

## **AC 2008-2856: NAVY OUTREACH: SCIENCE AND TECHNOLOGY EDUCATION PARTNERSHIP**

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# NAVY OUTREACH: The Science and Technology Education Partnership (STEP) Program

## Abstract:

The Science and Technology Education Partnership (STEP) is addressed as an outreach activity to strengthen the metrology profession. The Navy Metrology Engineering Center and Measurement Science and Technology Laboratory are located at the Naval Surface Warfare Center, Corona, CA. Since narrowly surviving the 1995 Base Realignment and Closure (BRAC) round, the Center needed a long term strategic approach to providing a pipeline of engineers to replace those lost during the BRAC process and a plan to replace the mass of baby boomers approaching retirement in the next 15 to 20 years. The Center developed a proactive approach to maintaining a pipeline of engineers that involved numerous outreach activities into the university and college systems and into local high schools that helped solve more immediate needs. However, it became clear that the lack of numbers of qualified students “entering” the engineering educational pipeline was the limiting factor in meeting the needs for the increasing demand for engineers.

The Navy Metrology Engineering Center has been a proactive and engaged partner in the STEP Program since its inception. STEP is a 501C(3) non-profit corporation funded privately by partner companies investing in the education of our youth in an attempt to raise the numbers of high technology educated workers in our community. STEP’s primary mission is to “Inspire students to pursue careers in math, science, engineering and technology” through an innovative, proactive approach that engages students, teachers and the “educational system” to high technology companies, colleges/universities, government activities, and resources to achieve its purpose. STEP is focused on the 3<sup>rd</sup> to 8<sup>th</sup> grade student population with outreach programs into the high school level.

This paper will discuss the underlying studies that led to the founding of STEP and describe its organization, mission, vision and outreach components. The presentation will reveal lessons learned, growing pains, successes and failures as well as achievements over STEP’s 8 year history. Correlation of STEP’s discoveries to other independent studies will be drawn.

STEP is an example of a locally grown program involving a partnership of companies, government, universities/colleges, and the educational system committed to achieve the goal of increasing the numbers of local students qualified to become America’s future scientists and technology professionals. STEP has been an active participant in the science education community in the Inland Empire region of Southern California (Riverside/San Bernardino Counties) for over eight years. STEP partners are committed to making a difference. A two page Executive Summary is attached and provided for convenience.

## Background:

This background is included to provide the context of how and why NSWC Corona Division and its Navy Metrology Engineering Center chose to participate in STEP as a continuing outreach

activity and to keep it as an important part of its overall human capital strategy. The remainder of the paper will focus on the STEP Program itself.

A consequence of the end to the cold war was that the Department of Defense (DoD) found itself with an excess amount of infrastructure that was no longer required. The excess infrastructure included personnel no longer needed to support our post cold war efforts. This led to congress authorizing a number of Base Realignment and Closure (BRAC) rounds to be conducted into the mid-1990's that were intended to right size DoD both in physical plant infrastructure as well as in personnel resources. BRAC rounds were conducted every odd numbered year culminating in the last, and most extensive, round occurring in 1995. This periodic BRAC process did reduce the size of DoD. However, several collateral consequences occurred to various sectors of the DoD workforce as a result of the periodic BRAC rounds; one being that DoD scientists and engineers who had been traditionally secure in a safe, stable employment environment were now included in the down sizing actions of BRAC. Some activities experienced large losses of personnel when bases were closed and functions relocated. Some engineers would voluntarily leave to find employment at other non-DoD government agencies to reconnect with a stable, predictable work environment. Others simply left for jobs in industry. Each DoD activity had its own BRAC experience.

The Navy Metrology Engineering Center and Gage and Standards Laboratory (now consolidated into the Measurement Science and Technology Laboratory) are located at the Naval Surface Warfare Center, Corona, CA (NSWC Corona Division). In 1990, there were 1,200 employees at NSWC Corona Division of which about 425 employees worked in the Metrology Engineering Center and associated Laboratory and functions. About 80% were scientists and engineers. Many had 5 to 15 years or more experience. As NSWC Corona Division proceeded through the various BRAC rounds, the work and employee base continued to erode. Less and less technical support was required for the shrinking DoD structure as bases were closed and ships and aircraft were retired and excessed.

By the last BRAC round in 1995, NSWC Corona Division had shrunk to about 670 people and the Metrology Engineering Center was down to 170 (40% of its former total just 5 years earlier). Many of the "survivors" were senior employees with 20 or more years experience with many nearing retirement age. During BRAC 1995, NSWC Corona Division was specifically addressed as a base that was performing important technical functions, but was deemed too small to stand alone. It was identified as an activity that should be closed with its needed functions and personnel to be relocated to other DoD activities. The Metrology Engineering Center functions and associated personnel were proposed to be relocated to a Navy activity in Indiana. This, of course, caused the highly experienced and technical workforce to begin to plan for a potential uprooting of homes and families and relocation to Indiana should the proposal be accepted by the BRAC Commission who had the final say. While the case was argued and reviewed, many employees found jobs in Southern California. Others awaited an outcome. A generous severance package would be available for those who chose to await the final outcome and then be involuntarily separated rather than relocate. One can clearly imagine the multitude of negative effects on the metrology engineering workforce during this time period.

The 1995 BRAC Commission, in its televised proceedings, spared NSWC Corona Division and the Metrology Engineering Center from closure and relocation. The base survived, but the technical workforce had severely suffered. The Center was heavily populated with very experienced individuals, but there existed “gaps” where very marketable engineers had left for a stable life. Little progress had been made to recover the numbers of engineers needed to provide the increasing technical support required of a now downsized Navy that was starting to refresh technology and systems. The difficulty that NSWC Corona Division was experiencing was heightened by the fact that DoD requires that its employees be United States citizens capable of obtaining proper security clearances. The southern California university and college system had insufficient numbers of engineers with US citizenship available to meet the high demand by both industry and government. NSWC Corona Division’s increasing demand for engineers willing to work at government wages could not be met without continuing to augment hiring through other avenues. With the high cost of living in Southern California, finding engineers elsewhere to relocate and remain was not proving effective.

It became clear that it would be of long term value to engage in outreach activities geared towards increasing the number of local students from our school systems who would pursue degrees in science and engineering. NSWC Corona Division experience over the years has been that “home grown” engineers already rooted in the area have had a tendency to stay employed with NSWC Corona Division for the long term while those hired outside the Southern California area have a high attrition rate over the first 3 years. Congressman Ken Calvert, the founder of STEP, had been intimately involved with the base during the 1995 BRAC process and looked to NSWC Corona Division as an early STEP partner. With this common interest, NSWC Corona Division became a STEP partner and adopted STEP as the outreach program to use to help build an increasing number of local students qualified and interested in pursuing careers in engineering.

## **The Science and Technology Education Partnership (STEP) Program:**

### **The Beginning:**

The beginning of STEP involves California Congressman Ken Calvert who represents the 44<sup>th</sup> District that includes a large portion of the Inland Empire region of Southern California (Riverside, CA). Congressman Calvert had committee assignments on the Science Committee and recently on Appropriations. He belongs to numerous House caucuses including the House Science, Technology, Engineering, and Mathematics Education Caucus.

In November 1999, Congressman Calvert received the “California Report on the Environment for Science and Technology” (the CREST Report) produced by the California Council on Science and Technology.<sup>1</sup> The report indicated that 9.3% of all jobs in California were in high tech industries which was well above the national average of 5.6% at the time. About 20% of the nations R&D was being performed in California at the time of the report. This R&D helped to sustain and advance California’s high tech industrial base. Simply put, California was the nations leading science and technology state. Science and technology was the underpinning of California’s leadership in agriculture, aerospace, defense, electronics, computers, software, movie production, multimedia entertainment, biotechnology, medical devices, environmental

technologies, and telecommunications. This leadership position provided jobs, sustained a high standard of living, and offered numerous other benefits to California residents. The report further provided a wake-up call by announcing that California was at risk of losing the lead it once enjoyed. Several factors were cited as contributing with the highlight being the inability of the state's educational system to produce a technologically skilled workforce in sufficient numbers and capable of sustaining the R&D activity. Findings included that a significant number of Californians did not have the education needed to benefit from job opportunities created in the high tech sector and that Californians graduating from the K-12 educational system and community college system were simply not adequately prepared to enter the high tech arena. Several recommendations were advanced to address the findings.

More recent studies continue to illuminate California's problem. In 2004, California ranked 48<sup>th</sup> in the nation for high school students going on to college. Statewide, 47 percent of high school graduates in 2006 enrolled in a state public university. For the Inland Empire region which is comprised of Riverside and San Bernardino Counties (an area east of Los Angeles and about the size of the state of New Jersey), the numbers were even lower at 38 percent. Only about 26 percent of Inland Empire high school students met the admission requirements for the University of California and California State University systems.<sup>2</sup>

The Inland Empire region had mostly missed out on the high tech prosperity enjoyed by its neighbors in San Diego, Orange County and Los Angeles. There was a keen interest in building a high tech sector in the region. The Inland Empire region is as populous as San Diego; however, it lags far behind in high technology employment. The challenge to build a high technology presence in the region, especially in the face of the CREST Report and other findings was the start of the activity that lead to the formation of STEP.

In January 2000, Congressman Calvert received a report from the Hispanic Outreach Task Force he had assembled to study ways to improve science and mathematics skills among K-12 students, particularly among the region's Hispanic population. This report provided a similar call to action for the need to address the education of our youth. Not only are minorities in need of assistance in math and science, but females also. A very recent article by Dr. Pamela S. Clute, professor of mathematics and education at the University of California, Riverside, again highlights this long known fact. She states that: "While it is true that women [now] represent 57 percent of the nation's college population, less than one-third major in science, technology, engineering, or mathematics. Research shows they [females] have the ability, but lack the interest."<sup>3</sup>

Staff research further produced more alarming facts: California ranked last among 40 states according to the results of the 2000 National Assessment of Educational Progress (NAEP)<sup>4</sup> tests, US students in the final year of secondary school scored well below the international average in math and science according to the Third International Math and Science Study (TIMSS), the US ranked 18<sup>th</sup> among 21 industrialized nations also per TIMSS (surpassing only Lithuania, Cyprus and South Africa.<sup>5</sup> New information from the Organization for Economic Cooperation and Development which consists of 30 member countries shows that American 15 year olds have actually lost ground in math and science compared to other member countries. In the organizations latest studies, the highest achieving U.S. students were either at or below its

average across member nations. Almost 25 percent of U.S. students demonstrated very low proficiency in science and 28 percent scored below the minimum level in mathematics. In math, Finland, Korea, and China were top performers with Finland taking top ranking in the science assessment.<sup>6</sup> The evidence of a need for a proactive program to improve science and technology education was overwhelming if the Inland Empire was indeed committed to advancing in the high tech sector.

William D. Green, CEO of a global management consulting and technology services company and vice-chairman of the Business Roundtable Education & the Workforce Task Force, has stated: “In every business, high performance begins and ends with education. In particular, we must re-double our investments in math and science education. We need people with skills in critical thinking, analytic reasoning, and problem solving. We need to be able to speak, to write, and to communicate. We need to enhance the richness and diversity of the American workforce, and we need it to be more confident. The Business Roundtable Education & the Workforce Task Force believes the United States must take the steps to begin to close America’s growing talent gap, and they [the steps] all focus on improving education. First, we need to benchmark U.S. performance against the best in the world and learn from these best practices to strengthen math and science education programs in kindergarten through 12<sup>th</sup> grade. We must also recruit and retain outstanding math and science teachers.”<sup>7</sup> William D. Green continues on to discuss the need to actively address the problem. However, the call for a program like STEP along with nationwide efforts has continually been at the forefront of the need to halt the erosion of America’s scientific base. The earlier studies drove the eventual formation of the STEP Program. The continuing evidence of the need to close our growing talent gap keeps STEP focused and active.

### **The Formation of STEP:**

In June 2000, Community, Education, Business and Technology Industry Leaders began organizing to form the non-profit, 501C(3) STEP Corporation funded privately by partner companies investing in the education of local children to attempt to raise the numbers of high technology educated workers in the community. STEP’s Board of Directors is comprised of industry (such as AT&T, Boeing, Southern California Edison, Computer Science Corporation, and others), university/colleges (such as University of California, Riverside and California Baptist College and others), the local educational institutions (Riverside County Office of Education), and local high tech government agencies such as the Navy Metrology Engineering Center. The Inland Empire is fortunate to have a number of innovative academic, government and business institutions involved in STEP to encourage students, especially those from underrepresented groups who do not have a family tradition of attending college. STEP believes that it is critically important to reach out not only to teachers (who can identify and nurture promising students) and to the students themselves, but also to families to create an environment conducive to success.

### **STEP’s Mission and Purpose:**

STEP’s primary mission is to “Inspire students to pursue careers in math, science, engineering and technology” through an innovative, proactive approach that engages students, teachers, and

the local K-12 educational system with high technology companies, universities/colleges, high tech government agencies and all of their collective resources to achieve its purpose of increasing and sustaining the high technology job sector in the Inland Empire. Through the formation of new educational partnerships between businesses, academia, and government entities within the community, STEP seeks to pave the way to achieve a prosperous future for all Inland Empire citizens based on the sustainable growth of a high technology industry. Specifically, STEP seeks to: **Raise** parental, industry, and community awareness of the skills gap between K-12 students and the labor needs of the high tech sector, **Stimulate and inspire** children's interests in pursuing math, science, engineering and technology educations, **Motivate** parents, teachers, the K-12 educational system, and business leaders to create a set of plans to address the educational situation to help achieve success, and **Stimulate** the Inland Empire into becoming a high technology leader.

### **How STEP Works:**

STEP is all about forming mutually beneficial partnerships with an eye towards the long term collective success and growth of the region. STEP is a people-centered, community building program aiming to strengthen the quantity and quality of our technologically skilled workforce. STEP causes the educational system at all levels to interact with high tech industry, business and government for the benefit of students, families and teachers. STEP's purpose is not to reinvent the many resources available in the community, but rather to connect them together to help make them more effective. STEP serves as a repository of information and a catalyst for action.

STEP's role is to make teachers, students and families aware of the educational resources available to help them succeed in math and science, and to foster awareness of the programs that can help students prepare for and succeed in college. STEP helps them to connect to the services available. STEP works with businesses and the community to identify employment trends and other technological infrastructure needs and works to help assure that the Inland Empire region has the resources it needs for success. To deliver these services, STEP sponsors an annual student and teacher conference, has educational outreach programs, provides seed money to pursue relevant recommendations to further its purpose, collaborates with business development organizations and individual businesses, and operates a website with information for all our conferences, partnering opportunities, and outreach activities.

### **STEP Operations:**

STEP operates through an annual conference and various outreach activities in addition to the STEP Board's partnering activities. The best way to describe STEP and its evolution is to chronologically review the STEP Conference activity and outreach initiatives which follow.

### **STEP 1 Conference (November 2, 2000):**

The conference invited some nine hundred local 3<sup>rd</sup> through 8<sup>th</sup> grade students and their teachers for a science show provided by General Atomics accompanied by an array of booths provided by high tech companies geared to demonstrate what scientists and engineers do. Hands-on student activities were also provided. After the students left, the audience shifted to industry, education,

government, and business leaders for an afternoon session. The afternoon featured the National Teachers Hall of Fame inductee, Jamie Escalante, as the keynote speaker and first STEP Award recipient who was well known as the inspiration for the movie "Stand and Deliver". Following the keynote, a panel discussion followed addressing the concerns, issues, and problems faced along with ideas and recommendations to make progress. The morning's model of having an annual children's science show (provided free to schools including transportation costs) and expo was adopted based upon the very positive response received.

### **STEP 2 Conference (November 29, 2001):**

The conference was expanded to accommodate 2,000 3<sup>rd</sup> to 8<sup>th</sup> grade students and their teachers. The General Atomics Science Show became a regular mainstay of the conference. The high tech expo expanded and STEP added a segment featuring Future Scientists and Engineers of America (FSEA) who conducted a hands-on experiment for all student attendees. Seed money for several area middle schools was provided for FSEA to start several after school science clubs. Three scholarships to the Riverside Community College were awarded. The afternoon used a luncheon format with industry, business, academia, and government leaders assembling to hear keynote speaker, Dr. Mae Jemison, the first woman of color in space. She was presented STEP's second award. The afternoon was focused on partnering and support.

### **Outreach (April 23, 2002):**

Funding had increased sufficiently to augment the local Science Fair efforts which were identified as one of the opportunities available to help. STEP awarded its First Annual \$1,000 (savings bond) Regional Science Fair Award for Outstanding Demonstration of Scientific Investigation.

### **STEP 3 Conference (November 1 and 2, 2002):**

The conference was expanded to a two day format allowing for up to 4,000 3<sup>rd</sup> to 8<sup>th</sup> grade students and their teachers to attend. The science show and expo remained a staple. Costs and transportation for students and teachers and their schools were, and continue to be, borne by STEP. The luncheon remained focused on partnering and support efforts. The luncheon keynote (and 3<sup>rd</sup> STEP Awardee) was Arnold Schwarzenegger. STEP financial support and community interest and support expanded greatly. The first teacher education segment was provided on a Saturday morning to train teachers in science and math and to provide tools and projects for teachers to take back to their classrooms. Continuing education units were provided by the Office of Education. The teachers were hosted at a closing appreciation luncheon that featured former California First Lady, Gayle Wilson as keynote. STEP announced a teacher tuition grant program for science and math.

### **Outreach (February 22, 2003 to April 23, 2003):**

STEP financially assisted and provided a volunteer base for the Science Olympiad in the Inland Empire. The Science Olympiad engages junior and senior high school students in an annual science competition. STEP awarded three \$1,000 stipends to teachers involved in Science

Olympiad to attend the Science Olympiad Summer Training Camps held in Michigan and Arizona. The Science Fair Award program was approved by the STEP Board as an annual support commitment as was the support to Science Olympiad. A STEP partner, Singh Chevrolet in Riverside, CA offered a new automobile for a local student who won first place at the state Science Fair. A local senior high school student won the \$16,000 car in 2003.

**STEP 4 Conference (November 6-8, 2003):**

The format remained the same. Highlights include 2002 National Teacher of the Year, Chauncey Veatch, as luncheon keynote speaker and STEP Awardee and Mrs. Caroline Snowbarger, Special Assistant for Teacher Quality in the Office of Elementary and Secondary Education as the teacher appreciation luncheon keynote speaker.

**STEP 5 Conference (October 13-14, 2004):**

Conference format remains fixed as it is successful. Keynote speakers and awardees include actor Robert Davi, I-SAFE National Spokesperson, and Dr. Jill Tartar, Director of Research at Search for Extraterrestrial Intelligence (SETI). STEP instituted an annual poster and essay contest for students offering savings bonds as award for 1<sup>st</sup> through 3<sup>rd</sup> places in age categories. The teacher conference was separated in time to attempt to allow teachers to both attend the student conference with their classes and attend the separate teacher conference which was held at STEP partner NSWC Corona Division facilities on March 19, 2005. The teacher appreciation luncheon keynote speaker was Dr. Adena Williams Lofton, Chief Education Officer at NASA Headquarters.

**STEP 6 Conference (October 18-19, 2005):**

The format again remained the same. Another 4,000 students and their teachers attended free of all costs. The STEP Conference awarded its first corporate award to General Atomics for their continued commitment and dedication to science education.

**STEP 7 Conference (October 11-12, 2006):**

Highlights included the STEP community leadership and partners luncheon keynote speaker and STEP Awardee, Elon Musk, SpaceX Chairman and CEO. Over 30 local elementary and middle schools attended.

**STEP 8 (October 3-4, 2007):**

Highlights included the STEP community leadership and partners luncheon keynote speaker and STEP Awardee, Dr. Sally Ride, First American Woman in Space and President/CEO of Sally Ride Science. She is also a Professor of Physics at the University of California, San Diego, CA. The second STEP Corporate Award was presented to a long time STEP partner and supporter, Bourns, Inc.

Again, over 30 elementary and middle schools attended the student conference. The teacher conference was put on by Dr. Pam Clute, Professor of Mathematics at University of California, Riverside and Head of the ALPHA Project and learning center at the university.

### **STEP Conference and Outreach Summary:**

The STEP Student Conferences have exposed some 23,000 students and 1,100 of their teachers to science, technology and engineering through the science shows and high tech expo held annually for the past 8 years. The STEP Student Conference format has stabilized and continued to serve about 4,000 3<sup>rd</sup> to 8<sup>th</sup> grade students and their teachers annually. The feedback forms we obtain from attendees indicate it receives continued high marks. Our data indicates that we get only about a 10% repeat population in our attempts to provide the experience to those who haven't yet had the opportunity to participate. The STEP community leadership and partner luncheon provides an annual opportunity to renew and expand the partnership, make new connections, obtain continued and additional support and sponsor funds, and outline past, present and future STEP plans. The STEP Teacher Conference has settled into an evening format hosted by the local university. It is focused predominately on mathematics and teacher activities to improve their skills. The STEP Teacher Conference also gives STEP an opportunity to thank the teaching community for their dedication to serving our children.

The various STEP outreach programs have been bounded by financial considerations. The Annual STEP Awards for the Inland Science and Engineering Fair division winners (STEP provides awards in each of the three divisions: Elementary-\$200 savings bond, Junior-\$500 savings bond, and Senior-\$1,000 savings bond) has been a positive incentive for students. They are the largest monetary awards given at the regional Science Fair. STEP volunteers help to serve as science fair judges at local competitions throughout the region. The Science Olympiad assistance keeps the Inland Empire active in this national competition and helps the volunteer teachers improve their skills through the three stipends offered annually. The annual STEP Conference poster and essay contests allow classrooms to engage before the conference with an opportunity to win a monetary award for placing in the three different divisions. It also allows those students who lean more towards English, literature, or the arts to engage their minds on science and technology. STEP publishes a periodic newsletter called "In STEP" for teachers, administrators, sponsors, and community leaders to provide information on upcoming events, profile regional technology companies, and promote teaming and partnering activities. The In STEP Newsletter is the periodic update on conference and outreach activities and resources available in the area. Finally, STEP provided \$6,900 seed money to Future Scientists and Engineers of America (FSEA) to jump start after-school Science Clubs at several local middle schools.

### **STEP Lessons Learned:**

The STEP Program has been in existence for going on 9 years now and has survived its infancy period. A number of lessons were learned along the way. The first lesson was how critical it was to engage the K-12 school system directly and involve them in the efforts. Buy in by educators is critical. An activity such as STEP can look as if it is moving into territory already occupied by the educational system. Keeping it clear that STEP was simply helping to connect

resources to assist an already taxed educational system was useful. The STEP Student Conference was a good first move. There is nothing wrong with providing a FREE science show and high tech booth expo. Just the exposure of thousands of students annually to science and technology is progress. Engaging the community leadership, industry, businesses, academia, educational system, and government entities in a commonly focused interest area such as STEP has helped make the conference long lasting. The STEP Conference is now one of the “must attends” in the area.

STEP’s Outreach efforts that work are non-invasive. STEP provides funds and volunteers only. STEP does not attempt to reinvent. STEP, although founded by a Congressman, has always been very careful to remain non-political. Politics can ruin it. The interest that we all share in serving the community and improving the lives of our children are above any political agendas. STEP welcomes all to help and draws from all walks of life, political affiliations and ethnicities. STEP volunteers were hard to obtain initially; however, there is nothing like four thousand enthusiastic kids at a science conference to cause volunteers to appreciate what they have worked on and agree to continue it.

Finally, the teacher training conference was the most difficult to get working well. At first, it looked like STEP was moving in on existing programs for training teachers. It was difficult to get good advice on how to be successful to help. Even something as simple as “when” to hold the training to obtain the maximum number of teachers attending received mixed advice from various “experts”. Hold the training on a Saturday when they are available. They’ll never come on a Saturday, hold it after school. Hold it in parallel to the student conference when the teachers are already there. Don’t hold it at the same time. STEP tried it all. Bottom line, STEP teacher training conferences got between 100 and 150 teachers in attendance no matter what was done. Lesson was, just pick a date and hold it. Using the local university to provide teacher training seems to be the best solution for STEP. They are experts and it saved an entire STEP sub-committee the time to find individual training modules and schedule them into a conference. Now all STEP does is provide the training space and the teacher appreciation dinner (which is always well received!).

### **STEP Results/Value:**

The STEP Program is attempting to inspire students from the early years of elementary education to become interested in math and science. That is a long term view and charge. One of the frustrating realities of an activity such as the STEP Program is the extreme difficulty in providing concrete data to show your results and value in real numbers. Numbers of students and teachers exposed to science and technology through STEP conferences is a weak metric when attempting to show results. Due to the privacy laws prohibiting the collection of student data and information as they flow through the educational system or even identifying actual students who attended STEP conferences leaves STEP with using examples of students and teachers who voluntarily identified themselves (with parental permission for students) as being actively assisted by STEP. STEP can point to industry engineering interns at local companies today who were early STEP Conference student attendees. STEP has science fair participants who use industry partner laboratory facilities and equipment and are mentored through their science fair projects. These science fair participants do extremely well.

STEP has compared its activities and outreach to studies conducted over the years to validate its active approach to improving K-12 engineering and science education. The 2004 American Society of Engineering Educators K-12 Leadership Workshop presented in an ASEE paper entitled “Engineering in the K-12 Classroom: An Analysis of Current Practices & Guidelines for the Future” is a recent example of an excellent validation of STEP’s activities. In this workshop, a set of six guidelines for improving engineering education and outreach were offered: Hands on learning (demonstrates relevance); Interdisciplinary Approach (adds tech component to all subjects); Standards (maps to state standards); Use/Improve K-12 Teachers (engages K-12 teachers in outreach); Make Engineers “Cool”; and Partnerships (creates incentives). STEP has worked on actively addressing each of these areas to some extent, and heavily worked four of the six. A quote from the Executive Summary of this 2004 ASEE paper follows:

“Many groups with a stake in K-12 science, engineering, and mathematics (STEM) education make a strong case for improved technical literacy.....However, repeatedly making the case to each other is simply “preaching to the choir.” The larger issue, then, is the upshot---where do we go from here?”

STEP’s answer was to become proactive and actively attack the problem to make a difference. STEP is an example of a locally grown program involving a partnership of companies, government, universities/colleges, and the educational system committed to achieve the goal of increasing the numbers of local students qualified to become America’s future scientists and technology professionals. STEP remains an active participant in the science education community in the Inland Empire region of Southern California. STEP partners are dedicated and committed to making a difference.

### **Benefits of STEP Participation to NSWC/Corona:**

A number of benefits to NSWC Corona Division have occurred as a result of STEP participation. The visibility of being active in the local community has been of great value. NSWC Corona Division is seen as a player and large technical employer in the Inland Empire. The community has come to place a high value on NSWC Corona Division as a member of the community. This became clearly evident during the most recent 2005 BRAC rounds where NSWC Corona Division was again closely reviewed for closure and relocation. The local community raised a serious voice of support and defended the base from relocation. This contributed greatly to the 2005 BRAC Commissions unanimous decision to leave NSWC Corona Division in place.

Other benefits include the strengthening of NSWC Corona Division’s partnerships with the local universities and colleges due to STEP participation. This has led to increased success in hiring local engineering graduates and expanding internships. Navy Metrology now has a couple of engineering interns from the local university that were early STEP student attendees. A local science fair 10<sup>th</sup> grade student linked up with the Measurement Science and Technology Laboratory through a STEP Conference and, using lab grade instruments, completed a project on determining the potential usefulness of using thermal imaging technology to evaluate autonomic vascular reactions. The study showed that thermal imaging may be useful in detecting pre-clinical stages of circulatory problems. This particular student not only placed in the state

science fair competition, but also presented the paper at the Measurement Science Conference in Long Beach, CA during January 2007 receiving the Youth Achievement Award. This student was the youngest to ever present at this Conference. The Navy Metrology Engineering Center has its eye on this student as a future metrology employee. Over 23,000 students and 1,100 teachers have been exposed to metrology engineering and measurement science. NSWC Corona Division engineers who volunteer for the STEP Conference leave with a sense of satisfaction of sharing what they do and its importance to our future generation of engineers. Repeat volunteers are common. The list of benefits is long, with some being unanticipated. Needless to say, STEP has been a win-win for NSWC Corona Division and the Metrology Engineering Center.

A list of STEP 8 Conference Participants Highlights, What Others are Saying (about STEP), and a list of STEP Outreach Programs/Projects are attached to this paper for information.

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## Executive Summary:

The Navy Metrology Engineering Center and Measurement Science and Technology Laboratory are located at the Naval Surface Warfare Center, Corona, CA. Since narrowly surviving the 1995 Department of Defense Base Realignment and Closure effort, the Center needed a long term strategic approach to providing a pipeline of engineers to replace those lost during the base closure process. In addition, the Center needed a replacement plan for the mass of baby boomers approaching retirement in the next 15 to 20 years. The result was a proactive approach to maintaining a pipeline of engineers that involved numerous outreach activities into the local university and college systems and into the local high schools that helped solve more immediate needs. However, it became clear that the lack of sufficient numbers of qualified students entering the engineering educational pipeline was the limiting factor in meeting the overall long term needs and increasing demand for engineers.

The Navy Metrology Engineering Center has been a proactive and engaged partner in the Science and Technology Education Partnership (STEP) Program since its inception in 2000. STEP is a 501C(3) non-profit corporation funded privately by partner companies investing in the education of our local youth to attempt to raise the numbers of high technology educated workers in our community. STEP's primary objective is to "Inspire students to pursue careers in math, science, engineering and technology" through an innovative, proactive approach that engages students, teachers and the local K-12 educational system with high technology companies, universities/colleges, high tech government agencies and all of their collective resources to achieve its purpose. STEP is focused on the 3<sup>rd</sup> to 8<sup>th</sup> grade student population with outreach programs into the high school level and university systems. STEP was founded by California Congressman Ken Calvert who assembled a Board of Directors comprised of industry (such as AT&T, Boeing, Southern California Edison, Computer Sciences Corporation, and others), university/colleges (such as University of California, Riverside, California Baptist College, and others), the local educational institutions (Riverside County Office of Education), and local high tech governmental agencies such as the Navy Metrology Engineering Center. The Board developed the mission and framework for STEP. STEP's mission is: **To raise** parental, industry, and community awareness of the skills gap between K-12 students and the labor needs of the high tech sector; **To stimulate and inspire** children's interest in pursuing math, science, engineering, and technology educations; **To motivate** parents, teachers, and the business community to create a set of plans to address the educational situation to help achieve success; and **To stimulate** the Inland Empire region of Southern California into becoming a high technology leader.

The first effort of the STEP Board to meet this mission was the development of the STEP Conference. The STEP 1 Conference was held on November 2, 2000. The Conference invited more than nine hundred local 3<sup>rd</sup> through 8<sup>th</sup> grade students for a science show provided by General Atomics Corporation accompanied by an array of interactive, hands-on booths provided by high tech companies geared to demonstrate what scientists and engineers do. After the students left, the audience shifted to industry leaders, educators, government and business leaders for an afternoon session. The afternoon featured the National Teachers Hall of Fame inductee, Jaime Escalante, as the keynote speaker who was well known as the inspiration for the movie "Stand and Deliver". A panel discussion followed to address the concerns, issues, and

problems being faced along with ideas and recommendations to make progress. Based upon the positive feedback received from students and teachers, the morning's model of having an annual children's science show and expo was adopted. Since STEP 1, the annual STEP Conferences expanded to a two day format (to accommodate up to 4,000 students each year) and were enhanced with a teacher conference with training and several outreach programs added to target identified needs. STEP 8 was held on October 3 and 4, 2007. To date, STEP Conferences have exposed about 23,000 local students and 1,100 teachers to science and technology and provided linkages for them to local industry resources. Over 500 teachers have received training to enhance their science and math teaching skills. Computers, equipment and materials have been provided to teachers and schools. About 40 companies doing business in the Inland Empire are now involved in helping STEP to maintain its privately funded and supported nature. The increased donations have allowed STEP to offer additional support to students including providing a \$1,000 Savings Bond to the winner of the County Science Fair (with reduced value bonds for 2<sup>nd</sup> and 3<sup>rd</sup> places). Several local students have gone to the state science fair level and placed. One student received an automobile from a STEP sponsor who offered a new car to anyone who won first place in the Senior (12<sup>th</sup> Grade) Division.

One of the frustrating realities of an activity such as the STEP Program is the extreme difficulty in providing concrete data to show value and accomplishment. Numbers of students and teachers exposed to science and technology through STEP is a weak metric when attempting to show results. Due to the privacy laws prohibiting the collection of student information as they flow through the educational system or even identifying the actual students who attended STEP Conferences, STEP is left with using examples of students and teachers who voluntarily identified themselves and availed themselves of assistance and help through STEP partners. There are industry engineering interns at local companies today who were early STEP Program student attendees. STEP has science fair participants who use industry partner laboratory facilities and equipment and are mentored through their science fair projects. These science fair participants do extremely well. STEP has compared its activities and outreach to studies over the years to validate its active approach to improving K-12 engineering and science education. The 2004 American Society for Engineering Society (ASEE) K-12 Leadership Workshop is a recent example of an excellent validation of STEP's activities. In this workshop, a set of six guidelines for improving engineering education and outreach were offered: Hands on learning (demonstrates relevance); Interdisciplinary Approach (adds tech component to all subjects); Standards (maps to State standards); Use/Improve K-12 Teachers (engages K-12 teachers in outreach); Make Engineers "Cool"; and Partnerships (creates incentives). STEP has worked on actively addressing each of these areas to some extent and heavily worked 4 of the 6.

STEP is an example of a locally grown program involving a partnership of companies, government, universities/colleges, and the educational system committed to achieve the goal of increasing the numbers of local students qualified to become America's future scientists and technology professionals. STEP has been an active participant in the science education community in the Inland Empire region of Southern California for over eight years. STEP partners are committed to making a difference. A list of STEP 8 Conference Participant Highlights, What Others are Saying (about STEP), and a list of STEP Outreach Programs/Projects are provided as attachments which follow this Executive Summary.



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## **STEP 8 Conference Participant Highlights**

### **Discovery Zone**

**Abbott Vascular:** The world leader in the design and development of cardiovascular medical products displayed some of its line of high-tech, life-saving cardiac products.

**American Society of Naval Engineers:** American Society of Naval Engineers (ASNE) consists of military and civilian professionals and students, engaged in or associated with the many facets of naval engineering. ASNE works to advance the knowledge and practice of naval engineering in public and private applications and operations, enhance the professionalism and well-being of members, and to promote naval engineering as a career field.

**Bourns, Inc.:** With worldwide headquarters in Riverside, Bourns, Inc. serves a broad range of markets, including telecommunications, computer, industrial, instrumentation, automotive, consumer, audio, and medical. Celebrating 60 years in the industry, Bourns is receiving this year's Corporate Award.

**California Baptist University, School of Engineering:** California Baptist College offers information on opportunities in the engineering educational and career fields. Students were able to interact with hardware used for university student research projects.

**California State University San Bernardino, Department of Computer Science:** Game playing is one area in computer science where graphics and artificial intelligence come into play. Games were demonstrated illustrate this synergy.

**Computer Sciences Corporation:** Computer Sciences Corporation (CSC) is the world's third largest provider of IT services. CSC professionals integrate technologies and solutions across industries to create the Best Total Solution™ – uniquely customized to meet the individual business goals of their clients.

**Discovery Science Center:** Discovery Science Center is a nonprofit organization dedicated to educating young minds, assisting teachers and increasing public understanding of science, math and technology through interactive exhibits and education programs.

**General Atomics:** Plasma and fusion are the focus of this "high-energy" exhibit. Students were able to interact with General Atomics engineers and scientists, while learning about and playing with plasma globes, infrared detectors, and more.

**Government Industry Data Exchange Program:** Government Industry Data Exchange Program (GIDEP) provides a valuable technical information link between the government and private business. GIDEP discussed how technology impacts data transfer and dissemination.

**Green Institute for Village Empowerment:** Green Institute for Village Empowerment (GIVE) is a non-profit advisory group that works to empower youth and communities regarding the struggle to realize sustainability.

**ISCA Technologies:** ISCA Technologies is a successful corporation whose mission is to provide integrated pest management tools and solutions that are effective, economical and ecologically friendly.

**Jet Propulsion Laboratory:** Jet Propulsion Laboratory (JPL) has pioneered efforts in deep space navigation and communication, digital image processing, imaging systems, intelligent automated systems, instrument technology, microelectronics, and more. Many of these disciplines found applications outside the planetary spacecraft field, from solar energy to medical imagery.

**Kaiser Permanente:** Kaiser Permanente, America's leading integrated health plan, presented a demonstration of ultrasound. This is technology and innovation that allows us to look beyond the surface. Using ultrasound, we can visualize internal body structures in a non-invasive way, without introducing any radiation into the body.

**Measurement Science Conference:** The Measurement Science Conference (MSC) booth gave students a look at the world of metrology, the science of measurements. Engineers described how measurements impact everyone's daily life.

**Mathematics, Engineering, Science Achievement Program, University of California Riverside:** The mathematics, engineering, science, achievement program is partnered with UC Riverside to serve schools and students that can benefit from math and science enrichment. MESA helps students by providing fun math based group learning activities, "hands-on" math and science projects, and field trips; in addition, contact with college students, university professors and professionals in math, science, and engineering is emphasized.

**My Learning Studio:** My Learning Studio has Science Kits for students and offers workshops where kids can conduct science projects, learn sign language, or choose from a wide variety of other classes.

**Navy (Norco) - Independent Assessment Center:** NSWC Corona Division, the Navy's Independent Assessment Agent in Norco, California assesses the effectiveness and reliability of advanced systems and equipment. An Infrared Camera and other measuring devices used for assessment were on display. NSWC Corona Division engineers were available to discuss the technology with the students.

**Riverside City Fire Department:** Riverside City firefighters will demonstrate various firefighting tools and will display one of their fire engines.

Riverside Community College: RCC will be providing information about available educational opportunities in Occupational Education and discuss degree programs related to science and technology.

Riverside County Flood Control and Water Conservation Department: Provided information on water quality protection best management practices.

Riverside Public Library: Riverside Public Library provided useful information on the various types of library services that are offered to the community.

Riverside Public Library Foundation: The Library Foundation raises funds to ensure the excellence of library services for Riverside residents, such as COMP Riverside. COMP Riverside, A non-profit partnership, is making sure all Riverside students can afford computers and become good at using them.

Riverside Public Utilities: For over twenty years, Riverside Public Utilities has provided educational support to the approximately 100 schools within our service area, including most of the schools in Riverside and Alvord Unified School Districts as well as many private schools.

Science Fair Winners: Science Fair Winners from the Inland Empire will be on hand to exhibit and discuss their science projects.

Science and Technology Education Partnership: Science and Technology Education Partnership (STEP) serves as the catalyst that brings parents, schools, industry, and government together to provide innovative math, science, and technology education programs that inspire students to become America's future science and technology professionals.

Southern California, Society of Automotive Engineers: The Southern California Chapter will be presenting recent University student projects.

Traveling Space Museum: The TSM, Orion Mini-Shuttle, is a 12-foot-long, motion-controlled flight simulator that resembles the Space Shuttle and gives students the sensation of piloting a spacecraft in low Earth orbit. The same technology used to train real pilots is featured in this video-linked two-seat shuttlecraft.

Wathen Aviation High School: Wathen Aviation High School at Flabob Airport and Medical Office High School Academies in Riverside. River Springs will display information relating to Wathen Aviation High School, Young Eagles educational aviation program for children.

Western and Eastern Municipal Water Districts: Western Municipal Water District presents the H2Olympics, taking water awareness to a whole new level! The event consists of a series of activities that encourage students to learn about water's unique properties and conservation. Students will be involved in a fun, hands-on science learning experience!



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## What Others Are Saying

“I realized early on in my life that I needed extraordinary discipline to reach my goals. I know that math and science are not always easy subjects for children, so it is important to make these subjects fun and interesting. This way, children will pursue career choices that will help California remain the technology leader of the country and the world. I’ll be back to see the breakthroughs the children discover through science and technology.”

*STEP 3 (2002) Conference Keynote Speaker, Governor Arnold Schwarzenegger*

“The STEP Conference is recognizing the need for improved math, science, and technology education for our children. This event gives kids a chance to see the fun side of these often difficult subjects.”

*Former First Lady of California, Gayle Wilson*

“The primary focus of the annual STEP Conference is not only to reinforce the importance of math and science education to our young students, but also to provide a forum for us all to work together – students, teachers, school administrators, community and business leaders, and high technology companies – toward the common goal of ensuring that the next generation fulfills their potential in mathematical, technological, and scientific discovery.”

*Congressman Ken Calvert*

“We must pave the way for students to become the workforce of the future with solid skills in math and science in order to compete in the 21<sup>st</sup> century marketplace. I support efforts like STEP and the possibility it provides in stimulating today’s children to become the innovators of tomorrow.”

*Riverside Mayor, Ron Loveridge*

“STEP exemplifies a model of how we can work together to provide schools the support they need, so that all of our children have the knowledge and skills necessary to lead successful lives. This effort is an excellent tool in capturing students’ imagination.”

*Riverside County Superintendent of Schools, David Long*

“Clearly, the demands of a high-tech workforce require solid math and science skills. As employment opportunities in science and engineering continue to increase, efforts like STEP will play a vital role in partnering with educators to prepare our children.”

*Dr. Susan Rainey, Superintendent – Riverside Unified School District*

“Attracting the high-tech industry to our region will be a key in sparking economic growth as we continue to grow. Efforts like STEP ensure that we will have a skilled workforce available for these high-tech companies.” *Darrell Talbert – Mayor Pro Tem, City of Corona*



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## **Educational Outreach Programs**

Since 2000, STEP has initiated a number of events and activities to increase student motivation, interest, and enthusiasm in science and technology. In addition to its annual conference, STEP is also involved in many worthwhile activities that take place throughout the year:

### **After School Science Clubs**

STEP donated \$6,900 to the Future Scientists and Engineers of America (FSEA) as seed money to start After School Science Clubs in local schools.

### **In Science and Technology Education Partnership Newsletter**

STEP publishes a newsletter for teachers, administrators, sponsors, and community leaders to provide updates on STEP activities, promote upcoming events, profile regional technology companies, and more.

### **Poster and Essay Contests**

STEP sponsors annual poster and essay contests for students to engage their imagination and writing capabilities. STEP awards first, second, and third place cash award for: elementary, middle, and high school.

### **Science Fair Savings Bonds**

Each year STEP awards a \$1,000 U.S. Savings Bond to a senior division student, a \$500 U.S. Savings Bond to a junior division student, and a \$200 U.S. Savings Bond to an elementary division student at the Inland Science and Engineering Fair for outstanding demonstration of scientific investigation. These awards are the largest of their kind in the largest regional science fair competition in California.

### **Science Fair Car Giveaway Program**

In 2003, STEP announced a Car Giveaway Program at the State Science Fair Competition. Due to the generosity of Singh Chevrolet in Riverside, STEP was able to award a senior high school student, who was admitted to college, with a brand new Chevrolet for winning First Place at the State Science Fair in Los Angeles. This Car Giveaway value of \$16,000 accounted for more than 25% of the State's Science Fair awards. Danielle Robinson, who attended Norco High School, was the lucky winner!

## **Science Olympiad**

As a partner with the Science Olympiad, STEP provides junior and senior high school students with an opportunity to learn more about math and science through friendly competition. To assist our region's competitiveness at the national level, STEP awards stipends for teachers to attend the Science Olympiad Summer Training Camp. STEP also played host to the 2004 Science Olympiad competition.