training

- *SET Sail (STEM EDUCATOR TRAINING), Project Based Learning Workshops, and STEM in a Box Curriculum.* Modules and training are provided at no cost to educators. This past year, about 75 teachers from across the country and around the world attended weeklong workshops focusing on the use of project-based learning in engineering design, chemistry, physics, math, computer simulation, biology, environmental science, and many engineering disciplines.

Additionally, more than 275 teachers were trained in SeaPerch Design and Build methods as well as in accompanying curriculum. These workshops offered teachers an opportunity to engage more fully in their educational fields by exploring and testing ideas in a creative and hands-on environment. Curriculum was

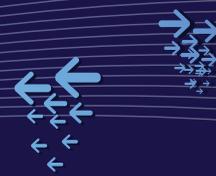
developed by and learning assessments were led by faculty and staff members from USNA STEM departments.

Teachers shared best practices and application methods. Follow-up with participants is conducted on a regular basis. In a parallel program, approximately 50 teachers attended a series of learning studios focused on developing project-based learning modules to be incorporated into their own classrooms. They also attended STEM camp sessions to experience interactive teaching and learning in practice.

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## SET SAIL: Empowering PBL Champions

Each year, teachers from across the country and around the world attend workshops at the Naval Academy focusing on the use of project-based learning in engineering design, chemistry, physics, math, computer simulation, biology, environmental science, and many engineering disciplines. These workshops offer teachers an opportunity to engage more fully in their educational fields by exploring and testing ideas in a creative and hands-on environment. Curriculum is derived from USNA departments, and teachers' shared best practices and application methods. Follow-up with participants is done on a regular basis – some teachers become our champions, taking the STEM message to and acting as a resource for many more teachers as well as students in their home communities. Xan Black is one of USNA's champions.

### XAN'S STORY

"I had the privilege of attending the Set Sail STEM Workshop for educators in the summer of 2011. The hands-on skills I learned there in teaching STEM have totally transformed my teaching, my career, and most importantly the careers of countless Oklahoma-area teachers and the lives of thousands of Oklahoma students. Thanks to the training and materials I received at the USNA teachers' workshop, I was equipped and prepared to teach an engineering design and a methods of research class at the high-school level here in Tulsa. Three-quarters of those students have gone on to STEM majors at the college level, thanks in no small part to the training I received at USNA.

In March of 2012 I had the opportunity to apply and was selected to go to work for Tulsa Community College as coordinator for Tulsa Alliance for Engineering. Again, I think that my success in gaining this position was due in large part to the training that I received through the workshop I attended at Annapolis. Since taking the coordinator role, the help we have received from the USNA has been absolutely a game-changer for STEM education in our area. We have had the extraordinary privilege of holding two SeaPerch workshops, a SeaPerch Challenge, and hosting a USNA STEM outreach effort over the midshipmen's spring break in the past 15 months. Thanks to the influence of the training I received from USNA directly and the outreach efforts they have made here in Oklahoma, we have been able to reach 5,000 students and 500 teachers in coordination with 150 engineer mentors through 107 distinct STEM events. Not a single one of these STEM outreach events would have happened without that initial training that I had the good fortune to receive at Annapolis in the summer of 2011 and the intentional follow-up mentoring, equipping, teaching, and encouragement that has taken the STEM community in Tulsa by storm. We have been mightily changed by the STEM outreach work of the Naval Academy and are extremely grateful for it!"

– Xan Black

# MISSISSIPPI NAVAL RESEARCH LABORATORY STENNIS SPACE CENTER

Stennis Space Center contains the largest concentration of operational and research oceanographers in the world.

## A National S&T Asset

The Naval Research Laboratory – Stennis Space Center (NRL-SSC) detachment in Mississippi is the major center for in-house Navy research and development in oceanographic modeling and prediction, biological and physical oceanography, marine geology, geophysics, geoacoustics, and geotechnology. It is also the Navy’s lead activity for mapping, charting, and geodesy research and development.

NRL-SSC’s Oceanography Division numerically models the ocean on some of the world’s most powerful supercomputers and operates a number of highly sophisticated graphics systems to visualize ocean model results. The seagoing experimental programs range worldwide.

The NRL-SSC Marine Geosciences Division conducts a multidisciplinary program of scientific research and advanced technology development directed toward maritime and other national applications of geosciences, geospatial information, and related technologies.

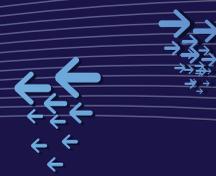
The branch of the Acoustics Division located at NRL-SSC centers its research on the characterization of environmental acoustics and the theoretical understanding and numerical modeling of how acoustic waves interact in the marine environment. The research is used in the development of technology used for prediction, system performance estimation, and tactical strategy planning.

NRL-SSC is collocated with Commander, Naval Meteorology and Oceanography Command headquarters, the Naval Oceanographic Office and Navy Department of Defense (DoD) Supercomputing Resource Center, in addition to NASA and other non-DoD agencies such as the National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency, and U.S. Geological Survey.

NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2009
Geographic Reach	St. Tammany Parish, La.; Pearl River, Hancock, Harrison, Jackson and Lamar counties, Miss.
FY13 S&E Mentors & Coaches	24 S&Es 4 coaches 9 mentors
FY13 Schools Reached	8 elementary schools 27 middle-schools 13 high-schools 11 school districts
FY13 Personal Interactions	77 teachers 2,325 students in classrooms 968 students outside classroom 1,000 hours (both paid and volunteer)
Other Partners & Catalysts	Office of Naval Research; University of Southern Mississippi; Greater New Orleans STEM Initiative; Northshore Community Foundation; Lake Pontchartrain Basin Maritime Museum; NASA SSC Education Office; Naval Oceanographic Office; Naval Construction Battalion Center Gulfport; SeaPerch.org; INFINITY Science Center; Belle Chasse Naval Air Station

## STEM Climate

Local implementation of NDEP-supported STEM initiatives at NRL-SSC commenced in calendar year 2009 (FY10). NRL-SSC’s location in Mississippi near the Louisiana border positions it well for STEM outreach in nearby schools in both states. NRL-SSC has



developed key STEM partnerships with the National Aeronautics and Space Administration and the Naval Oceanographic Office, both located on site at SSC. We have had a tremendous response to our offering of STEM programs in our local communities as evidenced by signed educational partnership agreements with 11 local school districts, six private schools, and two community organizations (and another in progress).

## Selected STEM Highlights

### Expositions, Festivals, and Demonstrations

In 2012, NRL-SSC began shifting its focus from single events such as these in favor of longer-term programs that have a sustained impact.

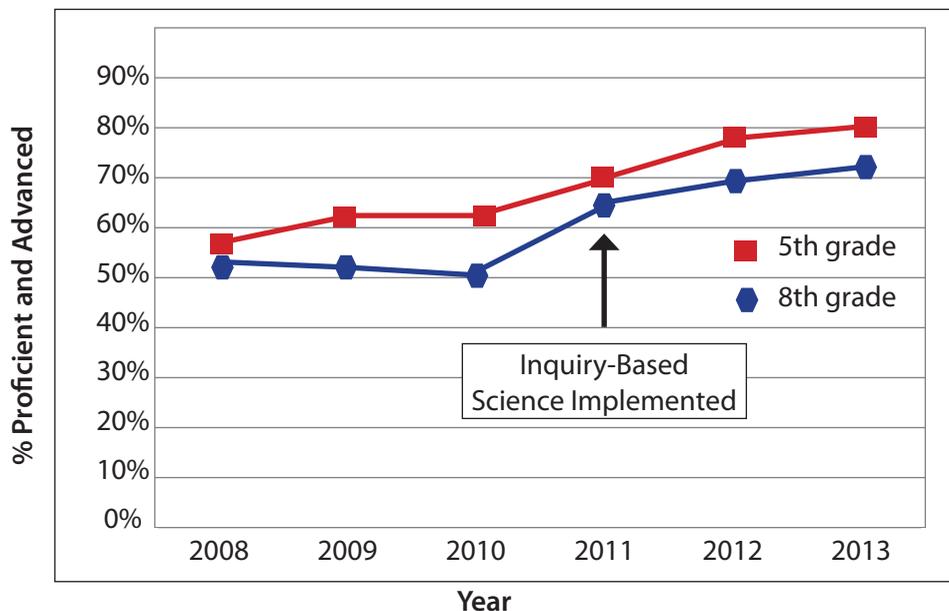
- *Career Day Speakers, Seminar Series, Science Fair Judges, Classroom Presenters, Teacher Banquets.* Special events at schools provide excellent venues for S&Es to share the Navy STEM story directly with students and educators and provide students with a unique opportunity for brief but meaningful S&E interaction.

- *Bayou Regional FIRST Robotics Competition.* NRL-SSC set up an NDEP/NRL booth for the fourth consecutive year. The booth allows students to visit with Navy S&Es, discuss internship opportunities, learn about available careers, and generally gain support.
- *Lake Pontchartrain Basin Maritime Museum.* For the third consecutive year, in partnership with the NASA-SSC Education Office, NRL-SSC sponsored a series of three one-week summer camps, each with 25 students (middle-school) who build their own SeaPerch. Mr. David Young visited each of the three camps to share details and answer questions about how SeaPerch relates to STEM careers available in the Navy.

### Classroom Activities

We have successfully persuaded teachers to relinquish precious minutes during the school day in the classroom for sustained activities.

SeaPerch. Thirteen of the schools participating in the Gulf Coast Regional SeaPerch Challenge used SeaPerch as an in-school



**Percent Students Proficient and Advanced on MS Science Test 2 in the Hancock County School District**  
(data and graph provided by Hancock County School District)

activity. S&Es visited two to three schools per week for eight weeks to mentor the students.

## Outside Classroom Enrichment Activities

We host a variety of activities, in cooperation with local and national stakeholders, that fit in this category.

- *SeaPerch*. Six schools that used SeaPerch as an after-school activity received visits from an S&E mentor one to two times per week for five to seven weeks. The visits culminated in the Gulf Coast Regional SeaPerch Challenge, held in Biloxi, Miss., on March 9, 2013. The event was hosted by NRL and the University of Southern Mississippi with funding from NDEP.
- *MATHCOUNTS*. Through partnerships with Leadership Northshore and the Northshore Community Foundation, we supported eight middle-schools participating in MATHCOUNTS clubs and competition teams during the 2012-13 school year in the St. Tammany Parish School System, La. Mentors regularly visited at least three of the teams either weekly or biweekly for one hour per visit for up to 12 weeks.

## Mentorship and Internship Activities

FIRST Robotics mentorship activities have strong support from our S&Es.

- *FIRST (FLL/FRC)*. NRL-SSC sponsored five teams again this year (three FLL and two FRC). At least one S&E mentor works regularly with each team. Two FRC mentors spent over 40 hours each during an eight-week period mentoring their team, as well as three days with the team at the Bayou Regional and an additional three days at the national competition.
- *Science and Engineering Apprenticeship Program (SEAP)*. NRL-SSC hosted nine high-school students as part of 2013 SEAP. Under the guidance of an S&E mentor, each student conducted an individual research project over eight weeks and delivered a poster presentation to peers, parents, and other S&Es upon completion.

## Teacher and S&E Training

By leveraging local partnerships, NRL-SSC has been able to help provide a wide variety of professional-development opportunities during FY13 for local teachers and administrators.

- *Science Literacy Academy*. Through a grant to the University of Southern Mississippi, eight elementary and middle-

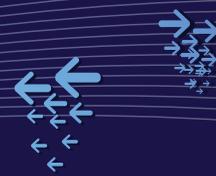
school teachers received five days of instruction on strategies for embedding literacy concepts into science curricula. The training was reinforced through the 2012-13 school year with a series of four one-day follow-up sessions.

- *Greater New Orleans STEM Initiative*. Through a grant, 36 teachers (grades three through six) from the Hancock County School District, Miss., received six-hour instructional sessions utilizing FOSS Science Modules.

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## NRL-SSC Helps Science Scores Soar

**H**ancock County School District (HCSD) was an early partner in NRL-SSC's STEM outreach efforts beginning in 2009. Stennis Space Center is located in the rural district, which serves approximately 4,400 PK-12 students.

It was clear at the initial meeting between HCSD Superintendent Alan Dedeaux and the NRL-SSC STEM coordinators that this district saw the value in community support. Dedeaux and his administration stressed their desire to move their science curriculum from traditional lecture-based teaching to inquiry-based learning. They were eager to begin a Navy partnership to help support that goal.

Since 2010, NRL-SSC has provided inquiry-based science kits for the district, teacher training on how to implement the kits, S&E classroom speakers and mentors, and excess lab supplies to help in their endeavor — an investment that has paid off. According to Kim Saucier, HCSD Science Curriculum Coordinator.

“Since the implementation of our inquiry-based science program in the 2010-11 school year, Hancock County School District has shown steady increases in the percentage of students scoring proficient and advanced on the state and federally mandated MST2, the Mississippi Science Test.

As a result of this implementation students are now doing science, not just learning about science. Consequently, they are understanding concepts and remembering what they have learned through experience, rather than memorizing facts and details.

In the past if you were to sneak a peek into one of our science classrooms, you would likely see students taking notes, reading from a textbook, listening to a lecture, or watching a teacher demonstration. Today, as you walk into our science classrooms you see students wearing child-sized safety goggles, conducting their own investigations, and recording their findings in their lab notebooks. Our students have become little scientists, and the teachers have become facilitators and lab assistants. One day these little scientists will be big scientists and we will all benefit from their excitement and love of science.”

Dedeaux has also seen positive changes in his faculty.

“The inquiry-based kits have also helped some of our elementary teachers increase their content knowledge and confidence in the areas of physics, chemistry, and other physical sciences, thus ensuring that our science curriculum is well-balanced,” said Dedeaux. “There is a new excitement about science in our district that is evident in our teachers, students, parents, administrators, and the local community.”

It's common knowledge that S&Es make decisions based on measurable, verifiable data. Seeing the uptick in HCSD's state science scores is encouraging to Dr. Joe Calantoni, the NRL STEM coordinator, who plans to involve more S&E participation in the classroom while continuing to support professional-development opportunities for HCSD teachers during the 2013-14 school year.

# WASHINGTON, D.C.

## NAVAL RESEARCH LABORATORY

Thomas Edison articulated his vision for the NRL when he said in 1915 that the government should have a “great research laboratory” to address national defense problems.

### A National S&T Asset

The Naval Research Laboratory (NRL) is the Navy’s single corporate research laboratory. Its mission is guided by the Office of Naval Research, and its activities are aligned with the four Naval Systems Commands (Naval Air Warfare Center; Naval Command, Control and Ocean Surveillance Center; Naval Surface Warfare Center; and Naval Undersea Warfare Center).

NRL is a full-spectrum laboratory, conducting a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, and systems, as well as toward ocean, atmospheric, and space sciences and related technologies. NRL provides the Navy with a broad foundation of in-house expertise and conducts primary, in-house research in the physical, engineering, space, and environmental sciences. NRL also pursues applied research and advanced technology development in response to identified and anticipated Navy and Marine Corps needs and provides multidisciplinary support to the Naval Warfare Centers.

Paul Jaffe, an electronics engineer at the U.S. Naval Research Laboratory (NRL), received the 2012 Vice Adm. Samuel L. Gravelly, Jr. Science, Technology, Engineering, and Mathematics (STEM) Education and Diversity Champion of the Year Award.

Ivan Galysh has been honored with the 2013 National Association of Rocketry (NAR) Howard Galloway Spacemodeling Service Award for contributions over the last decade focused on educating and motivating students in the technical disciplines of aerospace engineering.

### STEM Climate

The NRL educational-outreach program is part of the command’s community-outreach program and is the main venue to support educational initiatives locally. The program was established in 1985 by a presidential directive to government activities, instructing them to support local schools. The outreach program primarily supports local schools in the Washington,

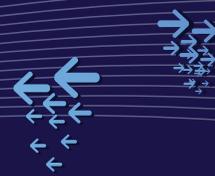
NAVY LOCAL IMPACT AT A GLANCE	
STEM Program Launched	2011
Geographic Reach	Within 60-mile radius of the laboratory, extending to D.C., Maryland, and Virginia
FY13 S&E Mentors & Coaches	>20 S&Es 12 coaches
FY13 Schools Reached	5 elementary schools 5 middle-schools 9 high-schools 4 school districts
FY13 Personal Interactions	>20 teachers >200 students in classrooms >4,000 students outside classroom
Other Partners & Catalysts	ReSET; Anacostia Community Museum; Federation of Galaxy Explorers; Washington Academy of Sciences; FIRST; American Society for Controls; Systems Engineering Consortia

D.C., metropolitan area under the DoD “Partners in Education” initiative. NRL has developed partnerships with nearby schools located along the Anacostia River in Washington, D.C., and has supported thousands of local students from elementary to high-school. Command volunteers, including military, federal civilian, and contractor employees, provide the staffing to support the various educational initiatives at the schools.

### Selected STEM Highlights

#### Expositions, Festivals, and Demonstrations

- *Thingamajig YMCA Showcase.* Demonstrated robots from FRC, FTC, and FLL. Provided children the chance to operate various robots. More than 4,000 people came to the event.



- *Prince Georges County STEM Fair.* Showcased robots for FRC, FTC, and FLL. Assisted in creating multiple teams in the county.
- *Andrews AFB Outreach.* Show and tell of FLL and FRC robots and provided information on the program.
- *Greenbelt Labor Day Parade.* Worked with students to build a float and demonstrated an autonomous robot walking in front of the float.
- *Ft. Belvoir Elementary STEM Fair.* Hands-on activities demonstrating robotics, SeaPerch, earth science, rocketry, food science, etc., to the 300 elementary students.

## Classroom Activities

- *STEM Lecture.* Presentation on robotics, science, and engineering to multiple schools.
- *Math and Reading Tutoring.* Volunteers spend an hour once a month tutoring elementary students in reading and mathematics.

## Outside Classroom Enrichment Activities

- *Chantilly Aerospace Club.* Yearlong club teaching students about rocketry and payloads. Competed in the Battle of the Rockets competition.
- *Summer Camp.* High-school summer camp teaching high-power rocketry, satellite design, and satellite-mission operations.
- *LaPlata SparkFun Tour.* STEM fair with SparkFun, USFIRST, VEX Robotics, TOP Coder, Catholic University, College of Southern Maryland, George Mason University, George Washington University, University of Maryland, and retired NRL employees from Toastmasters International operated booths to provide 300+ students with hands-on activities teaching how to interface and program Arduino boards, build robots, and solder and build electronics.

## Mentorship and Internship Activities

- *Science and Engineering Apprenticeship Program.* SEAP started at NRL in the late 1970s. Collaborating with NRL Sigma Xi chapter and Toastmasters, mentors teach public speaking as part of the summer research experience. This year, more than 50 students participated in the SEAP program.

- *FIRST Robotics.* S&Es and several local volunteers mentor several area robotic teams. Increased the number of teams for FY13 by holding a STEM Mentor Fair at NRL.

## Teacher and S&E Training

- *UMD Institute for Systems Research Engineering Design Review.* Taught teachers and university students about FIRST Robotics and the basics of building competition robots. Taught university students to be mentors for middle and high-school robotic teams.
- *American Society for Controls Annual Meeting.* Presentation on FIRST Robotics, the design of a competition robot.
- *University of Maryland Robotics Day.* Open to the public; demonstration of FIRST Robotics. Training how to set up teams and build a competition robot.

## For Information

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# APPENDIX: BEYOND K-12







# BEYOND K-12

The major goal of Naval enterprise outreach efforts is to develop a continuum of high quality STEM experiential, service-wide efforts to address current and STEM talent needs not only in K-12, but also “K through gray.”

The Naval enterprise realizes the importance of continuous, active development of the current and next generation of scientists and engineers for the Naval engineering work force. Approximately 30 percent of the Navy’s engineering work force will be eligible to retire by the end of 2014.

U.S. production of three- and four-year degrees in engineering is stagnant, while India and China have doubled their production. The average entry-level engineer takes two to three years to be efficiently and effectively integrated into Naval organizations.

The major goal of Naval enterprise outreach efforts is to develop a continuum of high quality STEM experiential, service-wide efforts to address current and STEM talent needs not only in K-12, but also “K through gray.” The Naval enterprise recognizes the need to strengthen scientific and technological capabilities, including current warfighting systems and military personnel needs, and enhance the quality of the Naval work force.

These efforts include:

- Awarding highly competitive scholarships to STEM undergraduate and graduate students and moving them directly into the Naval work force upon their graduation.
- Developing the next generation of civilian engineers for the Naval enterprise through project-based education, collaboration, and curriculum development.
- Developing successful programs that span most educational levels and emphasize Naval-relevant programs.
- Developing a systematic, integrated approach to STEM outreach to ensure a technically capable work force.

## Naval Air Systems Commands

NAVAIR also has programs that focus beyond the traditional K-12 STEM outreach activities. These additional programs allow students to experience NAVAIR activities in a way that will allow them to understand the potential for NAVAIR as a possible employer when they enter the active, full-time job market.

- *Scientist and Engineering Apprentice Program (SEAP).* This ONR-sponsored program offers high-school-aged students the opportunity to experience technical research during

the summer under the supervision of a laboratory mentor. Many NAVAIR sites participate in this program.

- *Naval Research Enterprise Internship Program (NREIP).* This program, also ONR-sponsored, provides current undergraduate sophomores, juniors, seniors, and graduate students exposure to the S&E work environment. Program is for 10 weeks during the summer. Many NAVAIR sites participate in this program.
- *Science, Mathematics and Research for Transformation (SMART Scholars).* This Scholarship for Service program has been established by the DoD to support undergraduate and graduate students pursuing degrees in STEM disciplines. The program aims to increase the number of civilian scientists and engineers working at DoD laboratories. Many NAVAIR sites participate in this program by hosting recipients of the SMART scholarships.
- *University Capstone Senior Design Program.* S&Es at NAVAIR’s Lakehurst New Jersey site award micro-contracts to nearby colleges and universities. The schools then give the work to the appropriate engineering school, and the school appoints a professor to work with a handful of juniors and seniors to develop engineering solutions to the design problems. The students present their solutions near the end of the school year.
- *Summer-Hire Programs.* All NAVAIR sites have traditionally provided summertime job opportunities for high-school and college-aged students. The number of students hired and the work performed depends on the needs of the various local hiring managers. Students in all disciplines (financial, logistics, science and engineering, project management, and contracting) are usually required to accomplish work that builds up over the course of a calendar year. When hired, the students are entered into our Pathways Internship Program, where they are provided with clear work objectives and a mentor who will see them through the development activities associated with their position.
- *Student Volunteers/Mentorships.* Several NAVAIR sites have agreements with local school systems that allow high-school seniors to perform voluntary internships in order to experiment with possible career choices early on in their





higher educational academic careers. These programs provide students with mentors who help the students understand more about how various technical disciplines are used in the work/laboratory environment.

- *Southern Maryland Mechanical Engineering Program.* NAVAIR's Patuxent River laboratory and the University of Maryland (UMD) have entered into a partnership to support internships for upperclassmen in a mechanical-engineering program with an aeromechanical concentration. Students take courses at the Southern Maryland Higher Education Center and are taught by Navy engineers and scientists. This experience exposes the students to naval air history, issues, processes, and practice. The curriculum is complemented with instruction at College Park. Upon completion of the academic program the students are awarded a BSME degree from UMD. Students are also required to complete 640 hours of on-the-job training to complete the internship program. Positions are available in conceptual design, safety, reliability, cost, research, development, design, and flight test of aerospace vehicles; component systems; and external support systems.

In addition to these activities, NAVAIR also offers incentives to help inform graduating scientists and engineers about the benefits of working at one of our eight primary sites. We provide NAVAIR information sessions and other useful workshops at large recruiting conferences and we invite qualified candidates for site visits so they can see and experience the surroundings before committing to a tentative job offer.

Once a candidate is offered a job, we cover their moving expenses if the job is their first federal government positions, and we place newly hired S&Es into structured developmental programs so that their first few years of employment and development are not left to chance.

## Naval Sea Systems Command

*Enterprise Talent Management Strategy.* In March 2011, NAVSEA signed on with the Enterprise Talent Management Strategy (ETMS) Instruction (NAVSEAINST 12330.4), which allows for national management and visibility of initiatives and investments related to all people-related activities, actions, and results.

The ETMS established Integrated Business Operation Teams (IBOTs) led by senior executives to connect and align all programs and processes. The IBOTs represent the four lifecycle areas of the work force: student engagement and outreach; recruiting; hiring and onboarding; and developing and retaining.

NAVSEA's student engagement and outreach IBOT (SEO-IBOT) applies a systematic, integrated approach to STEM outreach to plant the seeds of interest in K-12 STEM, nurture that relationship through scholarship/mentorship at the college/

university level, and produce a technically capable work force. In doing so, the SEO-IBOT focuses on three key elements:

- Engaging in scholastic engineering development programs that bring K-12 students, educators, NAVSEA professionals, and community leadership into partnerships that promote STEM interest;
- Providing scholarship and mentorship to engineering college students as encouragement for their continued academic pursuits;
- Investing in research and development funds to sponsored universities to conduct "relative research" efforts for NAVSEA and other Navy Systems Commands (SYSCOM) and to recruit STEM graduates into the NAVSEA work force.

Beyond K-12

- *Navy STEM Scholarship Program.* Designed to reach out to the next generation of scientists and engineers, this highly visible program strives to address decreasing numbers of science and engineering graduates by providing financial assistance to scholars pursuing STEM degrees from a historically black college or university (HBCU) or minority-serving institution. In partnership with other Naval SYSCOMs (FY13 – SPAWAR; FY14 – SSP), NAVSEA awards a one-time \$10,000 scholarship to freshman students pursuing a degree in STEM.

In the spring, scholars are given the opportunity to apply for summer student employment under the Pathways Intern Program, which provides them competitive wages, important technical experience, government-security clearance, industry networking opportunities, and engineering/science mentorship. Scholars who are hired into the student employment program receive a higher rate of annual tuition assistance of up to \$15,000. Upon graduation, students are noncompetitive converted to full-time employees.

- *Masters of Science in Systems Engineering (MSSE) Program at Tuskegee University.* This program is designed to increase the number of advanced-degree STEM graduates with the knowledge, skills, and abilities that NAVSEA needs in its work force. Tuskegee recruits recent STEM graduates into the 12-month master's program, which is specifically tailored to meet NAVSEA needs.

Students have the opportunity to work for NAVSEA the summer before the academic year begins and receive not only their salary for the time they are at work, but full tuition, books, and a stipend for housing, meals, and other expenses. Graduates become permanent employees upon completion of the academic program and sign a service agreement of three years to NAVSEA. NAVSEA intends to expand this program into other schools by FY15.



- *Naval Engineering Education Center.* A unique organization for the development of talented engineers necessary to lead the Navy forward, the NEEC provides young engineers and scientists access to projects of interest and importance early in their academic careers, which builds knowledge and enthusiasm for the field. These students are also partnered with trained professionals in the military and private sector to guide them through current projects and to offer insight to post-education opportunities.

Led by the University of Michigan, the NEEC is composed of the U.S. Navy, the American Society of Naval Engineers (ASNE), the Society of Naval Architects and Marine Engineers (SNAME), and 15 institutions of higher education. The NEEC leverages this collection of partnerships to share knowledge and resources in addition to creating a consistent learning experience regardless of where students obtain their naval-engineering education.

- *ONR Naval Research Enterprise Intern Program.* This 10-week internship program is designed to provide opportunities for undergraduate and graduate students to participate in research under the guidance of an appropriate research mentor at a participating Navy laboratory.
- *NAVSEA Pathways Internship Program.* This program offers a work experience that provides an opportunity for college students to pursue work that is relevant and beneficial to their academic studies. It is an excellent opportunity for college students to get an interesting real-world experience in their major field of study while contributing to the defense of our nation. Benefits vary across the enterprise but may include partial to full payment of tuition and books as well as noncompetitive conversion to full-time employment after graduation.
- *Educational Partnership Agreements and CRADAS.* NAVSEA has more than 300 Educational Partnership Agreements or Cooperative Research and Development Agreements in place with universities across the nation. These agreements connect warfare-center labs with universities for all manner of collaboration including capstone and design projects, graduate research fellowships, advisers/adjunct professorships, co-sponsors for K-12 STEM events like summer camps or after-school programs, technical research program/project advisers, and adopt-a-college programs.
- *SHPE Noches de Ciencias.* NAVSEA recently established a multiyear partnership with the Society of Hispanic Professional Engineers (SHPE) that will help in creating 150 new SHPE junior chapters at high-schools throughout five of SHPE's seven nationwide regions. Working with SHPE's professional and university Chapters, the NAVSEA-SHPE partnership helps these chapters build and expand its K-12 community-based Noches De Ciencias (Science Nights)

programs, STEM Toolkit programs, and robust MentorSHPE programs that will provide the basis for the development of new junior chapters.

- *Affinity Group Partnerships.* These are a best-practice example of how student engagement and outreach transitions into recruiting/hiring. Annually, NAVSEA participates in the recruiting events and conferences of major partners such as SHPE, National Society of Black Engineers (NSBE), Society of Women Engineers (SWE), Society of Mexican American Engineers and Scientists (MAES), American Indian Science and Engineering Society (AISES), and more. Many of these recruiting events include a K-12 STEM outreach component or college-bowl event.
- *Science, Mathematics And Research for Transformation).* The Science, Mathematics And Research for Transformation (SMART) Scholarship for Service program is an opportunity for students pursuing an undergraduate or graduate degree in STEM disciplines to receive a full scholarship and be gainfully employed upon degree completion. NAVSEA is proud to participate.
- *Hispanic Association of Colleges and Universities National Internship Program.* Since 1992, the HACU National Internship Program (HNIP) has placed over 9,500 undergraduate and graduate students in challenging paid internship assignments within federal agencies, corporations, and nonprofit organizations in Washington, D.C., and nationwide. NAVSEA is proud to participate.
- *Work force Recruitment Program for College Students with Disabilities.* The U.S. Department of Labor's Office of Disability Employment Policy (ODEP) and the U.S. Department of Defense's Office of Diversity Management & Equal Opportunity (ODMEO) manage the recruitment and referral program that connects federal and private-sector employers nationwide with highly motivated college students and recent graduates with disabilities who are eager to prove their abilities in the workplace through summer or permanent jobs. NAVSEA is proud to participate.
- *Naval Shipyard Apprentice Program.* In this four-year training program, designed to attract students to the federal government, students are taken through a challenging training program combining academics in a local community college, trade theory, and on-the-job experience to become skilled journeymen.





## Space and Naval Warfare Systems Command

Beyond K-12, SPAWAR is continually creating pathways leading to STEM degrees, employment, and successful careers at SPAWAR.

- *Professional Chapters MAES (Latinos in Science and Engineering) and NSBE (National Society of Black Engineers), SWE (Society of Women Engineers), WID (Women In Defense).* STEM professional chapters have been created to encourage and support minority students pursuing engineering and science degrees.
- *Pathways Internship Program.* This planned career-development program integrates classroom theory with paid work experience. Eligible students can be directly converted to a competitive service appointment.
- *Office of Naval Research Summer Internship Program.* This program provides current undergraduate sophomores, juniors, seniors, and graduate students exposure to the S&E work environment. The program is for 10 weeks during the summer. Nearly 50 college students participated last year.
- *Office of Naval Research Summer Faculty Program.* This program develops relationships between professors and SPAWAR STEM professionals in areas of common research interests. Faculty members work for 10 weeks during the summer.
- *San Diego State Foundation.* This foundation provides for part-time employment for local university and community-college students to assist STEM professionals in their work.
- *Historically Black Colleges and Universities (HBCU) Pipeline Program.* SPAWAR has an education partnership agreement with four HBCUs in South Carolina. Students in this program become a part of the Pathways internship program. The goal of the program is to reach minorities in STEM career fields.
- *Direct Hire.* The National Defense Authorization Act for FY09 section 1108(b) allows for direct-hire authority for candidates possessing an advanced degree to S&E positions at certain S&T reinvention laboratories.
  - *National DA 14 Direct Hiring Authority.* Allows for direct hiring of recent graduates in STEM fields
  - *Direct Hire Authority for Cyber Security Professionals*
  - *Direct Hire Authority for 2210s (INFOSEC) Information Security*
- *New Professional Program.* This allows for recently hired STEM professionals to acclimatize to the S&T environment

by taking two three-month tours before deciding on the group they want to work with. SPAWAR incentivizes the research divisions to take on new professionals by paying for their three-month tours.

- *SMART Scholarship.* This scholarship provides advanced education opportunities to current employees. In many cases stipends are augmented with internal funds so that recipients can work half-time while going to school and continue to maintain full salary.
- *Professional Development.* Each year SPAWAR provides dozens of short courses, online and in the classroom, to hone the professional skills of its STEM professionals.
- *NAVSEA Scholars Program.* SPAWAR partnered with NAVSEA in a formalized partnership with Tuskegee University to hire students in their master of science in systems engineering program. The program is designed to recruit minority students from HBCUs and MIs in STEM fields.
- *DOD Information Assurance Scholarship Program.* As a powerful incentive for students to enter the IA field, DOD offers the Information Assurance Scholarship Program. Students from universities that have been designated as certified IA universities are paid a stipend to pursue IA degrees. After graduation they have an obligation to DoD.
- *NADP-Naval Acquisition Development Program.* SPAWAR employs acquisition interns in systems planning, research, development, and engineering (SPRDE).
- *Naval Postgraduate School.* This program comes through Naval Postgraduate School, where employees participate in a cohort and receive a master's degree in systems engineering (this is the second year participating). This year a new program was started in which employees are in a cohort to receive master's of science degrees in electrical engineering.
- *Mid-Career Leadership Program.* This six-month program focused on developing employees who model command values and apply leadership to influence and effect positive change, empower each individual to make a difference, and instill a teaming and learning culture across SSC Atlantic. Participants develop skills outlined in the SPAWAR Leadership Competency Development Model and the Department of Defense Civilian Leadership Continuum to fulfill SSC Atlantic's mission, vision, values, and goals.

The program incorporates both resident and virtual learning events. Core program content consist of six modules and focuses on scientific and research-based exemplary leadership practices which address trust, communication, values, and team-building. The program includes interactive lectures, guest speakers/mentors,





and guided discussions. Participants engage in hands-on, activity-based experiential learning with practical application that reinforces leadership concepts.

- *Internal Boot Camp.* SPAWAR employees have customized, developed curriculum to enhance learning objectives in order to enable employees to obtain certifications for Security+, Network+ and other Information Assurance (CISSP) courses. These boot camps are taught by SPAWAR employees.
- *Leadership Development.* Supervisors and senior leaders are required to attend leadership-development training twice a year.
- *Quality of Work-Life Coordinator.* The Department of the Navy (DoN) and SPAWAR are committed to helping employees balance their work and private lives with programs available to both civilians and active-duty personnel. SPAWAR employs a full-time QOWL coordinator.

## U.S. Naval Academy

USNA provides a technically focused undergraduate program for over 4,000 students each year and also provides programs for undergraduates enrolled at other institutions.

- *USNA Undergraduate Program.* USNA midshipmen attend the Naval Academy, the undergraduate college for the Navy, for four years. For all 1,000 graduates each year, studies include a required technical core and so all graduate with bachelor of science degrees. About 65 percent graduate in a science or engineering major in which all complete technical capstone design projects. Many have been involved in technical internships, fleet activity, research conferences and independent research projects.
- *Midshipmen Research.* USNA policy is to develop and maintain research and scholarly activities that enhance the educational experience of midshipmen. A high percentage of faculty are engaged in funded research from sponsors such as ONR, NRL, NAVSEA, NAVAIR, AFOSR, DOE, NSF and NSA in addition to corporate sponsorship. Midshipmen can choose to conduct research with faculty members in topics such as cybersecurity, medical drug development, directed energy, alternative fuels, and advanced manufacturing, to name just a few, as part of their undergraduate program.
- *Midshipmen Internships.* These are conducted during the summer all over the country and abroad at, among others, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, MIT – Lincoln Lab, and the Defense Threat Reduction Agency.

- *Advanced Research Programs.* The Trident Scholar Program provides an opportunity for a select group of exceptionally capable midshipmen to engage in independent study and research during their senior year. Naval Academy faculty and other area specialists mentor the Scholars, helping them expand their knowledge and contribute to their fields of study.

Additionally each year, a small group of USNA juniors, who are seeking initial service assignments in the nuclear Navy, are offered the opportunity to compete for appointments as Admiral Frank Bowman Scholars. Candidates are selected for nuclear power training, participate in a related internship and an independent research project during their last year as a midshipman. During the first year of commissioned service after graduation they are offered a one-year master's program in a technical discipline.

- *STEM Outreach.* Over 250 midshipmen each year participate in STEM Programs to provide outreach to local and national communities and to facilitate the recruitment of USNA candidates with an affinity towards STEM majors. These programs incorporate naval themes and content to address technology through project based, hands-on learning, as well as an understanding of the broader academic theory underlying that technology.

Additional USNA STEM programs offered:

- *Naval Academy Science and Engineering Conference.* Hosted annually at USNA, this is a four-day undergraduate conference in November. This student-run conference brings together policy makers and science advisors together with university faculty and students to meet and discuss significant science and engineering issues and challenges. About 120 undergraduate students from 25 or more colleges and universities across the country attend and STEM midshipmen participate as conference facilitators
- *Pathways Internship Programs.* Offers students the opportunity to experience technical work while still attending an educational institution. Students can work full-time or part-time as temporary interns.
- *ONR SEAP.* Offers students the opportunity to experience technical research during the summer under the supervision of a faculty mentor.
- *Student Volunteers.* Offers students a short term opportunity to experience technical work while still attending an educational institution.
- *Postdoctoral Program.* Provides postdoctoral S&Es the opportunity for concentrated research and teaching experience in association with science and engineering



faculty in his/her field of study. Program is for one year, renewable for a second and third year.

- *Cooperative Programs for Scientific Interchange.* Designed to increase opportunities for the science education and opportunity for the faculty at the Naval Academy at various Navy and DoD sites across the country.

#### Faculty and Technical Support Staff Positions

STEM outreach activities at USNA are supported by OSD, ONR, NSF, DoDEA, and the Naval Academy Foundation with special support by the Northrup Grumman Foundation and the Odgers Foundation.

## U.S. Naval Research Laboratory

Beyond K-12 STEM, the U.S. Naval Research Laboratory (NRL) utilizes a variety of programs and incentives to recruit and hire top science and engineering candidates.

The following programs allow students and others to familiarize themselves with NRL and offer exposure to challenging work assignments.

- *Pathways Intern Programs.* Offers students the opportunity to work in their major field of study while attending a qualifying educational institution. Students can work full-time or part-time as temporary or non-temporary interns. NRL has students at the high-school, undergraduate and graduate level. Tuition may be covered.
- *Student Volunteers.* Volunteer service is limited to services performed by a student as part of an agency program established for the purpose of providing education experience for the student.
- *Historically Black Colleges and University and Minority Institutions (HBCU/ MI) undergraduate summer internship program.* The 10-week internship program provides young talented minority students an opportunity to conduct state-of-the-art research with NRL scientists who serve also as mentors.
- *Office of Naval Research Naval Research Enterprise Intern Program.* Provides current undergraduate sophomores, juniors, and seniors and graduate students exposure to the S&E work environment. Program is for 10 weeks during the summer.
- *National Research Council Cooperative Research Associateship Program.* Provides postdoctoral S&Es the opportunity to pursue research on problems that are compatible with the interests of the sponsoring laboratories and to contribute to the overall effort of NRL. Associateships are for one year, renewable for a second and third year.
- *American Society for Engineering Education Postdoctoral Fellowship Program.* Provides postdoctoral S&Es the

opportunity for concentrated research in association with selected members of the permanent NRL staff, often as a climax to formal career preparation. Program is for one year, renewable for a second and third year.

- *Office of Naval Research Navy Summer Faculty/Sabbatical Leave Program.* Engages university faculty members in the research programs at NRL to develop the basis for continuing research of interest to the Navy and establish continuing relations among faculty members and their professional peers. Faculty members work for 10 weeks during the summer. Sabbatical-leave participants are for six months to one year.
- *U.S. Naval Academy.* NRL Cooperative Program for Scientific Interchange. Designed to increase opportunities for the science education of midshipmen at the Naval Academy and to broaden the opportunity for USNA faculty members to keep current in their fields of interest. Faculty members work for 10 weeks during the summer.

NRL takes advantage of recruitment incentives offered to Federal activities including recruitment and/or relocation bonuses. New hires are also eligible for First-Post-to-Duty/ Permanent Change in Duty Station, student loan repayment, and Annual Leave Accrual, as well as several educational opportunities. In addition to these, NRL also utilizes the following initiatives:

- *Direct Hire.* The NDAA for FY09 section 1108(b) allows for direct hire authority for candidates possessing an advanced degree to S&E positions at certain S&T Reinvention Laboratories (NRL is one of the covered laboratories).
- *Distinguished Scholastic Achievement Appointment (DSAA).* Provides the opportunity to appoint individuals with undergraduate or graduate degrees through the doctoral level with a cumulative GPA of 3.5 or better to all professional positions with a positive education requirement up to the equivalent of a GS-12.
- *Karle Fellowship.* This fellowships is an NRL incentive for research divisions hiring S&Es. It provides a new hire free to the research division for no more than 24 months if criteria is met (NRL post doc hires are traditionally 12 months).
- *G&A exemption for new hires who have graduated from college within the past year.* NRL incentive for research divisions hiring S&E positions wherein if the new hire has graduated with a professional scientific or engineering degree within one year of hire, they are exempt from overhead for one year which is a cost savings to the research division.
- *G&A exemption for NRL post-doc hires.* NRL incentive for research divisions hiring S&E positions wherein if the new hire was a post doc with NRL prior to the hire, they are exempt from overhead for one year which is a cost savings to the research division.





# THE NAVY MODEL

*For Building STEM Capacity  
Through Community Engagement*

## 10 Actionable Components



**Create STEM Development Pathways**

**Engage Leadership**

**Recruit Volunteers**



**Focus on Inquiry and Design**

**Support Teachers**



**Forge Partnerships**

**Capitalize on Out-of-School Time**

**Stress Inclusiveness**



**Share Know-How**

**Measure Impact**