

Science Education in the National Interest



S Science &
T Technology
E Education
P Program

Science & Technology Education Program

*Annual Report
FY98*

Lawrence Livermore National Laboratory

DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

Lawrence Livermore National Laboratory

***Science & Technology
Education Program***

***Annual Report
FY98***

May 1999

*This work was performed under the auspices of the U.S. Department of Energy
by Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.*

Table of Contents

Overview	1
Introduction	1
New Director Appointed	1
Project Goals	2
Project Funding	2
Collaborative Efforts	3
Projects Funded by Defense Programs	3
Projects Funded by Laboratory General and Administrative Distributed Budget	3
Project Descriptions, Objectives and Accomplishments	4
Major FY98 Emphasis	4
Section 1 – Student Research Opportunities	5
Global/National Security Cooperative (NSC) Program	5
HBCU/ HSI/MI Research Collaborations Program (RCP)	8
Military Academy Research Associates (MARA)	10
Undergraduate Research Semester (URS)	13
Actinide Sciences Summer School Program (ASSSP)	17
Section 2 – Education Technology	21
Technology Resource Center	21
High-Performance (ASCI) Computing and Visualization	23
National Education Supercomputer Program (NESP)	25
Section 3 – Teacher Enhancement and Curriculum Improvement	27
Laser Science and Optics in the Classroom (LSOC)	27
Centers for Excellence in Student Research (CESR)	30
Critical Issues Forum (CIF)	32
Section 4 – Science Literacy and Education Outreach	35
Science on Saturday (SOS)	35
Fun with Science (FWS)	36
Expanding Your Horizons (EYH)	36
Future Scientists and Engineers of America (FSEA)	37
Math Challenge	38
Tri-Valley Science and Engineering Fair (TVSEF)	38
Explorer Post	39
Chabot Observatory Collaboration	39
Career Speakers	40
Partnership/Collaboration Efforts	40
Media Coverage	41
Appendix 1 – FY98 Participants and Demographics	43
Appendix 2 – STEP Project Contacts	49

Overview

STEP Contact: Don Correll

Introduction

The Science & Technology Education Program (STEP) at Lawrence Livermore National Laboratory strengthened its education goals and program content throughout fiscal year 1998. In addition, the science education activities offered through STEP further supported the educational needs of the Department of Energy Defense Programs and the local/regional community.

The Laboratory continued to serve as a resource and partner to students, teachers and university faculty, making available its world-class facilities, scientists and staff. In the broadest sense, these educational activities have helped to ensure both the national and economic security of our nation. Increasingly, the United States must have a citizenry and workforce capable of understanding and applying the scientific and technological innovations important to these critical concerns.

New Director Appointed

In May 1998, the Laboratory Deputy Director for Science & Technology and the Director for University Relations Program announced that Don Correll, Ph.D., would be the new director of the Science & Technology Education Program.

Project Goals

STEP was reorganized to more efficiently lead the Laboratory's science education activities with four goals for its projects.

FY98 Goals for STEP

- (1) To provide research opportunities at Lawrence Livermore National Laboratory (LLNL) for undergraduate and graduate students;
- (2) To exploit new ground in the use of current technology, such as the Internet, through educational activities that relate to and support the DOE scientific mission at the Laboratory;
- (3) To support pre-college teacher enhancement and curriculum improvement in technologies of special interest to the Laboratory;
- (4) To increase science literacy through educational outreach, with a special emphasis on the local and regional needs surrounding Lawrence Livermore National Laboratory.

Project Funding

Projects supported by the LLNL Science and Technology Education Program are funded from two sources:

- DOE Defense Programs (DP) Education Program
- LLNL General and Administrative Distributed Budget

Education projects funded by the DOE Defense Programs have their own individual objectives within goals (1) through (3); however, they all share a common overarching metric:

College students entering careers important to the intellectual capability required by the DOE national security mission.

Projects funded by the LLNL General and Administrative Distributed Budget also have specific objectives within goal (4); however, these education projects also share a common overall metric:

Pre-college students becoming aware of the role of science in our nation's future, and promoting science and technology careers required to meet future scientific goals.

Collaborative Efforts

The LLNL Science and Technology Program – <http://education.llnl.gov> – interacts closely with other LLNL educational activities which are managed by various areas within the Laboratory and are funded by different sources.

University Relations Program (URP)

<http://ep.llnl.gov/urp/>

Encourages and expands research collaborations between Lawrence Livermore National Laboratory and universities, research organizations and industries.

Summer Employment Program

<http://www.llnl.gov/llnl/02summer/SEP97x.html>

Offers full-time science and technology summer research appointments – for up to 12 weeks – to undergraduate and graduate students, university faculty, high school/secondary teachers and, occasionally, high school students.

Affirmative Action and Diversity Program (AADP)

<http://www.llnl.gov/aadp/zoutrea.html>

Represents the Laboratory to diverse communities as a resource for employment, education, and commercial ventures. For example, the American Indian Program (AIP) independently reviews and prioritizes action items relating to American Indian issues for the Laboratory and DOE/HQ.

Individual Laboratory Directorates, Divisions, and Programs

<http://www.llnl.gov/llnl/10org/direct.html>

Respond to unique needs as defined by the program content of the organization's education and outreach activities.

UC Davis Department of Applied Science (DAS)

<http://www.engr.ucdavis.edu/~das/>

Located adjacent to the Laboratory, DAS is a graduate department which specializes in applied science and has a large number of adjunct professors from Lawrence Livermore National Laboratory.

Human Resources Department

<http://eodd-server.llnl.gov/EODD/TE/TandE.html>

Provides employees with a variety of education and training opportunities through several academic programs. Employees may pursue an undergraduate or graduate degree from a local university; enroll in job-related university courses; or view televised seminars and courses.

Projects Funded by Defense Programs

With funding supplied from Defense Programs, STEP facilitates partnerships and collaborations with the education community to help ensure a highly-skilled, diverse workforce for the science and technology challenges within DP's national security mission needs.

Individual education projects fall inside of the DP mission-based science programs, such as the Accelerated Strategic Computing Initiative (ASCI) and the National Ignition Facility (NIF). These education projects engage students within the DP-relevant disciplines of computations/visualization, chemistry/materials science, engineering, physics, and other related physical sciences, such as lasers and optics. STEP projects place undergraduate and graduate students within DP research areas that cover a spectrum of topics – from high-performance computing, to laser physics, to nuclear chemistry.

The underlying goal of STEP projects funded by Defense Programs is to support the long-term workforce and core-competency needs of DOE/DP's programs related to national security.

As with the Lab's research, STEP's Defense Program science education is conducted in many circumstances as a collaboration between LLNL and the other DOE-DP national laboratories – Los Alamos National Laboratory (LANL) and Sandia National Laboratory (SNL).

A common theme of the science education projects within STEP is the integration of research and education at all school levels – pre-college, undergraduate, graduate. This integration is accomplished, in part, by having the Laboratory's science education activities take place within its DP mission-based, science programs.

Projects Funded by Laboratory General and Administrative Distributed Budget

With funding supplied from the LLNL General and Administrative Distributed Budget, STEP motivates pre-college students to consider a college education as part of their future career choices. These pre-college science literacy activities play an important role in the creation of future scientists, engineers and technicians by enlightening students to potential careers in science and technology, especially those of special interest to LLNL.

Through local and regional education partnerships, STEP leads the Lab's education efforts to stimulate greater interest in science and technology among students, teachers,

administrators and the public, and to encourage more students to pursue scientific and technical careers after high school. Such an education outcome is important to the economic security of our nation, so that the United States can compete successfully in the world marketplace and remain a major economic power.

Project Descriptions, Objectives and Accomplishments

The FY98 Annual Report for the LLNL Science and Technology Education Program is organized in four major sections, with titles that reflect the four major goals stated above. Each section provides descriptions of the corresponding projects and their goals, objectives, and accomplishments.

In addition, Appendix 1 presents Participant Numbers and Demographics for the various STEP projects. Briefly, STEP projects in fiscal year 1998 directly interacted with 262 pre-college and college student research interns, 2,015 elementary- and secondary-school teachers, and 10,920 elementary- and secondary-school students.

Appendix 2 provides STEP project contact information, which includes an organization chart, and a listing of staff managers and e-mail addresses.

Major FY98 Emphasis

During fiscal 1998, it became even more apparent that – because of a decline in U.S. students majoring in technical disciplines of interest to LLNL, such as physics – additional components needed to be added to our education activities. As reported by American Institute of Physics (AIP Enrollments and Degrees Report, January 1998), the situation with respect to U.S. students is that the number of undergraduates completing B.S. degrees in physics has been declining for the past seven years, leading to an overall reduction of 17%. In addition, the negative slope in the number of B.S. degrees awarded will not be changing over the next few years, as indicated by the undergraduate, junior-level enrollments in physics.

To reinforce the addition of those components, a new “Education – Research – Career” theme was developed for our science education projects involving pre-college, undergraduate, and graduate students. The “Education – Research – Career” road map attempts to answer the question, “What is the path that must be chosen to guarantee a challenging and rewarding career within science and technology?”

Student research interns participating in STEP experiences have added to their skills, knowledge, and abilities, which has supported them along a successful path to undergraduate school, graduate school, and/or a science research career.

During FY98, 104 high school, 114 undergraduate, and 44 graduate students participated in STEP projects which lasted for a period of a summer, semester or full academic year.

When these students were part of the Laboratory’s scientific inquiry, they directly experienced and participated in the Lab’s mission of “Science in the National Interest,” as is stated on the LLNL Web page – <http://www.llnl.gov>.

As the Science and Technology Education Program continues to facilitate student and teacher participation in LLNL research, we are accomplishing “science education in the national interest.”

Current STEP activities for FY 1999 are described on our Web home page (<http://education.llnl.gov>) under the banner “Science Education in the National Interest.”

Section 1 – Student Research Opportunities

Introduction

The STEP student research opportunities at LLNL mirror the educational and research opportunities provided by colleagues at other institutions, such as LANL and SNL. Student interns who have been involved in the Laboratory's world-class research have received experiences, which, in turn, have supported their educational and career goals. Exposing interns to scientific research and scientific careers will increase the number of successful students who choose careers of importance to the LLNL science and technology mission. Therefore, STEP offers numerous internships to undergraduate and graduate students that provide opportunities to become part of our world-class workforce and to use the Laboratory's state-of-the-art facilities.

Global/National Security Cooperative (NSC)

STEP Contact: Barry Goldman

Description

Global/National Security Cooperative (NSC) internships assist undergraduate and graduate students in science, mathematics, engineering, technology (SMET) and science teaching to complete their degree requirements and prepare for the transition into scientific careers in support of the Defense Program mission. NSC offers a unique blend of research experience and continuing education.

Student interns work as research team members in their fields of interest and earn credit for courses accredited by their universities. This research contributes directly to their degree requirements.

Each intern is matched with a Laboratory scientist to work together on a significant research project supporting the Defense Programs mission. Laboratory technical staff act as mentors and volunteer their time to guide the work of students. As a result, interns demonstrate improved confidence in their ability to successfully apply academic knowledge in a research setting. Evaluation data show that student involvement in cutting-edge research and the development of student/mentor relationships are keys to favorably influencing undergraduate students in their pursuit of graduate studies and future careers in basic and applied research.

Applicants for internships are referred to NSC from a variety of education projects including (but not limited to) the non-laboratory institutions listed below. Students not associated with any of these projects can individually apply for an internship appointment.

Partners

Laboratory:

- LLNL DP Programs and Directorates
- Research Internships for Education (RIE)
- Atmospheric Release Advisory Capability (ARAC)

Non-Laboratory:

- Associated Western Universities (AWU)
- National Association for the Advancement of Colored People (NAACP)
- University of the Pacific Engineering Industry Fellowship
- Northern Arizona University (NAU)
- University of California and California State University Campuses

Goals and Objectives

- Attract students to DOE/DP areas of research.
- Raise student awareness of DOE/DP research and its contribution to society.
- Enhance the academic development of SMET students with hands-on activities.
- Promote teamwork skills as a method of solving complex problems.
- Increase the number of underrepresented students entering SMET careers.
- Promote students' confidence in their ability to successfully apply theory to solve real-life problems.
- Export DP research and technology to enhance university SMET curricula.

FY98 Accomplishments

Global/National Security Cooperative (NSC)

- In FY98, approximately 48 students participated in the NSC program. Research Internships for Education (RIE) was used as a process to fund stipends in collaboration with LLNL research departments for 25 of these internships. An electronic bulletin board was also developed to facilitate networking among student internships.
- Also in FY98, STEP under-represented participation in NSC was 22.5%. Typically 10% of the applicants are under represented. Furthermore, 40% of the NSC participants were women while 30% typically apply.
- A Student News/Bulletin Board was also developed to facilitate networking among students and across programs, departments, and directorates at LLNL. This also included a list server allowing students to interact with each other and a way for us to continue communicating following their return to their academic institutions.
- Developed searchable database for easy applicant and research access.

Project Challenges

FY98/99:

- The Research Internships for Education (RIE) process used for bringing in students as “student guests” was first piloted in FY98. This process initially had to be approved by representatives of Finance, Budgets and Human Resources, which required numerous meetings during the year to address many issues. Once approved, RIE quickly grew to host 25 students in its first year.
- Also during FY98 Associated Western Universities lost its contract with DOE and the ability to bring students and teachers into LLNL through ICOs and the Idaho Operations Office. Although there was concern whether AWU would be allowed at all to operate under contract with the Lab, this was formalized and all participants converted under the new contract.
- The RIE process was terminated within the Lab effective January 1999. This occurred because of new IRS regulation interpretations. The result is we now have to hire students as student employees (which raises their rate of pay by at least twofold) or hire participating guests through Associated Western Universities (AWU).

Publications and Presentations

- NSC participants were involved in all URS seminars during the fall and spring terms and the Lab-sponsored (and STEP co-hosted) Summer Highlight Lectures and Tours during the summer.

Media Coverage

- 4/17/98, *Newsline* article, “*Interns Get Closer Look at Lab Life*”

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
Virtual Reality Lab Tour	Two 6/11/98 7/16/98	• Student Tour	• Sandia	• Tim Berg
Meteorite Impacts Lecture	One 6/18/98	• Student Lecture	• LLNL, B361	• Peter Fiske
Addressing Challenges with Automation	One 7/9/98	• Student Lecture	• LLNL, B361	• Erna Grasz
Nonproliferation, Arms Control and International Security	One 7/23/98	• Student Lecture	• LLNL, B361	• Dr. Cochran
Nova/Beamlet Tour	One 7/30/98	• Student Tour	• LLNL, Nova Bldg.	• Gary Stone
Transition from Student to Technical Professional	One Lecture 8/6/98	• Student Lecture	• LLNL-STEP, B361	• Carla Hagans UCB

HBCU/HSI/MI Research Collaborations Program (RCP)

STEP Contact: Kennedy Reed

Description

The Research and Collaborations Program (RCP) establishes and nurtures scientific collaborations, linking accomplished researchers and students from HBCUs, HSIs, and MIs with principal investigators at LLNL. The major focus is on research that supports the DP scientific mission. The collaborations build upon and enhance research capabilities that exist at the schools, and provide access to facilities and expertise at LLNL for faculty and student participants. They expand the capabilities of the schools for training students in scientific disciplines of importance to LLNL and DP. Through the involvement of professors, post-doctoral researchers and students, these collaborations also provide additional manpower and expertise for basic and applied research at LLNL. RCP collaborations over the years have resulted in an average of 70% of the participants entering graduate school, with 30% majoring in physics.

Partners

Laboratory:

- LLNL National Security Program and Discipline Directorates

Non-Laboratory:

- Eleven HBCUs, such as Alabama A&M, Howard University, Morehouse College, Prairie View A&M, and Spelman College
- Two HSIs: Florida International University, City College of New York
- DOE ER, DOE EM, ORISE, Sandia-CA, Auburn University, and UC Davis

Goals and Objectives

- Involve faculty and students from HBCUs and MIs in collaborative research with LLNL in direct support of DOE/DP programmatic needs.
- Expand training capabilities at HBCUs and MIs by providing opportunities for faculty and students to work with LLNL facilities and scientists.
- Produce greater visibility for HBCUs and MIs in nationally recognized scientific endeavors.

FY98 Accomplishments

HBCU/HSI/MI Research Collaborations Program (RCP)

- Professors and students in this program submitted or published more than 15 papers in scientific journals and made more than 18 presentations at conferences on work connected with projects in the Research Collaborations Program.
- Professor Colm Mulcahey (Spelman College) and Dr. Farid Dowla (LLNL) jointly organized and chaired a symposium entitled “Wavelets: The Latest Big Splash in Science, Engineering, Imaging and Graphics” at the annual AAAS meeting in February, 1998. Their collaborative work on wavelets has been supported by the LLNL Research Collaborations Program for HBCUs and Minority Institutions.
- Research grant awarded by DOE/BES to hire post-doctoral researcher for three years to work part time at Morehouse College and part time at LLNL Electron Beam Ion Trap Facility on our collaborative atomic physics research project.
- The Physics Department at Florida International University (an HSI) was granted approval for a Ph.D. program. The department chair sent a letter acknowledging the crucial role that the LLNL Research Collaborations Program played in bringing the FIU research program to a level that warranted approval for a Ph.D. program.
- A grant for Inertial Fusion Science Supporting Stockpile Stewardship was awarded to a Howard University professor working in our collaboration on High Energy Density Studies at Nova. There were only 14 grants awarded nationwide and the Howard University project was the only recipient from an HBCU or MI. These grants support the work of professors, and assist in the training of students in research relevant to Stockpile Stewardship.
- Work on telescope facility at Howard University; UCDRD funds and LDRD feasibility study grant for LIDAR development to be used with telescope at Howard University Atmospheric Observatory.
- Two new collaborations were started last year, one with City College of New York (CCNY), an HSI, and another with Southern University, an HBCU.

Publications and Presentations

During fiscal year 1998, the LLNL and HBCU/HSI/MI researchers within RCP collaborations either submitted or published 15 articles in refereed journals and additional 15 publications in the proceedings of various technical meetings. The RCP collaborations also led to over 30 presentations at various professional scientific societies or university symposia. As an example of the refereed journal articles (submitted and published), here is a list of the publications that appeared in the calendar year portion of FY98 (January - September 1998):

- N. Woolsey, B. Hammel, C. Keane, C. Back, J. Moreno, J. Nash, A. Calisti, C. Mossé, R. Stamm, B. Talin, A. Asfaw, L. Klein, and R. Lee, “*Competing Effects of Collisional Ionization, and Radiative Cooling in Inertially Confined Plasmas,*” *Phys Rev E* 57, 4650, (1998)
- B. K. Rai, R. S. Katiyar, K. T. Chen, and A. Burger, “*Raman and Photoluminescence Studies on Intrinsic and Cr-doped Single Crystals,*” *J. Appl. Phys.*, 83(11) (1998)

Publications and Presentations *continued*

- Kenneth Hardy, “Kinematic explanation of the observation of very narrow linewidths from dissociative recombination reactions,” *Phys Rev A* 58, 1256 (1998)
- B. Ritchie and C. Weatherford, “Use of a Fast Fourier Transform (FFT) 3D Time-Dependent Schrodinger Equation Solver in Molecular Electronic Structure,” *Int. J. Quantum Chemistry* 70, 627 (1998)

Military Academic Research Associates (MARA)

STEP Contact: Barry Goldman

Description

In order to foster a stronger relationship with the military and enhance the ties between the DoD, the Laboratory and DOE/DP, we have been working with undergraduate military academies, as well as several graduate institutions. As a result, LLNL work-study internships are provided throughout the year for undergraduate and graduate cadets/midshipmen working in areas such as the National Ignition Facility, stockpile stewardship, advanced manufacturing, high-performance computing (ASCI), non-proliferation and arms control, and intelligence assessment. Cadets/midshipmen will work on projects that represent LLNL programs that focus on national security issues and will study complex global issues by participating in ongoing Laboratory research efforts.

This experience is designed to enhance undergraduate and graduate learning and achievement in science through hands-on research experiences. These placements also offer them the opportunity to participate in on-going collaborative, multi-disciplinary teams pursuing scientific and technical solutions to some of our nation’s most challenging problems, many of which address areas critical to national defense.

Partners

Laboratory:

- Defense Program Directorates within LLNL and Sandia National Laboratories

Non-Laboratory:

- West Point (USMA)
- The US Naval Academy (USNA)
- The US Air Force Academy (USAFA)
- The Naval Postgraduate School (NPS)
- The Air Force Institute of Technology (AFIT)
- The US Coast Guard (USCG)
- The California National Guard
- The Reserve Officer Training Corps (ROTC)

Goals and Objectives

- Expose cadets/midshipmen and graduates to military research at LLNL.
- Provide thesis and research opportunities to cadets/midshipmen in support of research at LLNL.
- Facilitate civilian/military faculty and research collaborations.
- Utilize Laboratory research opportunities to encourage more cadets/midshipmen to pursue scientific and technical careers if they do not pursue military careers.
- Cadets/midshipmen gain self confidence in their ability to contribute to research.
- Cadets/midshipmen gain confidence in applying theory to real life and ongoing problems.
- Cadets/midshipmen benefit from the technology (and techniques gained from their) experience, networking, publications, and exposure to issues of national defense.
- Expand to include ROTC, thereby recruiting ROTC students to participate in URS and longer internships.

FY98 Accomplishments

Military Academic Research Associates

- MARA expanded exponentially in FY98. Expansion occurred with the addition of Sandia National Laboratories including the program as a part of their science education outreach efforts at both laboratory locations in New Mexico and California. Expansion also included cadets from West Point and the US Naval Academy with additional meetings/phone discussions to include the US Coast Guard and the California National Guard. Participation grew from some five cadets in FY97 to 23 in FY98 or a 360% increase in participation.
- Implemented Academy Day to highlight Lab DoD research.
- Presented Academy Day to cadets and midshipmen; briefings provided by top management; included an overview of all the DoD and military research being performed at LLNL (followed by tours) and with the expansion to include Sandia National Laboratories.
- Established Memorandum of Understanding with each academy under MARA.

Project Challenges

FY98/99:

- Because academy cadets/midshipmen are only available for five to six weeks during the summer, it is a challenge to locate meaningful projects. This is also a challenge because researchers lose the 10 to 12 weeks of student support from summer hires when they commit to an academy cadet/midshipmen.
- Expand the program to include ROTC participants continues to be a challenge because of ROTC commitments, scheduling difficulties, obtaining credits for off-site experiences so that one does not lose their military scholarships, and the need to take sequential courses and not delay their graduation. Also, identifying the partnership between LLNL and Sandia in the MARA collaboration. An LLNL steering committee is being identified for future direction and oversight.

Media Coverage

- September 1998, *DOE Monthly*, “Livermore hosts military student interns”
- 5/29/98, *Newsline* article, “Hands-on research experience for military cadets”

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
Academy Day	Two 6/2/98 7/16/98	<ul style="list-style-type: none"> • Profile LLNL DoD • Military research 	<ul style="list-style-type: none"> • LLNL – briefings held in B132, tours • Included Nova, ARAC, High Explosive Applications Facility and the Conflict Simulation Lab 	<ul style="list-style-type: none"> • George Miller, George Sakaldasis, Milt Finger, Ron Lehman, William Bookless, Tom Ramos, Lyle Cox, Col. Doug Beason, Michael Anastasio, Howard Powell, and Edward Teller. • The Lab Director Distinguished Lecture series hosted former Secretary of Defense, William Perry on 6/2/98.

On June 2, 1998, MARA participants included 12 USAFA cadets, three (3) West Point cadets, and seven USNA midshipmen. External participants included:

- Dr. Phillip Battle and Dr. Jim Huddle (physics professors) from the USNA
- Dr. Stephen Landowne (associate dean for Academic Research) and Col. Thomas Lainis (physics professor and summer research advisor) from West Point
- Lt. Col. Don R. Erbschloe (director of Faculty Research) and Capt. Ken Hart (Cadet Summer Research Program) and Col. Randall J. Stiles – USAF (director of Education)
- John Plencner (senior weapons scientist) and Jean Pruitt (DOE, Oakland Operations Office)

On July 16, 1998, an additional 13 faculty from the Naval Postgraduate School in Monterey participated.

Undergraduate Research Semester (URS)

STEP Contact: Beverly Williams

Description

The Undergraduate Research Semester (URS) Program provides unique and challenging off-campus research opportunities for upper-division undergraduate university students in science, mathematics, and engineering. This kind of research experience is not available at undergraduate institutions. This project is a partnership between Lawrence Livermore National Laboratory, Sandia National Laboratories (Albuquerque and Livermore), and Los Alamos National Laboratory, to provide 75+ science and engineering undergraduates a rich research experience in this collaborative program.

Students and laboratory scientists work together on significant research projects supporting the Defense Programs mission. Technical staff (mentors) volunteer their time to guide individual undergraduate students of science, math, and engineering through a 16-week research semester appointment. Supplementary educational activities enrich the participants' technical background and broaden their perspective for future career decisions. The combination of individual scientific research guided by mentors and supplementary educational activities structure the URS program as a dynamic opportunity for participating students and supports the Defense Programs mission immediately and in the future.

The URS Program enhances and expands upon the valuable connection between the university community and the DOE laboratories. Consequently, the program supports the traditional national goal to strengthen the quality of science, mathematics, and engineering research and education. The URS program places special emphasis on recruiting women and under-represented minorities in science and engineering fields.

Partners

Laboratory:

- Environmental Programs Directorate
- Computations (Nonproliferation/Arms Control)
- Proliferation Prevention and Arms Control
- Biology and Biotechnology Research Program
- Earth and Environmental Sciences
- Physics Directorate – Physics and Space Technology
- Electronic Engineering
- Chemistry and Material Science – Seaborg Institute for Transactinium Science
- Heath and Ecological Assessment

Non-Laboratory:

- Los Alamos National Laboratory
- Sandia National Laboratory, CA
- Sandia National Laboratory, NM

Goals and Objectives

- Develop a diverse workforce of individuals with enhanced problem solving and technical skills to enable the nation to meet current and future scientific and technological needs and to contribute to the research of the National Laboratories.
- Increase student's knowledge and skills in science, math, engineering, and technology topics.
- Increase student's understanding of the research process.
- Attract students to Department of Energy related areas of research.
- Strengthen and focus students' fields of study and career plans.
- Increase the diversity of students who participate in national research programs.

These objectives are formally and informally measured and evaluated through a variety of instruments and techniques that include surveys, informal feedback from mentors and students, observations, and student products.

FY98 Accomplishments

Undergraduate Research Semester (URS)

- Fiscal year 1998 marked the first year of the URS program. Lawrence Livermore National Laboratory and Sandia National Laboratories (CA) formed a successful collaboration by combining the URS student enhancement activities. Each lab shared the costs of the enhancement activities and coursework.
- Four of our outstanding fall 1998 URS students were selected to participate in the National Conference on Undergraduate Research (NCUR) at Salisbury University in Maryland. In addition, these students were selected to participate in the Council on Undergraduate Research (CUR) Second Annual Undergraduate Poster Session on Capital Hill. While in Washington, they met with their State Representatives to promote the value of undergraduate internship programs at the national laboratories.
- One of the participants, Dustin Froula, a senior from Cal Poly, was asked to speak to Secretary Peña's Science Advisory Board regarding the value of his URS internship experience at LLNL. The student was accepted to U.C. Davis based upon his experimental research on sonoluminescence (SL) for the Physics and Space Technology Directorate at LLNL.
- Developed a plan to market the URS program to undergraduate students.
- Coordinated the administration of URS among the Tri-Lab Coordinators.

Project Challenges

FY98/99:

- Rebuild the national recruiting infrastructure.
- To share in the costs, LLNL designed the URS Poster and Sandia National Laboratories-New Mexico printed and mailed the posters. Having these two major activities done in two different locations was a real challenge. Our September mailing deadline was not met due to the challenges of the two laboratory locations.
- Incorporate National ROTC students into the URS Program.

Project Challenges *continued*

- Develop an online URS application. The URS Web Page is available on the Internet; however, the online application did not work. Students had to download the URS application and mail to the DP lab of their choice.
- To hire all URS students as Laboratory employees will increase the cost per student. In addition, the LLNL hiring process is labor intensive. Students are unable to begin their URS semester as a group. Some students will experience a 17-week internship; others will have to shorten their internships to 14-15 weeks.
- Costs are higher; therefore, we have had to decrease our program from 12 to only eight students.
- The number of URS applicants available to LLNL was low for spring '99 semester. By the time STEP received approval from the Director's Office to charge 25% of URS student time to a special G&A account, most of the applicants had been chosen by the other DP labs.

Publications and Presentations

- Each URS student's final research paper is submitted to the Technical Information Department for review and release. Once reviewed, the Laboratory publishes the paper. In addition, each student co-authors a paper in his/her specific research field.

Media Coverage

- URS poster and flyer was mailed to 11,000 colleges and universities across the United States.
- Occasionally, *Newsline* (the weekly LLNL newspaper) features an article about our URS student activities. A half-page article featured the URS student participation in the National Conference on Undergraduate Research (NCUR) and the Undergraduate Research Poster Session on Capitol Hill, sponsored by the Council on Undergraduate Research (CUR).
- 5/29/98, *Newsline* article, "Lab interns preach gospel of undergraduate research to Congress"

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
Tours	3	<ul style="list-style-type: none"> • SNL-CA and LLNL-Livermore Site 300 	<ul style="list-style-type: none"> • SNL-CA • LLNL-Livermore Site 300 	<ul style="list-style-type: none"> • Various LLNL and SNL employees
Seminar Series	6	<ul style="list-style-type: none"> • Enhancement Activity – student awareness of Lab-wide research opportunities available at LLNL and SNL 	<ul style="list-style-type: none"> • LLNL • SNL-CA 	<ul style="list-style-type: none"> • LLNL and SNL employees

Workshops and Events *continued*

Event Name	Number of Events	Event Purpose	Location(s)	Speaker(s)
Field Trips	4	<ul style="list-style-type: none"> • Enhancement Activity – Exposure to Science and Technology in the S.F. Bay Area 	<ul style="list-style-type: none"> • San Francisco • Lawrence Berkeley Lab • U.C. Santa Cruz, Long Marine Lab • Monterey Bay Sanctuary • Stanford Linear Accelerator • NASA - Ames 	<ul style="list-style-type: none"> • S.F. Exploratorium • LBL employees • U.C. Santa Cruz students • Monterey Bay Docents • Stanford Univ. Grad. Students • NASA employees
Workshops	6	<ul style="list-style-type: none"> • Enhancement Activity – skills necessary to meet student requirements: • Technology Web Page Development • Research Course (3) • Electronic Poster Development Class • Design and Delivery Presentation Class 	<ul style="list-style-type: none"> • LLNL 	<ul style="list-style-type: none"> • LLNL and SNL-CA employees and Consultant Companies
Events	6	<ul style="list-style-type: none"> • Enhancement Activity – Student/ URS Requirements • Mentor URS Orientation • Student/Mentor - Luncheon • Student URS Orientation • Poster Session • Student Symposium • Oral Presentations- Student/Mentor/ Awards Breakfast 	<ul style="list-style-type: none"> • LLNL • SNL-CA 	<ul style="list-style-type: none"> • LLNL and SNL-CA employees • URS Students

Actinide Sciences Summer School (ASSSP)

STEP Contact: Barry Goldman

Description

The purpose of the Actinide Sciences Summer School of the Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS) is to provide education and research training in transactinium science for undergraduate and graduate students. The intent of this project is to encourage students to pursue scientific careers, in general, and to give them exposure to the actinide sciences, which may encourage them to consider careers fields that lie at the heart of the DOE mission. It is particularly aimed at undergraduate students who have shown an interest in the field of nuclear science, and have attended the Nuclear Summer Schools at San Jose State University and Brookhaven National Laboratory funded by the DOE and sponsored by the American Chemical Society.

The program builds on students' classroom education, hands-on laboratory work with actinides, and training in the use of state-of-the-art instrumentation, thus the program reinforces and continues their interest through further specialized education. It is essential to encourage students in this field, through their college graduation, and help them pursue graduate studies or careers in actinide sciences.

Student participants will be partnered with laboratory scientists on research projects where they may be offered hands-on experience with plutonium and other actinides, and receive training in using state-of-the-art research equipment. Listed below are some possible research projects:

- Actinide migration, and nuclear waste disposal in the geosphere
- Separation chemistry of actinide and fission products related to nuclear diagnostics
- Modern spectroscopic methods for the detection and specification of actinide colloids
- Actinide interactions at the mineral water interface
- Geochemical modeling with actinide systems
- Molecular modeling and electronic structure calculations of actinides.
- Application of X-ray synchrotron radiation methods to actinides

Carefully-selected technical staff and program personnel served as mentors to the students and as counselors for educational possibilities that the students may wish to pursue. Distinguished scientists from around the world gave presentations to the participants during this summer program. Actinide students from across the United States had the unique opportunity to learn from professionals on the safe handling of radionuclides in glove boxes and how to safely work with plutonium compounds. Other activities for the summer students included:

- Tours of facilities at LBNL, Stanford University and the University of California Berkeley
- Participation in safety and presentation-skill classes
- Preparation of poster presentations for LLNL and the Internet.

The importance of the ASSSP is intensified by the shortage of actinide experts at LLNL, and, in fact, the world. This sector of the scientific community continues to retire, leaving ever-widening gaps in the core capabilities of the programs and disciplines throughout the DOE complex. The eventual goal of the Actinide Sciences Summer School Program is to support the long-term manpower and core-competency needs of the defense-related programs within DOE.

Partners

Laboratory:

- Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS)
- LLNL Chemistry and Material Sciences Directorate

Non-Laboratory:

- American Chemical Society
- San Jose State University and Brookhaven National Laboratory
- US student participants
- UC Berkeley

Goals and Objectives

- The LLNL objective is to help the Laboratory and DOE educate and train the future generation of scientists in the knowledge and expertise required to meet the nation's changing needs in environmental protection and remediation; nuclear waste isolation; national security; nuclear surveillance; nuclear energy; and industrial applications of nuclear methods.

FY98 Accomplishments

Actinide Sciences Summer School Program

- Established LLNL/ASSSP as a national program taking students from across the United States.
- Program is intended as continuing educational research experience beyond the ACS Radiochemistry Summer Schools held annually at San Jose State and Brookhaven National Laboratories.
- Eight students from across the United States participated in a seven-week program.
- 30% of the ASSSP students attended the ACS Radiochemistry Summer School.
- One 1998 ASSSP student will be offered a postdoctoral research LLNL fellowship in FY99.
- Lecture series consisted of pioneer leaders in the field of actinide science from universities throughout the U.S. and from other national laboratories.
- Participants toured the Lawrence Berkeley National Laboratory cyclotron facilities and the Advanced Light Source.
- All students completed poster and Web presentations of their projects, available through this Web address:
http://www-cms.llnl.gov/private/seaborg_asssp_site/seaborg_home.html
- All students had “hands-on” laboratory experience with a short-term research project and were mentored by LLNL staff scientists.
- Provide “hands-on” laboratory radiological training needed that many universities cannot provide.

Project Challenges

FY98/99:

- Provide laboratory research and mentor experience equally to all students who require additional training.
- Attract high-quality candidates who are interested in nuclear and actinide science from a small national pool.
- Expense of local housing and travel costs for a nationally-represented student body impacted program's cost effectiveness.
- Expand the program to include more students.
- Expand the length of the program to give greater "hands-on" research experience.
- Involve more university faculty.
- Identify and provide additional LLNL safety courses for each student.
- Obtain University accreditation.

Publications and Presentations

Invited presentations

- Professor Darleane Hoffman, recipient of the 1997 National Medal of Science, Chemistry Department, University of California, Berkeley and Group Leader of Heavy Element Chemistry and Lawrence Berkeley National Laboratory.
Title: "Atom-at-a-time Chemistry of the Transactinide Elements"
- Professor Ken Czerwinski, Chemistry Department, Mass. Inst. of Technology
Title: "Nuclear Fun at MIT"
- Dr. David Clark, Director, Glenn T. Seaborg Institute at Los Alamos National Laboratory
Title: "Careers in Actinide Science – An Inorganic Chemist's Perspective"
- Dr. David Shuh, Staff Scientist, Lawrence Berkeley National Laboratory
Title: "Synchrotron Radiation Techniques for Actinide Chemistry and Materials Science"
- Dr. Dale Perry, Staff Scientist, Lawrence Berkeley National Laboratory
Title: "The Inherent Diversity of Actinide Chemistry"
- Dr. Dick Haire, Staff Scientist, Oak Ridge National Laboratory
Title: "Past, Present, and Future Perspectives of Actinide Science after Three Decades"
- Dr. Lynda Soderholm, Staff Scientist, Argonne National Laboratory
Title: "From Actinides to Superconductivity"
- Professor Sue Clark, Chemistry Department, Washington State University
Title: "Actinide Geochemistry"

Media Coverage

- 8/7/98, *Tri-Valley Herald* news article, "Lab's intern program fills chemist gap"
- 12/15/97, ASSSP Web site established:
http://www-cms.llnl.gov/private/seaborg_asssp_site/seaborg_home.html
- 7/31/98, *Newsline* article, "Laboratory program gives summer interns hands-on experience in radiological sciences"

Workshops and Events

- ASSSP students toured Lawrence Berkeley National Laboratory (LBNL) and had the opportunity to attend a lecture given by Nobel Laureate Professor Glenn T. Seaborg.
- Tour of the Cyclotron facility at LBNL and met with Prof. Darleane Hoffman, 1997 National Medal of Science award recipient, and her Heavy Element Research Group.
- Tour of Advanced Light Source at LBNL, a state-of-the-art synchrotron radiation facility for studying actinide materials.
- Lecture Series – See Publications and Presentations for list of scientists who participated in the ASSSP lecture series.

Section 2 – Education Technology

Introduction

As a science and technology national laboratory, Lawrence Livermore National Laboratory has always been committed to advancing technology within its mission-based science. Likewise, the use of technology to support our science education activities is a major goal of STEP.

A major component of the STEP Education Technology projects relates to use of the Internet and utilizing supporting educational materials available through the Web.

Pre-college teachers have a very little time to research science education material for use in the classroom. The Technology Resource Center helps teachers, who work under extremely tight schedules, to explore the Internet with greater ease and flexibility, and find materials that would be helpful to their students.

During FY99, beginning with Science on Saturday, we plan to add Internet access to our Science Literacy and Education Outreach projects.

The use of high-performance “supercomputers” for visualization in support of pre-college and undergraduate science education (the National Education Supercomputer Program) is possible because of the Internet and Web capabilities found at the majority of schools around the United States.

Technology Resource Center

STEP Contact: Brian Lindow

Description

The Technology Resource Center is an educational server (<http://hangar.llnl.gov>) and computer facility that allows our partners in the education community to communicate with LLNL and to reach out to the vast resources on the Internet. In addition to technology workshops, we are providing access to electronic lesson and curriculum materials centered on the Laboratory and Defense Programs, such as ARAC.

We believe that technology will serve as the gateway to the future both economically and socially. It is crucial, therefore, that both teachers and students be technically literate and understand the use of the Internet in research that support Defense Programs. This can only be accomplished through hands-on training and to place Laboratory technology in the hands of students and teachers.

Because of the demand and popularity of the entry-level workshops such as “Introduction to the Internet,” “Finding Educational Resources on the Internet,” and “Beginning Building Web Pages,” higher-level workshops have been developed and are extremely popular. A complete list of workshop offerings can be found at <http://hangar.llnl.gov/workshops.html>.

Partners

Laboratory:

- Computations Directorate

Goals and Objectives

- Integrate educational technology at the school, district and county level.
- Promote school-wide emphasis on the use of technology as a tool to support authentic learning.
- Increase use of the Internet as a research tool for teachers and students.
- Develop student knowledge of and hands-on experiences with technology.

FY98 Accomplishments

Technology Resource Center

- Former DOE Secretary Peña visited the Technology Resource Center computer lab and saw a demonstration of the technology workshops and Education Technology projects.
- Expanded to 12 different workshops.
- 99 total technology workshops presented.
- 2,015 registered teachers attended.
- 487 teachers, out of that 2,015, participated as part of in-service technology training.
- Added Web-based curriculum and registration; calendar; Web site editor; and banner creation system.

Publications and Presentations

- A variety of educational Web sites throughout the Internet have added links to the Technology Resource Center Web site. We have also made presentations at a number of educational technology conferences within California (e.g., San Joaquin, Alameda, and Contra Costa County Offices of Education educational conferences).

Media Coverage

- 4/98, *DOE This Month*, general announcement of Technology Resource Center workshops
- 8/10/98, *Tracy Press* newspaper article, "Lab helps teachers bring education to the Internet"
- 8/14/98, *Newsline*, "Lab in the news" LSOC workshop at SJSU

High-Performance (ASCI) Computing and Visualization

STEP Contact: Brian Lindow

Description

The purpose of the High-Performance (ASCI) Computing and Visualization project is to bring to the student's desktop the rich resource of high-performance computing and scientific visualization, adapted from the Accelerated Strategic Computing Initiative (ASCI) computing tools. This type of technology is currently available only to the scientific community. Through the use of these tools, for further scientific investigation, we expect students to explore many difficult concepts and topics previously only investigated by research scientists. One example already in progress is the Atmospheric Interactive Research (AIR) simulation.

Teachers working hand-in-hand with Laboratory computer scientists and atmospheric scientists from the Atmospheric Release Advisory Capability (ARAC) Program are adapting the unique capabilities and models tools from our DOE/DP-funded center to produce computer-generated models of atmospheric dispersion of potentially toxic or dangerous materials.

By using dispersion simulations, students can explore many difficult concepts associated with physics, earth science, biology, and chemistry. Discussions of the consequences of dispersed substances can lead to a greater understanding of the associated ethical, social, and historical issues.

Partners

Laboratory:

- Accelerated Strategic Computing Initiative (ASCI)

Goals and Objectives

- Integrate the National Education Supercomputer Program activities with the ASCI educational activities and begin the search for funding of an upgrade to the Cray YMP-EL.
- Demonstrate the unique computational capabilities of ASCI to teachers and students and give them access to computing tools and resources.
- In the LLNL' Visitors' Center, provide live demonstrations of the current simulations running on the National Education Supercomputer and on the unclassified ASCI machines.
- Encourage students to pursue careers in scientific computing and visualization and to understand the role of simulation and modeling in scientific research.
- Create virtual reality tours of ARAC, Nova, ASCI, and (in the future) NIF.

FY98 Accomplishments

High-Performance (ASCI) Computing and Visualization Project; Atmospheric Interactive Research (AIR)

- Prototype of simulation on the supercomputer (NES, Cray YMP-EL).
- Added the capabilities to save/edit in the Java applet.
- Granted \$200K in funding from DOE-ER for continued development and incorporation into the NESP
- Over 2,000 downloads and executions of the Gausslet simulation.
- Over 7,000 requests per month on the Web site.
- Created a Java applet for the Atmospheric Interactive Research project that allows students and teachers to run simulations over the Internet.

Project Challenges

FY98/99:

- Past and present challenges include maintaining a supercomputer on a very limited budget and converting the non-parallel applications on the Cray to parallel applications on the new NES. Future challenges include identifying simulations that can be adapted for educational use without substantial rewriting or explanation.

Publications and Presentations

- A variety of educational and technical Web sites throughout the Internet have added links to the Atmospheric Interactive Research Web site, e.g., the Eisenhower National Clearinghouse (<http://www.enc.org>).

Media Coverage

- Selected as one of the top dozen educational sites on the Internet by the Eisenhower National Clearinghouse (a federal clearinghouse for educational materials on the Internet) for the month of February 1998.

National Education Supercomputer Program (NESP)

STEP Contact: Brian Lindow

Description

The National Education Supercomputer Program (NESP) is a national resource utilized by more than 15,000 education-community users nationwide. NESP brings the power of advanced scientific computing, previously available only at national laboratories, to a much broader community. The NESP provides a platform to demonstrate the use of simulation and modeling scientific research, which is the cornerstone of the Accelerated Strategic Computing Initiative (ASCI).

Partners

Laboratory:

- Computations Directorate
- Atmospheric Release Advisory Capability

Non-Laboratory:

- Minnehaha Academy – Minneapolis, MN

Goals and Objectives

- Prepare the NESP hardware and software for upgrade and integration into the ASCI educational activities.
- Integrate technology at the school level and eventually at the district level.
- Promote school-wide use of computer technology as a tool to support authentic learning.
- Develop student knowledge and hands-on experiences with technology.
- Integrate the use of simulation and modeling as a tool in teaching science.

FY98 Accomplishments

National Education Supercomputer Program (NESP)

- Maintained a resource that is actively used by 15,000 teachers and students in all 50 states.
- Over 300 computer simulations run per day by students throughout the country.
- Over 20,000 requests per month on the web site.
- Continued to convert the existing software (Wireman, CliMoMan) into Java applets so that they can run through a Web browser.
- Continued the installation of the ARAC Gaussian model to run on the supercomputer with an interface to the Java applet.
- The Minnehaha Academy continued to test the NESP software and develop curricular units incorporating the software.

Publications and Presentations

- A variety of educational and technical Web sites throughout the Internet have added links to the National Education Supercomputer Program Web site.
- Presentation at the Technology Leadership Conference

Media Coverage

- The National Education Supercomputer Program is presented and discussed at a variety of educational conferences (e.g., NSTA) by the master teachers in the NESP. These teachers describe the program and encourage other teachers to become involved.

Workshops and Events

- Workshop at the Technology Leadership Conference in Brainard, MN, June 5, 1998.

Section 3 – Teacher Enhancement and Curriculum Improvement

Introduction

STEP supports pre-college teacher enhancement and curriculum improvement in the sciences and technologies of interest to Lawrence Livermore National Laboratory to help with the overall “pipeline” issue of helping high school students develop the skills necessary to consider science and technology majors in college. Our projects in support of this goal emphasize creative thinking and problem-solving skills necessary for a successful undergraduate education in science, mathematics, engineering, and technology majors. These projects include, among other activities, workshops in which the direct participants (high school teachers or students) are introduced to scientific research methods that support the particular objective(s) of the project.

Laser Science and Optics in the Classroom (LSOC)

STEP Contact: Richard Farnsworth

Description

The Laser Science and Optics in the Classroom (LSOC) program is a high-school component initializing a School-to-Career path, leading students to careers in laser science and optics. Teachers who participate in LSOC receive materials and lessons to help them integrate laser and optics technology into high-school science and mathematics curricula. LSOC lessons are activity-based, giving students hands-on experience using lasers and optics equipment.

The goal for the funding provided in FY98 was to conduct a study to determine what a high-school laser-education program would look like and create lesson plans. During the first year, LSOC accomplished that goal and moved into lesson plan and materials development and began pilot testing materials in schools.

The LSOC Web site connects students, parents and teachers to the entrance requirements for undergraduate and graduate laser and optics programs; provides virtual tours of LLNL laser laboratories with introductions to the men and women who perform the work; and links them to employment opportunities.

Partners

Laboratory:

- Laser Programs

Non-Laboratory:

- Los Angeles, Fresno, Pleasanton, San Ramon School Districts
- San Francisco Exploratorium
- San Jose State University
- San Jose Tech Museum
- Las Positas Community College

Goals and Objectives

- Increase the number of students aware of laser science and optics career opportunities.
- Increase student awareness of career and education opportunities.
- Develop and disseminate laser and optics lesson plans.
- Develop classroom laser and optics equipment.
- Conduct teacher in-service instruction.
- Integrate research into pre-college instruction.
- Present student research in Optical Society of America (OSA) conferences.
- Provide teacher internships in laser and optics programs.

FY98 Accomplishments

Laser Science and Optics in the Classroom, LSOC

- Developed lesson plans and materials.
- Developed collaborative partnerships to leverage costs, acquire expertise in curriculum development, and participate in dissemination.
- Developed laser activities and classroom equipment to support student activities.
- Created a Web-based lesson dissemination database to allow teachers in distant locations to create and submit lessons for use in the LSOC, and be able to acquire LSOC lessons.
- Received and piloted test science and math lessons in classrooms.
- Trained 40 teachers to use the LSOC materials as the LSOC pilot test audience.
- Drafted 40 lessons using lasers and optics.

Project Challenges

FY98/99:

- Obtain funding.
- Manage growth and demand for the program.

Publications and Presentations

Invited Presentations:

- San Francisco Exploratorium
- San Jose Tech Museum
- Los Angeles Unified School District
- DOE Day Oakland

Media Coverage

- 8/3/98, *The Valley Times* newspaper article, “High school teachers learn laser lessons”
- 8/7/98, *Newsline* article, “Making education crystal clear”

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
LSOC Teacher In-Service Workshop	3	<ul style="list-style-type: none"> • Prepare teachers to use the LSOC kit in the classroom • Draft lessons for the LSOC database • Develop master workshop trainers for the region (NOTE: Merced City College provided two faculty; others to follow in FY99) 	<ul style="list-style-type: none"> • San Jose State University, Physics Dept. facility • San Francisco Exploratorium • San Jose Tech Museum 	<ul style="list-style-type: none"> • Prof. Gareth Williams, Physics Department, SJSU • Paul Doherty, Senior Scientist, Exploratorium
LSOC Teacher Tours of LLNL laser laboratories	1	<ul style="list-style-type: none"> • Introduce teachers to laser research applications 	<ul style="list-style-type: none"> • Medical Photonics • Nova • Crystal Laboratory 	<ul style="list-style-type: none"> • John Marion • Natalia Zaitsva • Gary Ross

Centers for Excellence in Student Research (CESR)

STEP Contact: Richard Farnsworth

Description

The Centers for Excellence in Student Research (CESR) are sites that prepare teachers to guide students conducting independent research. The CESR provides teachers with instruction and resources to help them introduce research as a learning strategy into the classroom. CESR is divided into three components:

- Research Boot Camp: a workshop where teachers learn the fundamentals of research and strategies to guide students conducting research;
- Boot Camp Follow-up: teachers and their students receive ongoing mentoring throughout the research project; and
- Student Research Symposium: students present their findings.

Partners

Non-Laboratory:

- San Joaquin County Office of Education

Goals and Objectives

- Introduce research methods into classrooms leading to students conducting scientific research and communicating the results in a public forum.
- High school teachers will be able to understand and be able to guide student research projects.
- Under the guidance of teachers and outside mentors, students will complete research investigations; and students will communicate their research findings in a written paper and poster presentation in a Student Research Symposium.

FY98 Accomplishments

Centers for Excellence in Student Research (CESR)

- Eleven Boot Camp teachers completed the Follow-up workshops along with their students.
- Twenty-five students presented their findings in a Student Research Symposium.
- Boot Camp model was successfully applied to other research themes. In FY98, the San Joaquin County Office of Education adapted the Boot Camp to prepare teachers to guide student research in a health science theme in a project funded by the National Institute of Health.

Project Challenges

FY98/99:

- Continue funding.
- Disseminate the “Boot Camp” lesson plan curriculum to community colleges and universities to use in teacher in-service projects.
- Combine with the LSOC project.

Media Coverage

- 5/12/98, *Tri-Valley Herald* newspaper article, “*Symposium tests intellectual boundaries*”
- 5/17/98, *The Valley Times* newspaper article, “*Students take science to new level in program*”
- 5/22/98, *Newsline* article, “*A STEP up for science instruction thanks to Lab’s teacher boot camp*”

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
Boot Camp	1	<ul style="list-style-type: none"> • Prepare students to conduct research 	<ul style="list-style-type: none"> • LLNL 	<ul style="list-style-type: none"> • Dr. John Knezovich, Director of the LLNL Center for Accelerator Mass Spectrometry
Student Research Symposium	1	<ul style="list-style-type: none"> • Students present their research papers 	<ul style="list-style-type: none"> • Blackhawk Museum 	

Critical Issues Forum (CIF)

STEP Contact: Stephen Sesko

Description

The Critical Issues Forum (CIF) program, developed at Los Alamos National Laboratory, was designed to involve high school students and their teachers in issues related to proliferation and control of weapons of mass destruction (WMD), particularly nuclear weapons. Current modules in the CIF include:

- Proliferation, non-proliferation, and counter-proliferation issues
- The disposition of nuclear materials
- Issues related to terrorism and WMD.

In addition to the DP-oriented content, the LLNL CIF also provides students with comprehensive instruction and guidance on professional research methodologies, particularly strategies that can be used with the Internet. These methodologies include brainstorming, evaluation of content, synthesis of information, and professional writing.

The Critical Issues Forum is a collaborative project. LLNL-STEP – working with the Center For Non-proliferation Studies at the Monterey Institute of International Studies (MIIS) and with faculty from the Naval Post-graduate School (NPS) – leads the project in California, Oregon, Washington, and other locales. LANL-SET leads the project in New Mexico. LLNL-STEP also involves scientists and other professionals from within the LLNL complex.

Participants also take part in a culminating “conference” activity, where the individual teams address a real-world problem provided by the laboratories and/or the DOE, focusing on the topic. In the future, the laboratories and other organizations will consider using teleconferencing technology for the final student forum.

Partners

Laboratory:

- Science Education Team – Los Alamos National Laboratory

Non-Laboratory:

- Center for Non-Proliferation Studies – Monterey Institute of International Studies
- Faculty of the Naval Post-graduate School
- Joel E. Ferris High School – Spokane, WA
- Lewis and Clark High School – Spokane, WA
- Thurston High School – Springfield, OR
- Acalanes High School – Lafayette, CA
- California High School – San Ramon, CA
- San Leandro High School – San Leandro, CA
- Sierra High School – Manteca, CA
- Monterey High School – Monterey, CA
- The York School – Monterey, CA

Goals and Objectives

LLNL and LANL have established the following for CIF:

- Increase opportunities to develop greater public understanding of the DP National Laboratory missions by interrelating and leveraging DP Laboratory programs.
- Increase access to, and involvement with, Laboratory personnel (scientists, technicians, etc.).
- Provide opportunities for students and teachers to develop and apply critical thinking and problem solving skills to a complex problem of DP, national, and global significance.
- Increase public understanding of the issues relating to the future of the nuclear world.
- Model collaboration between large national institutions and state educational communities.
- Allow teachers and students to develop the connections between scientific concepts and everyday life.
- Provide multiple perspectives for the current issue.

FY98 Accomplishments

Critical Issues Forum (CIF)

- LLNL-STEP PIs worked with R. Alexander and W. Robertson of LANL to begin the CIF project in California.
- LLNL-STEP and LANL conducted discussions with Drs. A. Sands and C. Bowen of Monterey Institute to develop a West Coast collaboration.
- STEP recruited four schools for the FY98 topic; two schools discontinued later in the program because of curriculum changes at their sites.
- A kick-off conference for teachers was held at LLNL with R. Alexander and W. Robertson of LANL as guest speakers and facilitators.
- A kick-off conference for students was held at Las Positas Community College in Livermore, with guest speakers Drs. Lynne Anderson-Inman and Mark Horney, and content expert Dr. Clay Bowen.
- Four California students and their teacher attended the student conference held in New Mexico.
- Two California teachers took part in the two summer sessions that led to the development of the FY99 topic.
- Participated with two high school teachers and 50 students.
- Started to contribute to the CIF Web site at LANL.

Project Challenges

FY98/99:

- Because of issues raised about the topic for 97-98, LLNL STEP has become much more sensitized to the culture of LLNL and how it differs from the educational culture. As a result, we started a procedure that attempts to involve scientists and other experts in the decision-making processes of CIF 98-99. These experts come from NAI, classification, security, and other areas.
- The main challenge is the recruitment of new teachers into the project. It is our goal to increase the number from 8 to 12, possibly 15 for the next round of issues. We also want to begin the development of an LLNL Web site for CIF.
- Begin to involve the LLNL directorates to a much greater extent.

Publications and Presentations

An informal presentation of CIF was made at the Northwest Council for Computer Education conference in Spokane in March 1998.

Workshops and Events

<i>Event Name</i>	<i>Number of Events</i>	<i>Event Purpose</i>	<i>Location(s)</i>	<i>Speaker(s)</i>
CIF Kick-off Teacher Workshop	1	<ul style="list-style-type: none"> • Acquaint teachers with the program • Introduce the Web site, expectations, and requirements • Introduce the pedagogical concepts and the research methodologies • Introduce DP content 	<ul style="list-style-type: none"> • LLNL • Las Positas College 	<ul style="list-style-type: none"> • R. Alexander, W. Robertson of LANL, M. Horney, L. Anderson-Inman of University of Oregon
Student Workshop	1	<ul style="list-style-type: none"> • Acquaint students with the project 	<ul style="list-style-type: none"> • LLNL, Las Positas College 	<ul style="list-style-type: none"> • University of Oregon • M. Horney, L. Anderson-Inman
CIF Summer Workshops	2	<ul style="list-style-type: none"> • Introduce the DP topic content • Develop the topic structure, classroom activities • Develop resources for students 	<ul style="list-style-type: none"> • MIIS • LANL 	<ul style="list-style-type: none"> • MIIS • C. Bowen, G. Kampani, S. Parrish, M. Barletta, and K. O'Brien • LANL - R. Parker, H. T. Hawkins, P. Cunningham

Section 4 – Science Literacy and Education Outreach

Introduction

STEP's science literacy and education outreach efforts at LLNL are designed to address requests from both the education community as well as the public. Program audiences encompass everyone from students, parents, and teachers to organizations and businesses. Through our activities we showcase and raise the public's awareness of the Laboratory's research and development efforts in science, engineering and technology.

Some of these efforts depend primarily on volunteers throughout the Laboratory who are supported by their management. The Science & Technology Education Program staff provides additional support. In classrooms and at special events and workshops, volunteers conduct presentations, demonstrations and discussions centered on Laboratory expertise and core competencies in science and technology. They invite audience participation through hands-on activities and through stimulating discussion about the concepts being presented.

The STEP staff maintains an extensive collection of newspaper articles published in LLNL *Newsline* and various local newspapers about Science Literacy and Education Outreach activities. A listing of approximately 50 articles, published during fiscal year 1998, is offered at the end of this section under the heading "Media Coverage."

Science on Saturday (SOS)

STEP Contact: Don Correll

Description

Science on Saturday is a six- to nine-week series of presentations gleaned from the forefront of research in a variety of disciplines being conducted at LLNL and other R&D organizations. The goal is to allow students, through these lectures, to interact with well-known scientists and engineers in the hopes of increasing the numbers who pursue careers in science and technology. These presentations are co sponsored by Science and Technology Education Program and Sigma Xi.

FY98 Accomplishments

Science on Saturday (SOS)

- 1993 Nobel Laureate Russell Hulse, from the Princeton Plasma Physics Laboratory, was a guest speaker.
- Nine presentations were offered in FY98. The topics ranged from super fast computers to highlights from the MARS Pathfinder.
- A total of 2,375 students, parents, and teachers attended the FY98 series.

Fun with Science (FWS)

STEP Contact: Linda Dibble

Description

Through the Fun with Science (FWS) program, laboratory volunteers conduct interactive presentations and demonstrations in the classroom and at various community events. They engage the participants in discussions about scientific and mathematical concepts, ideas, and principles. In addition they invite audience participation both through hands-on demonstrations and through discussions about the concepts being presented.

FY98 Accomplishments

Fun with Science (FWS)

- A total of 4,160 K-12th grade students participated in the FWS presentations this year.
- The FWS volunteers visited twenty-eight schools and/or community events located throughout the state of California and Nevada.
- FWS participated in a special science Olympiad in Kings County, which is heavily populated by migrant workers' children.
- The second annual FWS picnic on the lawn was held in August and over 400 lab employees and their families attended this noon time event.

Expanding Your Horizons (EYH)

STEP Contact: Linda Dibble

Description

The Expanding Your Horizons (EYH) program provides an informal science experience for young women, grades 6-12, who are traditionally underrepresented in the sciences. Volunteers conduct one-day conferences, serve as role models, and offer hands-on activities that promote the importance of science, mathematics, engineering and technology as career choices.

FY98 Accomplishments

Expanding Your Horizons (EYH)

- This year over 600 young women attended the Tri-Valley Conference held in April at the Pacific Bell facility in San Ramon.
- This year over 350 young women attended the San Joaquin Conference held in October at the University of the Pacific in Stockton. The majority of these attendees were from underrepresented ethnic backgrounds.

Future Scientists and Engineers of America (FSEA)

STEP Contact: Don Correll

Description

STEP has partnered with the Future Scientists and Engineers of America (FSEA), a national, non-profit organization based in Southern California. FSEA provides the structure, project material, documentation and workshop training necessary to establish after-school science clubs in K-12 schools. The program is structured around LLNL volunteers mentoring students on science and engineering projects that challenge the students to creatively solve problems as a team.

FY98 Accomplishments

Future Scientists and Engineers of America (FSEA)

- A workshop was held for principals, teachers, mentors and others interested in FSEA. Two schools volunteered to pilot the program in the spring.
- The American Indian Charter School in Oakland, CA, became an official club in September. There are 30 students in this club.
- A combined elementary and middle school in Manteca, CA, became an official club in September, as well. There are 29 students in this club.

Math Challenge

STEP Contact: Don Correll

Description

Math Challenge is an annual competition sponsored by DOE and supported by Lawrence Livermore National Laboratory, which provides enrichment materials, scientific mentors, and judges. Schools from throughout Northern California may enter up to five teams, with three students each, who participate in this competition. The math challenge is a one-hour written test consists of 15 questions.

FY98 Accomplishments

Math Challenge

- During FY98, 50 high school students – representing nine separate high schools – participated in the event.

Tri-Valley Science and Engineering Fair (TVSEF)

STEP Contact: Don Correll

Description

The Tri-Valley Science and Engineering Fair (TVSEF) is a science competition for local middle and high school students, co-sponsored by Lawrence Livermore National Laboratory and the Tri-Valley Business Council. Students are offered opportunities to develop original scientific experiments under the guidance and mentorship of teachers and scientists and engineers from local businesses. The fair is affiliated with the Intel International Science and Engineering Fair.

FY98 Accomplishments

Tri-Valley Science and Engineering Fair (TVSEF)

- This year a total of 105 students participated in this event.
- The TVSEF team won third place at the International Fair.
- Donated funds by local businesses and industry increased from \$13K to \$25K.
- The Contra Costa Newspaper Group became a supporting sponsor.

Explorer Post

STEP Contact: Linda Dibble

Description

The Science and Engineering Explorer Post 957 is under the “career awareness” auspices of the Boy Scouts of America and is chartered by STEP/LLNL. Members consist of college-preparatory high school students who work on projects while learning how to conduct official club meetings, work in a team environment, and interact with adults as advisors and mentors. Some LLNL volunteers act as advisors to the students while others provide training, project demos, and tours.

FY98 Accomplishments

Explorer Post

- Membership increased to 41 high students in FY98, from 34 high school students in FY97.
- Student projects for the year included Web page development, Excel spreadsheet documents, and fiber optics demos.

Chabot Observatory Collaboration

STEP Contact: Brian Lindow

Description

STEP partnered with the Chabot Observatory to chair the Virtual Science Center committee and technology design for the new observatory. This new observatory is a \$52 million dollar facility being constructed in the Oakland Hills. It is a 76,000 square foot science education center similar to the Lawrence Hall of Science. The observatory is scheduled to open in late FY99. It will include a 250-seat planetarium, 210-seat OMNIMAX theater, multimedia technology lab center, a “Challenger Center” for space flight simulation, as well as numerous other attractions.

FY98 Accomplishments

Chabot Observatory Collaboration

- Developed the capability to explore the universe indoors, online with the Virtual Science Center, using the new SMARTNet (Science, Mathematics, and Real Technology Network).
- Developed prototype simulation/Web site and curricular units for the Virtual Science Center. Prototype topics include solar astronomy and virtual planetarium.

Career Speakers

STEP Contact: Linda Dibble

Description

Through the Career Speakers program, STEP answers various requests from the K-12 educational community for career speakers in classrooms and at career fairs, science fair judges, and one-day job shadowing opportunities. LLNL volunteers serve as role models for students, demonstrating that all people – regardless of ethnicity, gender, ages, and background – can pursue and enjoy careers in science or technology. These volunteers also raise public awareness of the Laboratory’s research and development efforts in science, engineering, and technology.

FY98 Accomplishments

Career Speakers

- STEP responded to 41 requests for volunteers to represent the Laboratory at school and community events.
- There were 3,150 participants involved in or attending these events. This number represents a broad spectrum of ethnic backgrounds.
- One volunteer answered over ten of these requests singularly and, because a majority of the students were from a Hispanic background, often spoke Spanish to the students.

Partnership/Collaboration Efforts

STEP Contact: Linda Dibble

Description

Educational Partnerships and Collaborations represents STEP’s efforts to address the requests, both by the education community as well as the public, for LLNL partnerships, collaborations, committee representation, and presentations. Through committee memberships we engage fellow members and participants in a better understanding of the programs offered through STEP and strengthen our relationships with the community at large.

FY98 Accomplishments

Partnership/Collaboration Efforts

- Two STEP managers co-chaired the California Cooperative Education Association's (CCEA) Annual Conference in Sacramento. Over 150 representatives – from community colleges, four-year colleges and universities, and private, public, and government businesses – participated in the conference.
- STEP recently submitted a proposal to house the first paid CCEA Executive Director. This bid was awarded to STEP and implementation is expected in FY99. This is expected to result in increased synergism between LLNL and all four-year and two-year academic institutions in the State of California regarding internships and school-to-career initiative.
- A STEP manager is now the President Elect for CCEA and will be President in June 1999.

Science Literacy and Education Outreach

Media Coverage

- 11/7/97, *Newsline* article, “Kickoff touts bigger fair, more flair” (TVSEF)
- 1/30/98, *Newsline* article, “‘Science on Saturday’ series gears up for second season”
- 2/6/98, *Valley Times* newspaper article, “Lab’s science series for students begins with special lesson”
- 2/4/98, *The Independent* newspaper article, “Popular Lab Series Is Back for Nine Weeks”
- 2/4/98, *The Independent* newspaper article, “Pleasanton Library Presents Super Science Series for Kids” (FWS)
- 2/6/98, *Tracy Press* newspaper article, “Lab aims to make science fun”
- 2/6/98, *San Francisco Chronicle* article, “Graphics Magic”
- 2/10/98, *Tri-Valley Herald* newspaper article, “Lab lecture on uses of supercomputers”
- 2/13/98, *Newsline* article, “Science on Saturday features ASCI leader”
- 2/14/98, *San Jose Mercury* newspaper article, “Lab talk to feature computer simulations”
- 2/18/98, *Tri-Valley Herald* newspaper article, “Discussion of the ‘Red Planet’ on tap Saturday”
- 2/18/98, *Tri-Valley Herald* newspaper article, “Exploring Mars tops Saturday’s talk on science”
- 2/19/98, *Stockton Record* newspaper article, “Pathfinder to be topic”
- 2/20/98, *Newsline* article, “JPL systems engineer to take employees, students on a special mission to Mars”
- 2/22/98, *Tri-Valley Herald* newspaper article, “Kids launch questions at Mars mission scientist”
- 2/23/98, *Tri-Valley Herald* newspaper article, “Pathfinder Revisited”
- 2/27/98, *Newsline* article, “Science on Saturday lecture goes probing for the next big quake”
- 2/27/98, *Stockton Record* newspaper article, “Quake talk Saturday”

Media Coverage *continued*

- 3/8/98, *Tri-Valley Herald* newspaper article, "Girls expand science and math horizons at San Ramon expo"
- 3/6/98, *Newsline* article, "Saturday speaker to examine technology's role in combating nuclear proliferation"
- 3/6/98, *Tracy Press* newspaper article, "Science lecture Saturday"
- 3/8/98, *The Valley Times* newspaper article, "Calculating for career success" (EYH)
- 3/13/98, *Newsline* article, "Investigating the mysteries of science" (EYH)
- 3/13/98, *Newsline* article, "Nobel Prize-winning physicist to share the story behind his discover of binary pulsars"
- 3/13/98, *Tri-Valley Herald* newspaper article, "Nobelism to talk about space"
- 3/13/98, *Tracy Press* newspaper article, "Science-lecture series continues at LLNL"
- 3/20/98, *Tracy Press* newspaper article, "Science talks continue at lab"
- 3/20/98, *The Valley Times* newspaper article, "Lab's wildlife biologist will be lecture guest"
- 3/20/98, *Newsline* article, "Lab's wildlife biologist to reveal mysterious life of underground creatures at Site 300"
- 3/26/98, *Tri-Valley Herald* newspaper article, "Teens who build model of heart will talk at lab"
- 3/27/98, *Tracy Press* newspaper article, "Lab lecture series continues"
- 3/27/98, *Newsline* article, "Science of Saturday to feature heart monitor research by students"
- April 1998, *American Scientist* (bimonthly), "Science on Saturdays Attracts Hundreds of Students"
- 4/2/98, *Tri-Valley Herald* newspaper article, "Robots featured at final Saturday lab talk for teens"
- 4/2/98, *San Jose Mercury News* article, "Classes/lectures - Science on Saturday"
- 4/3/98, *The Valley Times* newspaper article, "Robots to take center stage at lab lecture"
- 4/3/98, *Tri-Valley Herald* newspaper article, "Where fun is part of the equation"
- 4/3/98, *The Valley Times* newspaper article, "Students strut their scientific stuff at Blackhawk museum"
- 4/4/98, *Tri-Valley Herald* newspaper article, "Winning science fair projects on display at Blackhawk museum"
- 4/10/98, *Newsline* article, "Science" (TVSEF)
- 4/29/98, *Tri-Valley Herald* newspaper article, "Lab's Saturday talk focuses on radioactivity's mystery"
- 5/1/98, *The Valley Times* newspaper article, "Livermore lab engineer to give radioactivity talk for students"
- 5/1/98, *Tracy Press* newspaper article, "Illuminating lecture at LLNL"
- 5/16/98, *Tri-Valley Herald* newspaper article, "Pleasanton teens win an 'Oscar' at Intel fair" (TVSEF)
- 5/20/98, *The Independent* newspaper article, "Science Team a Winner"
- 5/22/98, *Newsline* article, "Sweet smell of success for research on healing power of garlic"
- June 1998, *DOE This Month*, "9th Annual Math Challenge"
- 8/8/98, *Hayward Daily Review* newspaper article, "Slimy goo helps give children science lessons sure to stick" (FWS)
- 8/27/98, *Tri-Valley Herald* newspaper article, "Teens don lab coats, research cancer" (TVSEF)
- 8/28/98, *Newsline* article, "Science fair winners get hands-on experience at Lab" (TVSEF)
- 9/4/98, *Newsline* article, "Science faire for kids of all ages" (FWS)
- 9/9/98, *The Valley Times* newspaper article, "Conference aims to expand girls' horizons" (EYH)

Appendix 1 FY98 Participants and Demographics

LLNL-STEP collects demographic data in two broad categories:

- Student and Teacher Programs
- Educational Outreach Programs

Within each category we collect data for pre-college (direct¹ and, where appropriate, indirect² participation), undergraduate, and graduate participants. The following table reflects the programs that are in each category:

<i>Student and Teacher Programs</i>	<i>Educational Outreach Programs</i>
Global/National Security Cooperative Program (NSC)	Math Challenge
HBCU/HSI/MI Research Collaboration Program (RCP)	Fun with Science (FWS)
Military Academy Research Associates (MARA)	Expanding Your Horizons (EYH)
Undergraduate Research Semester (URS)	Future Scientists and Engineers of America (FSEA)
Actinide Sciences Summer School Program (ASSSP)	Science on Saturday (SOS)
High-Performance (ASCI) Computing and Visualization	Tri-Valley Science and Engineering Fair (TVSEF)
National Education Supercomputer Program (NESP)	Explorer Post
Critical Issues Forum (CIF)	Career Speakers
Laser Curriculum (LSOC)	
Centers for Excellence in Student Research (CESR)	
Technology Resource Center <i>(data discussed separately)</i>	

Among the Student and Teacher activities, the emphasis is directed at the college level. Typically, the Student and Teacher Programs are directly funded from DOE-DP because of the DP mission-related content of the programs.

¹ K-12 teachers are included within “Direct Pre-College.”

² The “Indirect Pre-College Participants” were calculated using the following multipliers: Elementary (K-3rd = 20, or 4th-5th = 30); Middle School (125), or High School (150) factor – California State Department of Education statistics were used in calculating the Indirect Pre-College demographics (<http://www.cde.ca.gov/demographics/>).

In FY98, three programs:

- Critical Issues Forum (CIF)
- Laser Science and Optics in the Classroom (LSOC), and
- Centers for Excellence in Student Research (CESR)

were directed at pre-college participants.

Two computing projects:

- High-Performance (ASCI) Computing and Visualization, and
- National Education Supercomputer Program (NESP)

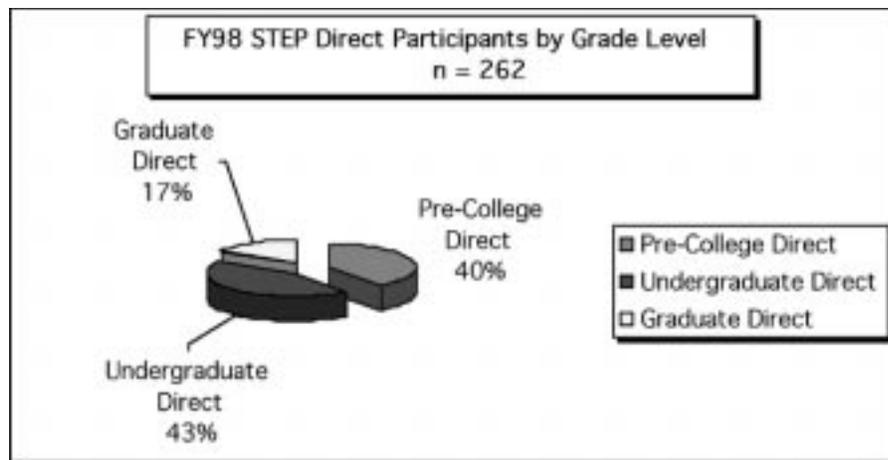
were used by participants from elementary school through the university level.

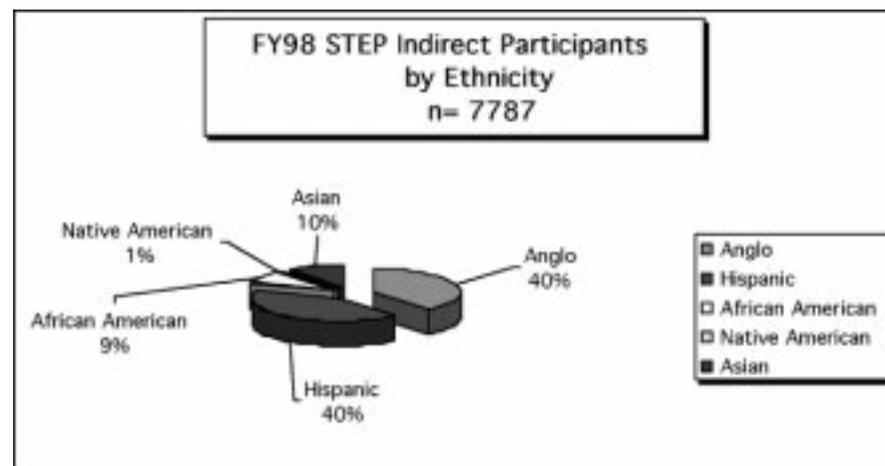
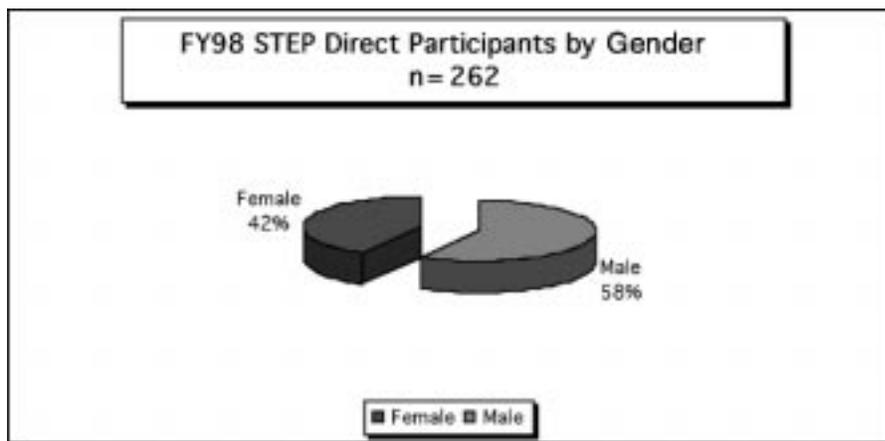
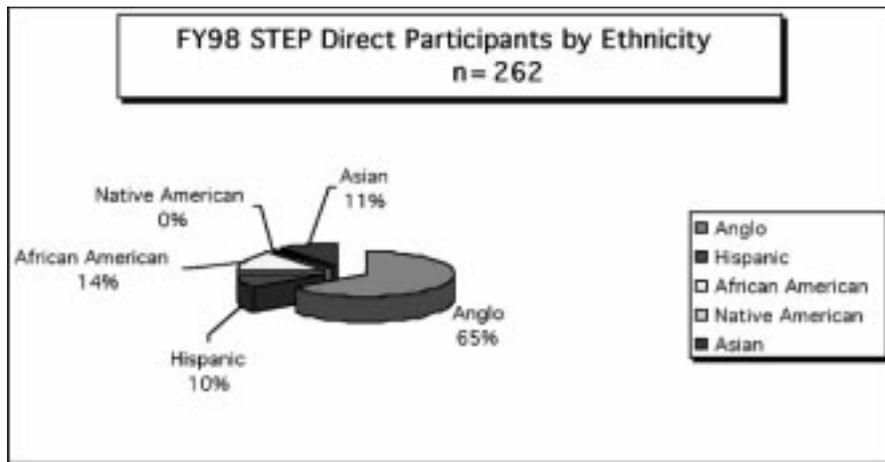
The Technology Resource Center program is unique and will be discussed later.

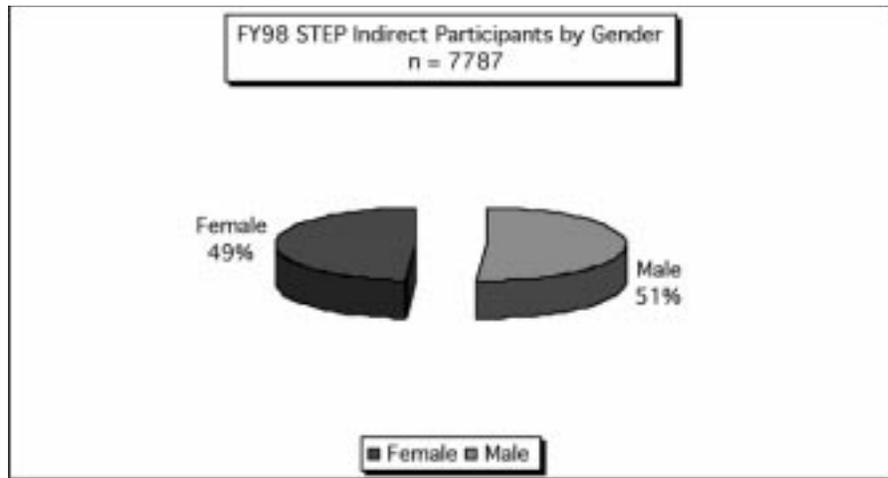
The following table presents total participant data for the Student and Teacher Programs, excluding the Technology Resource Center program:

	<i>Pre-college</i>	<i>Undergraduate</i>	<i>Graduate</i>
<i>Male</i>	55	68	30
<i>Female</i>	49	46	14
<i>Total</i>	104	114	44

The makeup of the Student and Teacher participants is shown in the following five graphs:





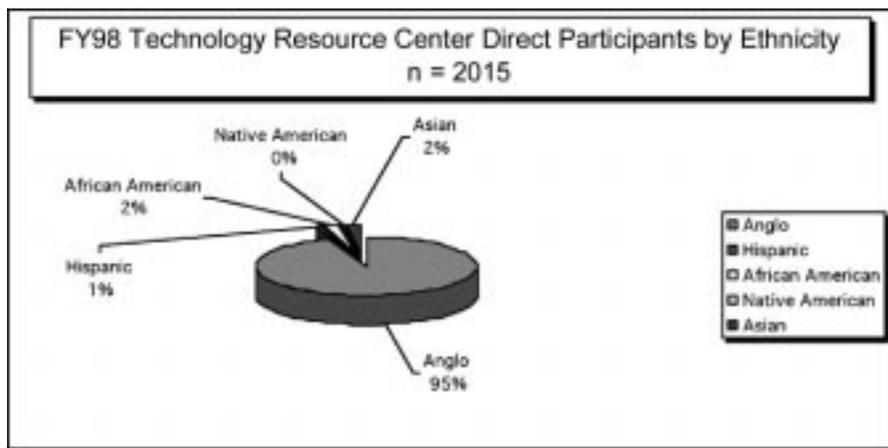


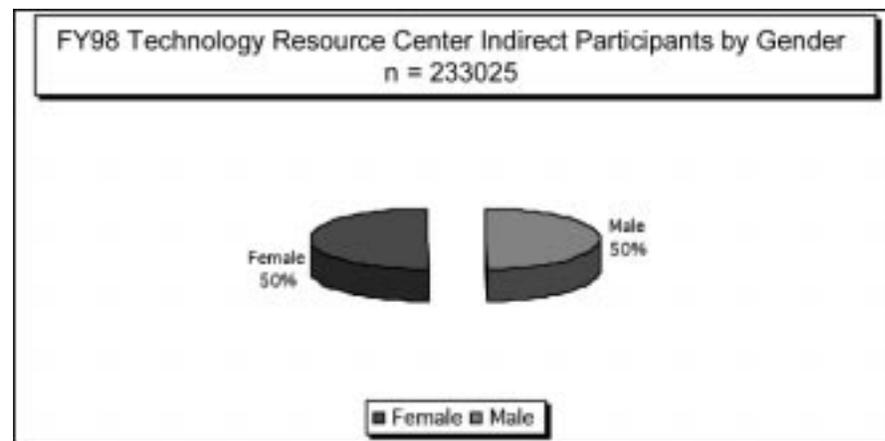
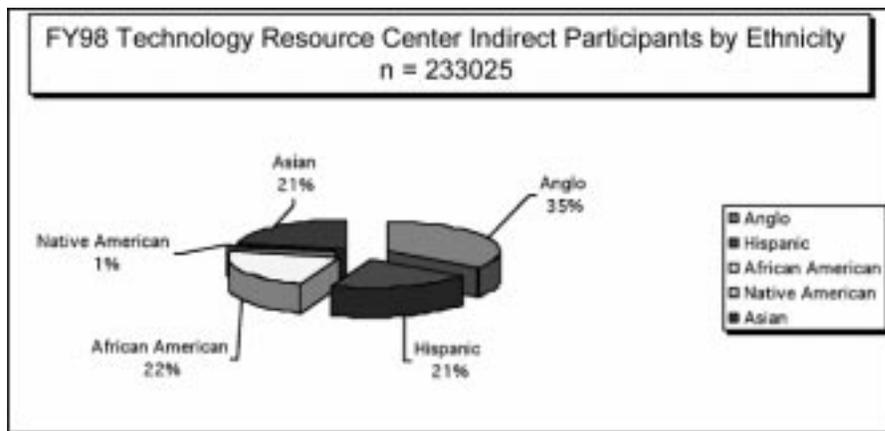
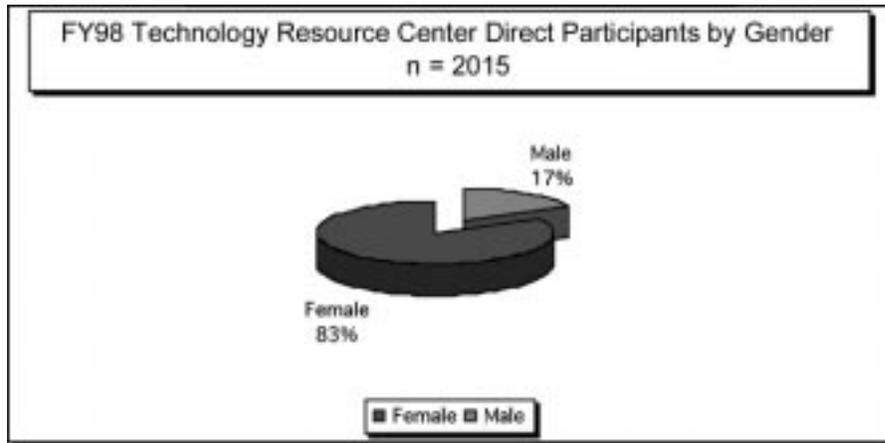
The Technology Resource Center is unique in that, while it is a DP-funded program, it fits the one-day-event description that characterizes most of the Educational Outreach programs. The Technology Resource Center instructors have helped teachers who work under extremely tight schedules, to explore the Internet for material that can be used to enhance science education instruction.

The following table presents total participant data for the Technology Resource Center:

	<i>Direct Participation</i>	<i>Indirect Participation</i>
Male	345	120,116
Female	1670	120,696
Total	2015	240,812

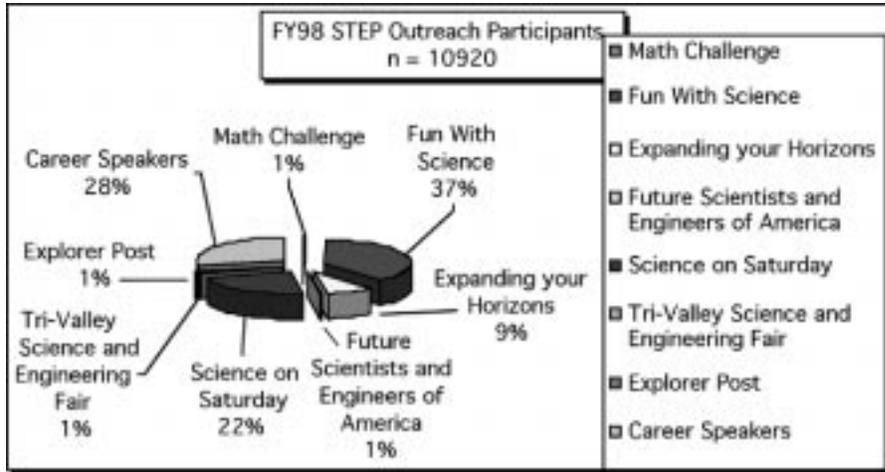
The makeup of the Technology Resource Center participants is shown in these graphs:





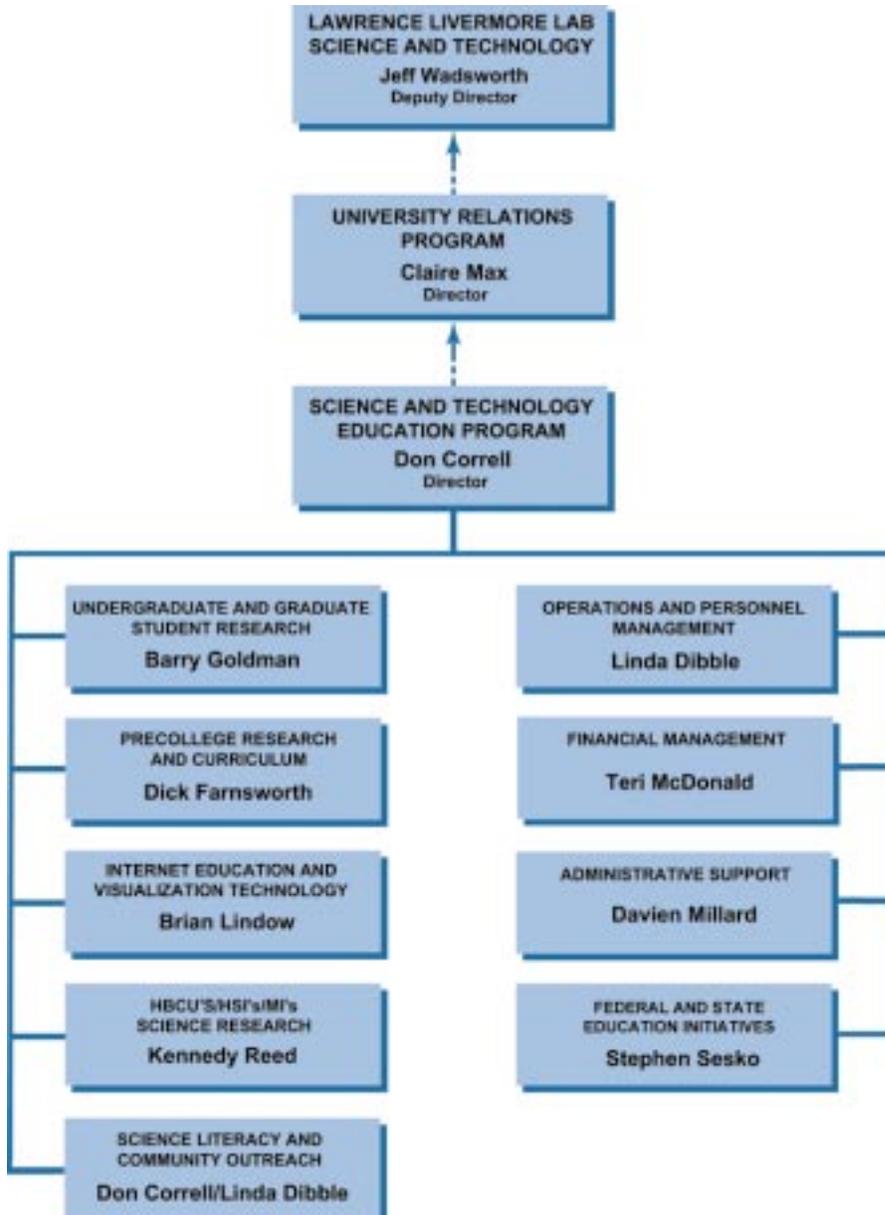
Among the Educational Outreach Programs, most are directed at middle and high school students. They are usually one-day events, though some, like Science on Saturday, run in a series, or like the Explorer Post, meet weekly for a set period of time. Fun with Science is primarily directed at elementary school participants. Typically, the Educational Outreach Programs are funded through LLNL funds.

The following chart shows the breakdown of participants by program:



Appendix 2 STEP Project Contacts

Organization Chart



Science & Technology Education Program Office and Project Managers

<i>Name</i>	<i>Phone Number</i>	<i>Fax Number</i>	<i>E-mail Address</i>
Correll, Don	(925) 422-6784	(925) 422-5761	correll1@llnl.gov
Dibble, Linda	(925) 423-8651	(925) 422-5761	dibble2@llnl.gov
Farnsworth, Dick	(925) 422-5059	(925) 422-6079	farnsworth1@llnl.gov
Goldman, Barry	(925) 422-5177	(925) 422-6079	goldman1@llnl.gov
Lindow, Brian	(925) 424-5464	(925) 422-6079	lindow1@llnl.gov
McDonald, Teri	(925) 422-7700	(925) 422-6079	mcdonald12@llnl.gov
Millard, Davien	(925) 422-5460	(925) 422-5761	millard1@llnl.gov
Reed, Kennedy	(925) 423-1112	-	reed5@llnl.gov
Sesko, Stephen	(925) 422-5385	(925) 422-6079	sesko1@llnl.gov
Williams, Beverly	(925) 422-5020	(925) 422-6079	williams92@llnl.gov

Science & Technology Education Program (STEP)

Lawrence Livermore National Laboratory
7000 East Ave, L-428
Livermore, CA 94550