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KSTEM
Inspiring, Engaging, Educating the next generation of
STEM graduates/Portsmouth Naval Shipyard Employees

Introduction

Over the last Two decades, of well-documented research and media discussion has made makes it clear: in order to ensure our future economic prosperity, national security, and global leadership in the 21st century, we must inspire, engage and educate students to pursue science, technology, engineering, and math (STEM) related careers. American business, political, and military leaders are calling for our nation's schools to cultivate widespread literacy in STEM subjects in an effort to address current and projected US needs. The focus of this white paper is to demonstrate how the schools of Kittery, Maine, with funding from the Office of Naval Research and the Department of the Navy and with the support from the Portsmouth Naval Shipyard (PNS) can answer this national call for a STEM-educated workforce and how Kittery, because of its relationship with the PNS, is perfectly positioned to return on the investment and fulfill a 21st century STEM mission.

Since 1800, Seavey Island in Kittery has not only been the home of the Portsmouth Naval Shipyard (PNS) but has also developed close educational and economic ties with PNS. The Kittery School Department currently serves approximately 1,000 students of military families. In addition, PNS Economic Impact studies for the last several decades show that the town of Kittery has provided the second highest number of civilian employees in the state of Maine and the third highest in the Seacoast region behind Sanford, ME (#1) and Rochester, NH (#2).

Traditionally, a majority of the PNS workforce came up through shop-based apprenticeships focused on the ship building trades or were was hired as laborers without any credentials. Yankee ingenuity and craftsmanship of the PNS civilian and military personnel have made this shipyard one of the US Navy's centers for naval design, development, and reparation.: the 74-gun warship USS Washington of 1815; the first ever submarine hull, *L-8,* built in 1917; the *Albacore*, with its revolutionary hull design, built in 1953; PNS's first nuclear submarine *Sand Lance* in 1969. While the talents and knowledge of generations of PNS workers evolved to meet the changing strategic and technological demands of the US naval fleet, . Today, however, the needs and standards of PNS are now calling for a more highly STEM-educated workforce. PNS now provides refueling and modernization work for Los Angeles and Virginia class nuclear fast attack submarines. Dry docks are being built to accommodate ___ which have even more sophisticated weaponry and propulsion systems. The level of complexity involved in required

for the reparation of these nuclear submarines requires significantly more engineers with sophisticated and integrated STEM knowledge and skill base. As a result, This is reflected in the fact that the 1,400 college educated engineers now working at the shipyard is beginning to equal the 2,000 skilled laborers. Students coming out of the Kittery schools who are looking to the shipyard for employment can no longer count on doing so with only a high school diploma, as they have for many years. To be competitive and fill naval and national needs, they will increasingly need a higher education and advanced STEM training.

Coupled with this increasing need for a highly skilled and knowledgeable STEM workforce is the PNS 10-year projection that approximately 51% of its current workforce will be eligible to retire. Secretary of the Navy, Ray Mabus in *"Securing Our Future: the Naval Science, Technology, Engineering, and Mathematics (STEM) Workforce"* addresses the gap this creates between need and preparedness, "large numbers of Naval STEM professionals will be retiring over the next few years, and fewer American students are graduating with the preparation and interest needed to pursue STEM careers" (Securing Our Future: The Naval STEM Workforce, June 2011). The time is now to help create a pipeline of highly educated workers who can meet the naval and national competitive requirements. With its close relationship with the Portsmouth Naval Shipyard and through an emphasis on the inspiring and engaging students in STEM learning, Kittery is primed to be part of the solution.

Currently, The Kittery school system is at similar cross roads as the PNS and the Department of the Navy. Kittery community members and district leaders have been are currently echoing the questions being asked nationally: Does our current system prepare our children to succeed in college, in the workforce, and as citizens of the United States and the world? Will our students be able to compete in the workforce and contribute to the economic needs of our region and country? Does our staff have the knowledge and skills to engage and inspire our students to achieve academic excellence? As a local education system, how can we increase our capacity to improve teacher effectiveness and thereby student achievement? The signs are positive that Kittery has not only the will to supports its education system while but also looking the desire wants to improve it. The town voted to keep its high school, Traip Academy, open instead of moving its high school students to another larger school system. There is a growing and increasingly vocal group of well-educated parents who are calling for higher would like to see the standards in the Kittery schools raised and who believe that all students benefit from being sufficiently challenged. We have a strong school board and a new superintendent, Allyn Hutton, who brings great energy and experience to her commitment to strengthen the Kittery schools. One of her key focuses is Traip Academy, which because of its small size and limited funds, has struggled to provide students with sufficient enriching programs. A Traip advisory committee is currently working to create a more effective vision for the high school. With this opening, it is a perfect time for the a STEM initiative to help bring about "a fundamental shift in a comprehensive high school learning experience as prioritized in *Securing Our Future*." The A STEM initiative could also help to deliver the message of higher expectations to a high school that has had sent only a small portion of each graduating class attend on to four-year degree programs. A larger portion of Traip graduates have pursued jobs in and around the seacoast area and have looked to PNS for employment with just a high school degree. Now is the time

for Kittery to implement a plan to educate its children "to compete in an age where knowledge is capital, and the marketplace is global."

The Kittery schools are also positioned to positively influence the children of military families with a STEM initiative. Military families come to Kittery through the PSN and and through relocation from the nearby Coast Guard Base and the Pease National Guard. During any given school year, almost 20% of the Kittery school population is comprised of students whose parent(s) are serving in the U. S. military. Although many of these students are in our school system for only two years, it is enough time to inspire them through a STEM initiative, could reach and inspire military children while they are here. Indeed, an opportunity which could make all the difference to their future. offered by the STEM-initiative to the child of a Navy, Coast Guard, or Air National Guard military family could make all the difference in this child's future. PNS nuclear engineer Sarah French, who mentored Traip students in the FIRST Robotics, credited her experience with FIRST Legos in middle school and FIRST Robotics in high school with her decision to pursue her nuclear engineering degree. A STEM initiative in Kittery could offer another benefit to the military. Because of the small size of the Being small, the Kittery schools, it could be are the perfect size for the ONR to establish a pilot site for its STEM initiative their program that could then replicated in larger education systems near other strategic military bases throughout the country and the world.

With funding from the Office of Naval Research and the Department of the Navy and support from PNSY, Kittery can fulfill a 21st century STEM mission.

That Kittery's school system can fulfill this STEM mission is evident in the traction of the Odyssey of the Mind (OM) program. Revitalized by Kittery parents in 2007, after being dormant since 1996, OM is an international educational program that provides creative problem-solving opportunities for students from kindergarten through college. Team members apply their creativity to solve assigned problems,that range from building mechanical devices to presenting their own interpretation of literary classics, . and They then bring their solutions to competition on the local, state, and world level. Since 2008, around approximately 70 Kittery children (K-__), with the support of 20 plus parent volunteers, have been inspired by the OM's academic challenges. of the OM program. In fact, in just a few years, Kittery has grown its OM program into one of the largest and most successful in the state. In 2011, five of the eleven Kittery teams in the competitive divisions took home trophies for 1st, 2nd, or 3rd place. Two of those teams, both which focused on technological problems, went on to participate in the World Finals at the University of Maryland. "It's just a fabulous program," said parent Amy Driscoll. "These kids had to solve a complex problem all on their own and be creative at the same time. That's a lesson we all could use."

A 2008, 3rd and 4rth grade (?), all-girls Kittery team, The Eccentrics, illustrates how programs like this can help to motivate girls in the sciences. The Eccentrics tackled the challenge, designed and sponsored by NASA, that which asked the team to produce a performance that solved a problem in one of the Earth's systems and whose solutions would start a "fad." "Towards the end, we were working on it every day," said 8-year old Daria Barbour. "But as

much work as it was, I never got tired of it. It was so much fun!" Katie Peternell whose daughter was on The Eccentrics team said, "We were just so thrilled that they had a chance to do this. We never thought they'd actually win."

Further evidence that STEM-related programs have become a priority in the Kittery School system, is Traip Academy's after school program Robo-Rangers FIRST Team #3597, started last year. Traip Academy teachers and FIRST advisors, Joseph Boudreau and Ed Disy, had had little experience with FIRST Robotics, but they understood that by introducing this program and enlisting students to participate they would offer an extraordinary opportunity for increasing student aptitude for science, technology, engineering, and math. Studies support this, showing that FIRST students are more likely to have an apprenticeship their freshman year of college, more than twice as likely to pursue a science or technology career, and nearly four times as likely to pursue a career in engineering (insert Internet citation here.). For six weeks and countless numbers of hours, Traip Academy students worked alongside Portsmouth Naval Shipyard mentors including engineers (names). The support of the mentors on the PNS Outreach Team and the individuals who volunteered their time to work with Traip the male and female Traip students enabled made the launch of this program to be a success. It also encouraged Traip to offer its first ever Robotics course, which will introduces the fundamental concepts of robotics, safety, hardware, software, and programming using robotic C and Lab View. The twenty female and male student enrolled in this course have the support of six PNS mentors and the opportunity to These committed participants will become the second Traip Academy Robo-Ranger Team to participate in the regional 2010 FRC competition. in (city). OM, Robo-Rangers FIRST Team, and the Robotics course lay the foundation for the success of a STEM initiative in Kittery. A STEM initiative would then help establish the Kittery schools as a place that inspires and encourages students in these 21st century skills.

Revision of original

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