Section 3

Science Education Programs

Supported by the Department of Energy Office of Defense Programs

College Co-op Program

Program Description

The College Co-op Program, established in FY01, is designed to provide a unique and challenging off-campus research opportunity for university undergraduate students in science, mathematics, computer science, and engineering. Patterned after the Laboratory's successful MIT Engineering Internship Program and the former DOE/DP Undergraduate Research Semester Program, the CCP will initially provide an enriched 16-week research experience for up to 15 undergraduates per semester, an opportunity that is not typically available at undergraduate institutions. Extensive evaluation data have shown that student involvement in cutting-edge research and a positive mentor relationship are keys to favorably influencing undergraduate pursuit of graduate studies and future careers in basic research and advanced technologies. The CCP is designed to provide such an incentive.

The program places special emphasis on building Laboratory diversity (i.e., underrepresented minorities), recruiting and selecting women and underrepresented minorities. Program participants and their Laboratory mentors will work together on significant research problems while doing so at a relatively low cost to the Laboratory since technical staff are asked to volunteer their time while serving as mentors and tutors. Supplementary educational activities to complement the 16-week research appointment are designed to enrich the participants' technical backgrounds and broaden their perspectives for future career decisions. These activities, combined with individual scientific research guided by mentors, make the College Co-op Program a powerful opportunity for participating students.

Performance Objectives and Milestones

The goal of the College Co-op Program is to develop a diverse work force of individuals with enhanced problem-solving and technical skills to meet the Laboratory's current and future scientific and technological needs, and to contribute to the research of technical line organizations.

The objectives that support this goal are to

- require that students contribute directly to ongoing Laboratory research projects;
- attract students to learn in Laboratory-identified Critical Skills areas;
- strengthen and focus students' fields of study and career plans;
- increase diversity of students that participate in national research programs;
- increase students' knowledge and skills in science, math, engineering, and computer science; and
- increase students' understanding of research process.

These objectives are formally and informally measured and evaluated through instruments and techniques that include surveys, informal feedback from mentors and students, observations, and assessment of student products. Assessment tools will be designed to provide coordinators and staff information to ensure quality undergraduate research experiences. These tools will include pre- and post-surveys, weekly student feedback sessions, site visits and observations, technical presentations, and a poster session display. The student products (presentation and poster display) will provide additional information to determine if students are increasing understanding of the research process and the research topic, and improving their

communication skills. In addition, students will be encouraged to submit results of their research for a journal for publication.

Indicators of success for CCP are

- Broad-based excellence in science and engineering
- Clearly defined roles and expectations
- Participating colleges with adequate infrastructure and support for co-op programs
- Adequately funded Laboratory infrastructure and coordination
- High-quality students, mentors, university faculty participation
- Clear connection to work force needs
- Student research that is important and engaging
- Educational component tied to university curricula
- Use of assessment data for continuous quality improvement

Supporting the Laboratory in fulfilling "Institutional Goal #7 – Focus on diverse, entry-level and strategic hiring" is the most important contribution of this program. CCP supports Laboratory needs with quality research now and in the future by building the diversity of the scientific candidate pool. Undergraduate students will work closely with scientific researchers in areas strategically related to the Laboratory mission and the needs of sponsoring technical line organizations. Research areas include projects from basic science through process engineering. Project areas include advanced computing, improved sensors, high-energy materials, enhanced surveillance and satellite research, and new technologies that support the Laboratory's scientific direction. In support of the stockpile stewardship mission, students will conduct research and contribute to basic science in areas such as analysis and assessment, theory, computer modeling of complex systems, environmental stewardship and technologies, and nuclear science. Los Alamos National Laboratory wishes to locate and retain quality staff for a variety of technical positions. The Co-op Program will assist in this effort to locate superior quality students.

The CCP student recruitment effort targets the best schools in science and engineering. Based on an initial assessment of top schools with co-op programs, the effort began with Texas A&M (1,064 co-op students), Georgia Tech (2,363 co-op students), and the University of Michigan (300 co-op students). New Mexico and California universities as well as Morehouse College will also be considered in the initial set of schools to contact in FY02. Selection of university partners will be defined with respect to strengths in scientific disciplines.

Students are recruited through a variety of strategies that include on-campus posters, a Web page, individual contacts at universities, student ambassadors (past participants), and recruiting visits by coordinators to targeted universities and colleges. Based on experience, we believe it is important to have a Laboratory technical staff member and a local university professor or administrator serve as champions for each university. It is preferred that the laboratory technical champion be an alumnus of the university he/she represents. The time necessary to make initial contacts, open lines of communication, establish champions, and formalize agreements is significant. Future success will depend upon ongoing recruitment and regular maintenance of university contacts.

The inaugural 16-week program began in September 2001 and will continue with a new group of students in January 2002. When applications are submitted, students will subsequently be selected and assigned a laboratory mentor. Internally, we will implement procedures for soliciting research proposals, reviewing the proposals, selecting the research projects and mentors, and strategically placing students.

The program is designed so the participants spend approximately 80% of their time

conducting science research with their mentors and 20% of their time participating in special supplementary educational activities designed to provide them with an introduction to research that supports the Laboratory mission. These activities include tours, field trips, lectures, workshops, technology training, and demonstrations. In addition, students are instructed in preparing and displaying a scientific poster session, giving a technical presentation, and writing a scientific paper. Special seminar sessions which highlight research skills help strengthen student understanding of the research process.

Formal partnership agreements with participating universities are in the process of being established. The agreements will include university commitments such as identifying top-quality students and participating faculty. Estimates from our hosting scientists indicate that, on average, a typical mentor scientist and hosting group will contribute over 100 hours of time per student per semester to support the research component of this program, and another 30 hours supporting the educational and tutor components. In addition, talks are presented throughout the semester that are prepared and delivered by scientists and staff who donate their time to enhance the experience of the students. There will be approximately 15 enhancement activities totaling approximately 60 hours of volunteer time.

Highlights of this Year's Accomplishments

The highlight of this young program was the successful recruitment and placement of three highly qualified students for the inaugural Fall 2001 semester co-op phase. By all accounts the students enjoyed a rewarding experience and plan to return to the Laboratory for an internship in summer 2002. Clearances are being processed for the three in order to allow them access to a wider variety of research facilities upon their return.

Glenn Matthews (Fig. 22), a Georgia Institute of Technology student with a 4.0 GPA, majoring in materials engineering. His mentor was Dr. Cindy Sandoval of ESA-WMM (Weapons Materials and Manufacturing). His research project involved researching the production of ceramic particles using a plasma torch and performing adsorption experiments in an effort to understand the mass transfer of water and gases through foam materials. Glenn will be returning this summer to continue his research with Dr. Sandoval.

Figure 22. Glenn Matthews.

Nabil Schear (Fig. 23), a Georgia Institute of Technology student with a 3.6 GPA, majoring in computer science. Nabil's passion is in high-performance computing and intelligent systems. He was able to use these talents in NIS-9 (Weapons Technologies) under the tutelage of Dr. Keith Lindsay. His research was working with the Multi-Platform Trusted Copy (MPTC) software development team that is developing a cutting-edge cybersecurity application using Java. Nabil continues to work for Dr. Lindsay on an off-site basis during this semester and will return to the Laboratory in the summer.

Figure 23. Nabil Shear.

David Seigel, a New Mexico State University student with a 4.0 GPA, majoring in mechanical engineering. David enjoys working with materials and was able to expand his knowledge with the help of his mentor, Dr. David Hayden at ESA-WMM (Weapons Materials and Manufacturing). His work included the adaptation of tooling and fixturing to new isosatic and die presses. David will be returning to the Laboratory this summer to continue his research project.

Recruitment is in full swing for the spring 2002 semester. One student has been identified and has accepted a co-op position at the time of this accounting:

Mark Pape, a Texas A&M University student with a 3.9 GPA, majoring in applied mathematical sciences. Mark's excellent proficiency in mathematics and computers will be enhanced with assistance from his mentor, Dr. Loren Toole at D-4 (Energy and Environmental Analysis).

Plans are in place to expand the College Co-op Program by Fall 2002 to reach the targeted 15 students per semester. However, all support for the program comes from the sponsoring technical organizations; therefore, further expansion of the program will be dependent on available FY02 programmatic funding.