

NOT FOR PUBLICATION UNTIL RELEASED BY THE
SENATE COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP

STATEMENT OF
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BEFORE THE
SENATE COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP
ON
NAVY STEM PROGRAMS AND
NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

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Introduction

Thank you for the opportunity to be here today to talk about the Department of the Navy (DoN) Science and Technology (S&T) Strategy and how it supports Science Technology Engineering and Math (STEM) Education and Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) programs. In building a future Fleet and Force to achieve U.S. national security objectives, we balance S&T resources between a range of initiatives to support near-term advances in established operational areas – and to sustain long-term research that will prove disruptive to traditional operational concepts.

Naval Science and Technology Strategy

As the Office of Naval Research (ONR) celebrates its 70th anniversary in 2016, the Navy continues to leverage its phenomenal track record in maintaining a decisive capability advantage. The Naval S&T Strategy guides these efforts. Our strategy is simple: *to discover, develop and deliver decisive naval capabilities, near to long term, by investing in a balanced portfolio of breakthrough scientific research, innovative technology and talented people.*

Executing the Strategy

Our Naval S&T investment portfolio falls into four broad components: Discovery and Invention which make up our basic and applied science efforts; our technology push to the warfighter efforts such as Leap Ahead Innovations and Innovative Naval Prototypes; our technology pull from the warfighter efforts such as Future Naval Capabilities; and a Quick Reaction S&T (QRST) capability to respond to rapidly emerging requirements from the warfighter. Our STEM efforts align with and support the portfolio to ensure we maintain a world class, diverse workforce today and into the future.

New technologies emerge from basic research. ONR's Discovery and Invention develops fundamental knowledge, provides a basis for future Navy/Marine Corps systems, and sustains

our Scientist/Engineer workforce. Our challenges are to increase the technological, educational, and inspirational superiority of our current and next STEM workforce.

Science, Technology, Engineering and Mathematics (STEM)

The Navy has a rich history of providing educational opportunities for students of all ages. These opportunities begin with naval-relevant outreach programs at the kindergarten through high school grade levels. They continue through internships and other programs in post-secondary schools, supporting student advancement into post-doctoral work and continue through all stages of professional development.

We aim to inspire, engage and educate the current and next generation of scientists and engineers, and to attract, employ, develop and retain our diverse technical workforce through collaboration across the Navy, the federal government and the broad STEM community. There is no more valuable investment we can make in Naval S&T than in the minds of our current and future workforce. A portion of our investment takes shapes in our internship programs.

The Science and Engineering Apprenticeship Program (SEAP) program is an eight-week paid internship opportunity for high-school students working at either a Naval Research Laboratory location or Naval Warfare Center. Throughout the apprenticeship interns gain real-world, hands-on experience and research skills under the guidance of a mentor. These internships introduce high-school students to the Naval Science and Technology environment.

Recent SEAP student research areas include: corrosion preventive compound analysis, pathogen carriage by fleas in Kenya, manufacturing ball bearings using additive manufacturing, high altitude balloon design, wave energy testing; nanocomposite analysis, and collision avoidance for collaborative Unmanned Aerial Vehicles.

The Naval Research Enterprise Internship Program (NREIP), similar to SEAP, is a ten-week long paid research internship opportunity for undergraduate and graduate students working either

in a Naval Research Laboratory location or Naval Warfare Center. NREIP interns gain real-world, hands-on experience and research skills, under the guidance of a mentor. These internships introduce post-secondary students to the Naval Science and Technology environment. NREIP interns have proven to be an excellent source of future Naval Research Enterprise employees.

Students conduct research in a wide range of areas including: cyber analytics, 3D printing applications, underwater archaeology, taxonomic analysis, digital forensic analysis, flight training devices, virtual reality technologies, and psychology of unmanned systems.

Post-secondary students apply for this prestigious and competitive opportunity that can be a career and life changer. Last year, nine students from Hawaii earned NREIP internships. They are students at the University of Hawaii at Manoa, and at the University of Hawaii Kapiolani Community College. We are proud and happy for their ongoing success, and for the successes of all NREIP student interns.

In addition to NREIP and SEAP, ONR supports an internship at a Naval Research Laboratory location through the Historically Black Colleges and Universities/Minority Institutions Undergraduate Internship Program. These research interns are active participants and conduct hands-on laboratory research under the guidance of senior Naval Research Laboratory staff. At the conclusion of the program, students prepare written reports and make brief presentations describing their summer's work. In addition to conducting scientific research, the interns attend scientific and skill-set seminars on laboratory safety, ethics in science and engineering, job-search skills, and resume writing.

At the post graduate level, ONR sponsors a Young Investigator Program (YIP). This program attracts outstanding new faculty researchers to naval-relevant research and encourages their teaching and research careers. Young Investigator Program awards are made to academic researchers who have entered a tenured track position within the past five years. Proposals not selected for young investigator awards are considered for ONR's regular research grant program in competition with other research proposals submitted to ONR.

The 2015 ONR YIP awards went to 36 outstanding young investigators, including Dr. Michael Bell at the University of Hawaii for his proposal: Improved Physical Parameterizations for Tropical Cyclone Prediction.

For faculty members there is the Sabbatical Leave Program which provides fellowship appointments to science and engineering faculty members from institutions of higher education to participate in research of mutual interest to the faculty member and peers at naval laboratories for a minimum of one semester to a maximum of one year. Each participant receives a monthly stipend making up the difference between salary and sabbatical leave pay from the home institution. Relocation and travel assistance may be provided to a qualifying participant.

ONR also sponsors the Summer Faculty Program provides science and engineering faculty members from institutions of higher education the opportunity to participate in research of mutual interest to the faculty member and peers at Naval Laboratories for a period of 10 weeks. Participants may be appointed as a summer faculty fellow, as a senior summer faculty fellow, or as a distinguished summer faculty fellow. Weekly stipends are paid, travel expenses are reimbursed, and fellows may be allowed to bring an undergraduate or graduate student to the lab to assist with the summer research (and also receive a student stipend).

In addition to our internship, faculty and investigator programs, I would like to highlight some specific efforts we have in Hawaii. The University of Hawaii West Oahu campus, with an ONR grant, is developing a STEM Center of Excellence & Bachelor of Applied Science Concentration in Sustainable Facilities Planning & Management. This grant is transforming the school's existing physical science laboratory into an interactive STEM Center of Excellence; establishing our first STEM-related academic program in Sustainable Facilities Planning & Management; and furnishing the science laboratories with essential hands-on equipment to support student learning and K-12 teacher education. The West Oahu campus serves an area of Oahu populated by many families working in the Pearl Harbor Naval Shipyard, and the program is being established with direct participation and support of Navy Shipyard personnel.

ONR is sponsoring an international competition called the Maritime RobotX Challenge December 11-18, 2016 in Oahu to find the best way to make an unmanned surface vehicle function on its own. The challenge, which is organized by the Association for Unmanned Vehicle Systems International Foundation and NAVATEK, a local leader in ship design research, will foster student interest in autonomous robotic systems operating in the maritime domain, with an emphasis on the science and engineering of autonomy. Eighteen teams are participating from universities throughout the United States, including the University of Hawaii at Manoa, and internationally from Australia, Singapore, Korea, Japan, and China. Each team is provided with a 16-foot Wave Adaptive Modular Vehicle, that will serve as the maritime platform for the various sensor suites and control systems that the teams determine necessary to complete the mission tasks. These vessels will be provided without propulsion units so that the maneuvering and control of the vessel must be selected by each team, and integrated fully into their autonomy schema. The students have the opportunity to come up with solutions that could potentially set the new standards in autonomy and innovations that build on existing work.

Finally, I would like to highlight the Asia-Pacific Technology and Education Partnership (APTEP) which combines our education, research and entrepreneurship efforts. The primary goal of APTEP is to use Hawaii as the U.S. leader and capacity builder to promote commerce and partnerships in the Asia-Pacific region through alternative energy research, scientific and engineering education, and support of energy startup companies. This includes continuing development of world-leading U.S. research capabilities; a U.S. economic base providing technologies to meet Asia-Pacific needs; and a U.S. workforce educated to develop and implement appropriate technologies. In addition, APTEP promotes partnerships with Asia-Pacific nations for the open exchange of technology advancements and joint educational opportunities.

The work conducted under APTEP can be categorized under the three APTEP pillars – Education, Technology Research and Evaluation, and Technology Commercialization. There are multiple performers under each pillar, but I will point out one in each. Under Education, the

Maui Economic Development Board has developed the Asia Pacific Energy Inquiry, a program of inquiry learning and teaching based on the Island Energy Inquiry™ workshops and curriculum. Under Technology Research and Education, the University of Hawaii at Manoa is conducting scientific research on alternative energy, energy security, micro-grids, and the integrity of renewable energy. Lastly, under Technology Commercialization, the Energy Excelerator is helping startups implement solutions for energy challenges in Hawaii and the Asia-Pacific region.

Hawaii is uniquely suited to serve as the center for APTEP activities due to geographic location; environmental similarities to other Asia-Pacific regions; cultural, educational and economic ties to many Asia-Pacific nations; and world-leading research capabilities in scientific and technology areas highly relevant to Asia-Pacific needs.

Due to global energy demands and, in particular, increasing demands in developed and developing nations, the APTEP vision is focused on “alternative energy for sustainability.” Investments provided by APTEP will maintain and further expand Hawaii's capabilities in the areas of research, education and commerce, including but not limited to: World-leading alternative energy research and technology development at the University of Hawaii (UH) and the Hawaii Natural Energy Institute; UH educational curricula growing future leaders in Asia-Pacific energy technologies, economics, policy and cultural sustainment; Educational, training and outreach activities at community colleges and local economic development organizations.

Small Business Innovation Research (SBIR)

ONR's SBIR program has been successful in helping small businesses make progress in technology development, and we continue our efforts to facilitate small businesses transitions from S&T and development to production. A key element in our efforts is STTR - the Small Business Technology Transfer program which is a sister program to SBIR, established by Congress in 1992 with a similar statutory purpose as SBIR. A major difference between the two is that the STTR program requires the small business to have a research partner consisting of a

University, Federally Funded Research and Development Center, or a qualified non-profit research institution. In STTR, the small business must be the prime contractor and perform at least 40% of the work, with the research partner performing at least 30% of the work. The balance can be done by either party and/or a third party. Small businesses remain one of Navy's most productive sources of innovation. Active oversight and management of SBIR/STTR goals, utilizing marketing, metrics, and improved communications, will ensure that Navy remains aware of small business capabilities – and that small businesses are more aware of Navy requirements. We need to utilize small businesses to the maximum extent possible, and are already doing so in areas as diverse as development and construction of combat ships and landing vessels, design and manufacture of airframe structural components, marine charter transportation, and non-nuclear ship repair. Small businesses have repeatedly proven their ability to provide lean, agile and innovative solutions to warfighter needs.

As Naval S&T has succeeded in developing new capabilities, it has also created and continued to support successful businesses. One example is Makai Ocean Engineering Inc. In the past, the Navy would determine the location of newly laid surveillance cables by conducting an expensive acoustic survey with a vessel after the cable was laid, which endangered the covertness of the operation and delayed the use of the surveillance system. Makai developed a method of accurately computing the location and shape of an array on the seafloor shortly after deployment, so that the array can be immediately used.

The benefit to the Navy is a real-time deployment model that improves the stealth and deployment accuracy of installed surveillance arrays and also results in several million dollars of cost savings per year. Also, in 2010, Makai integrated the technology developed from this SBIR into software for the oil seismic industry to install and retrieve cables with geophones for 4-D seismic surveys. Makai generates over \$1 million/year in revenues from the sale of this product.

This is just one example of ONR's use of the SBIR and STTR programs to enhance warfighter effectiveness while saving taxpayer dollars and helping small businesses to grow and thrive.

Conclusion

Our STEM and SBIR/STTR efforts here in Hawaii and across the country will enable us to maintain our world class workforce, inspire and engage students, and develop the community of entrepreneurs to rapidly move decisive technology to our warfighters.