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April 1 - June 30, 1996

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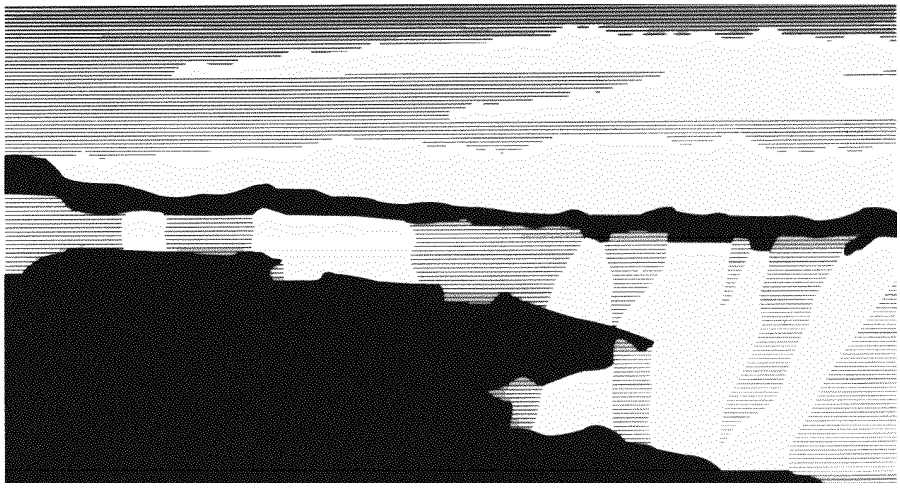

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LOS ALAMOS NATIONAL LABORATORY

SCIENCE EDUCATION PROGRAMS

PROGRESS REPORT

April 1 – June 30, 1996

Los Alamos National Laboratory

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LOS ALAMOS NATIONAL LABORATORY

SCIENCE EDUCATION PROGRAMS

PROGRESS REPORT

April 1 – June 30, 1996

TEACHER ENHANCEMENT

National Teacher Enhancement Program (NTEP)

The emphasis for the last academic-year workshop and summer institute was leadership within a curriculum development component. A final institute was designed to bring the first two years together and to provide leadership development activities for the teachers.

A fourth and final academic year workshop was held in April to introduce an Event Based Science (EBS) Curriculum model. Teachers assembled research teams based on selected areas of research. Each team was charged with accumulating data from a variety of sources, including the public library, the Laboratory Study Center, and the Internet. They were also charged with beginning the development of a scenario based on a real life science event.

The teachers selected one of three areas for further immersion. Areas for self-immersion projects encompassed the science fields of physical science (centered around energy), earth science (centered around volcanoes and earthquakes), and life science (centered around drought). These were identified by the individual teachers as areas where growth was needed. The task was to develop a transfer strategy that included a curricular component and a leadership component.

The summer session was scheduled for three weeks (June 3-7, June 24-28, July 1-3). The teachers continued the development of their immersion projects based on the Event Based Science model. Dr. Russell Wright, EBS coordinator and author, was contracted to present the philosophy and methodology behind EBS. Dr. Wright demonstrated the model with one of the EBS modules developed for national dissemination and then helped each team as they continued to develop their own immersion projects. Three distinct curriculum products were developed and are being copied for distribution to each NTEP participant.

Continuation of communication between NTEP participants was emphasized during the last week of the summer session. Each participant was gifted an IBM 286 computer, a modem, and PC Lite software while Carolyn Briles, GEONet electronic bulletin board system coordinator, registered each participant on the GEONet system. Instruction on the use of GEONet was provided and copies of the GEONet handbook were distributed.

The NTEP GEONet menu has been updated to meet the needs for information sharing between teachers.

Application guidelines for submitting follow-up award proposals for participating teams were distributed to each attending participant. Applications for the award are due on August 30, 1996 and selected recipients will be notified of their award status by September 20, 1996. The award will allow each team the opportunity to incorporate their developed curriculum projects into the 1996 fall semester. As part of the follow-up award, visitations by the NTEP coordinator will be made to evaluate the effectiveness of the curriculum and leadership roles assumed by the teachers.

Nonproliferation & International Security – Teacher Enhancement Program (NIS – TEP)

Six high school science and math teachers arrived June 17th to participate in Los Alamos National Laboratory's 1996 summer Nonproliferation and International Security Division's Teacher Enhancement Program. NIS-TEP is being coordinated in parallel with the Teacher Research Associates (TRAC) program, a DOE-funded program with ten teacher participants. The Laboratory groups hosting NIS-TEP teacher researchers this summer are: NIS-1, NIS-2, NIS-3, NIS-6, and EES-3.

The teachers spend four days each week at their respective research sites. In addition, the NIS-TEP and TRAC teachers meet one day each week as a group to tour Laboratory facilities, to participate in workshops, and to work on their educational transfer plans. Prior to completing the eight week research appointment on August 9th, each teacher will submit a technical paper describing the research s/he conducted while at the Laboratory and an educational transfer plan outlining the ways in which the Laboratory experience will be transferred to the teacher's classroom the following academic year.

Teacher Environmental Assessment and Monitoring Program (TEAM)

Student Water Quality Research Summit

The 1995-96 TEAM program held its culminating event: the 1996 TEAM Program Student Water Quality Research Summit. The Summit was held Monday, May 6, 1996 at Los Alamos National Laboratory, Los Alamos, New Mexico.

Nearly 20 teachers and over 40 students from schools in Colorado, New Mexico, Texas, and Mexico attended the two-day Summit. The Student Water Quality Research Summit was open to all TEAM program participants pending acceptance of their proposal. Each TEAM teacher participant was invited to bring three students to the Summit to represent their school. This team of students presented the results of one project/investigation of that TEAM teacher's water quality research efforts.

There were three components to every school's participation in the Summit: (1) A Research Report; (2) An Oral Presentation of Research, and; (3) A Poster Session (Visual Display). In addition to listening to student presentations, participants heard

presentations from Laboratory scientists, and toured water-quality-related Laboratory sites and facilities.

Lead Teacher Meetings

The TEAM program coordinator held a very productive day-long planning session with this year's Lead Teachers in preparation for the 1996-97 TEAM summer institute. The session focused on learning additional skills related to using the STELLA® systems modeling software, as well as:

- Developing journal topics/reviewing journals;
- Developing Daily Reflection Time;
- Developing the three "Reflection/Transfer" sessions;
- Developing the GEONet training/review session;
- Planning for academic-year follow-up.

1996-97 TEAM Summer Institute

The 1996-97 TEAM program summer institute was held from June 10-28, 1996. The program is for science, math, computer, or technology teachers currently teaching high school students in grades 9-12 who are interested in learning about a systems thinking approach to math, science, and technology instruction. This year's program was designed to provide teachers experienced in facilitating student water quality field investigations with additional skills and tools to help them understand and illustrate the complexities and interrelationships between and among the factors which impact the water quality of a riparian system.

Key components of the institute included: (1) an overview of computer modeling and simulation by several scientists at the Advanced Computer Laboratory; (2) learning how to use STELLA® systems modeling/systems dynamics computer software to develop a model of a local river system; (3) an overview of the surface, groundwater, and other related water systems in Pueblo/Bayo Canyons by Laboratory scientists; (4) the creation of a model of Pueblo/Bayo Canyons based upon information gathered in the field; (5) learning to create models for student manipulation for instructional purposes; and (6) development of a plan to transfer summer institute experiences to the classroom.

Teacher-participant response to the TEAM summer institute was very favorable. In response to the question "Overall, how would you rate your TEAM summer institute experience," participants gave the institute a 1.21 rating on a scale of 1 to 5, where 1="Excellent" and 5="Poor" (n=14). All participants (n=14) either "Strongly Agreed" (12) or "Agreed" (2) with the statement "I would recommend the TEAM program to a friend/colleague."

Teacher Research Associates (TRAC)

Ten high school science and math teachers (four from New Mexico, three from Arizona, two from Colorado, and one from Okinawa, Japan) arrived June 17th to participate in Los Alamos National Laboratory's 1996 regional TRAC program. The teachers are

working for eight weeks on research projects under the supervision of Laboratory scientists. Laboratory groups hosting teacher researchers this summer are: AOT-5, CST-1, EES-1, LS-4, MST-4, MST-11, and P-23. In a coordinated effort, DOE's Nonproliferation and National Security Office of Research & Development (NN-20) has funded six teachers to conduct research with the Nonproliferation and International Security Division through the Teacher Enhancement Program (NIS-TEP).

The teachers spend four days each week working at their respective research sites. In addition, the TRAC and NIS-TEP teachers meet one day each week as a group to tour Laboratory facilities, to participate in workshops, and work on their educational transfer plans. Prior to completing the eight week research appointment on August 9th, each teacher will submit a technical paper describing the research s/he conducted while at the Laboratory and an educational transfer plan outlining the ways in which the Laboratory experience will be transferred to the teacher's classroom the following academic year.

Teacher Opportunities to Promote Science (TOPS)

The final academic year workshop for FY 96 was held at the Ramada Classic in Albuquerque on April 18-19, 1996. The workshop topic was Event Based Science (EBS) with Dr. Russell Wright presenting the EBS unit "Tornado!". The topic was chosen to provide background science content for the group's ongoing weather research. Dr. Wright also worked with the teachers as they began work on their own EBS units.

Site visits to the classrooms of TOPS teachers were conducted in May. The purpose of the visits was to provide technical support and monitor participation in the storm tracking project. Student impact surveys were distributed to all the teachers either during the site visits or through the mail. The surveys were administered to their students and will be used as the midpoint data collection for the study in progress on the attitudes of students towards science, math, and technology.

The first two weeks of the TOPS Summer Institute were conducted at Chamisa Elementary School in White Rock during the weeks of June 17-21, and 24-28, 1996. Teachers worked individually or in small groups on their EBS units. As support for this activity, the teachers participated in mini workshops on instructional design, including presentations by: Jean Reid on "Creating the Thoughtful Classroom"; Ross Brewer on the Exemplars mathematics project and performance assessment; a local librarian on integrating literature and research skills; and a local math teacher on teaching math through science content. Teachers were assigned to LANL scientist mentors as consultants on their EBS units and all have continued the contact with their mentors over the summer via e-mail and site visits.

TOPS Mentor/Weather Tracking Project

The spring TOPS Mentor workshop was held in Los Alamos on May 3-4, 1996. LANL staff introduced the teachers to the topic of lightning and led them through a hands-on applied physics lab session on constructing lightning detectors. The detectors are designed to enhance the Davis weather stations used by the teachers for the storm

tracking project. Teachers will use the detectors as part of their classroom teaching to collect lightning data for lab scientists.

The lightning detectors will be modified for use with the regular TOPS teachers during the summer institute in July. LANL staff and the TOPS mentors brainstormed ways to improve the product and strategies to simplify the construction process. Design modifications were made and planning sessions held for the summer institute.

Science Outreach Program

In June, the Science Outreach program completed a three year cycle working with teachers in grades K-12 using educational technology as a focus. The program provided teachers with science and math content/process, technology integration, and leadership skills through hands-on curriculum building workshops and summer institutes.

The new focus of the Science Outreach program for the summer of '96 is to provide technology support to three existing teacher programs TEAM, NTEP, and TOPS. TEAM is a high school teacher development program where participants work with probes for water quality testing. NTEP is an elementary teacher program where Science Outreach is focusing on bringing in technology to enhance student learning in the program. TOPS middle school teachers are working with weather tracking, specifically on real time tracking of hurricane Bertha. Each program is receiving current technology components which support the individual program's science content, educational goals and objectives. Science Outreach will continue to support the teachers of these programs when they return to their classrooms in the fall with their educational technology needs as well as with their networking requirements.

Science Outreach participants continue to lead the Regional Educational Technology Assistance (RETA) initiative in order to form a regional support structure that will help the districts establish the capacity to conduct and sustain high quality educational programs and connect resources for additional professional development. The RETA participants will also support the efforts of the New Mexico Net Day Community Project in the upcoming school year, as they guide districts in strategies to increase community involvement and strengthen public awareness of uses of educational technologies.

CURRICULUM IMPROVEMENT

Radiation/Risk Assessment Curriculum Development

Risks, Rewards, and Responsibilities Curriculum

The Risks, Rewards, and Responsibilities Curriculum deals with the concept that you take risks to receive rewards but have responsibilities, both personal and societal. During this quarter, plans were formulated and additional funding was found to support the curriculum during the rest of the fiscal year. It is planned to distribute the curriculum for beta testing to three hundred teachers next fall for use in the 1996-97 school year. The curriculum kit tentatively will include:

- The Curriculum
- *LA Science, Number 23, 1995*
- The eight volume set of nuclear waste texts produced by the DOE
- A Canadian video tape dealing with the basics of radiation
- A *60 Minutes* segment titled *The 8 Billion Dollar Piggy Bank*
- An Achievement TV tape about science, careers, and ethics that aired on PBS
- The Laboratory NEWNet tape

In addition to the curriculum kit, teachers and students will be supported with listservs established at the Laboratory. These will be called SWOOPE-Teachers and SWOOPE-Kids to capitalize on previous DOE and Laboratory investment in the Students Watching Over Our Planet Earth (SWOOPE) Program. In recent years, SWOOPE has been sustained by Terry Kerns, working independently from West Virginia. Terry has been receiving fiscal support from Bell Atlantic and the EPA.

STUDENT SUPPORT

Pre-Service Institute for Science and Math (PRISM)

Ten students are attending an eight-week summer institute conducting research on topics in astronomy. The participants have formed project teams to (1) discover extra-terrestrial radio sources, (2) identify variable stars with a scanning CCD telescope, and (3) characterize super-novae from a database of stellar images. LANL astronomers, advanced student mentors and UNM astronomy educators helped the PRISM participants with these projects. The students attend an introductory astronomy class and lab two nights per week at UNM-LA and work on the research projects four days per week at the university and Laboratory sites.

Since last summers' institute, the students' performance levels have increased. One measure of this improvement is their ability to self-direct and self-monitor their projects. Another supporting measure was the following comment by Mike Zeilik (UNM Professor of Astronomy) who facilitated a group study session. "Your students are very good at working in collaborative groups. It takes my students on main campus several months to know how to work in teams. Also, conceptually the PRISM students are way ahead of my main campus students."

Summer Experience for the Economically Disadvantaged (SEED)

Students were recruited in cooperation with counselors and principals from area high schools. Ten students were selected to participate in summer research experiences, with four students in SEED II and six students in SEED I. The schools which the participating students attend include: Española Valley HS, Jemez Valley HS, Pojoaque Valley HS, the Santa Fe Indian School, and Mesa Vista HS.

An orientation session was held for students on June 1, during which the program goals and objectives, summer schedule, training and student responsibilities were discussed in detail. A lunch was held for participants and mentors following the orientation meeting.

The program coordinator planned a class at UNM-LA for SEED students (General Studies 162) to be held every Wednesday morning from 8:30 - 11:30 AM during the summer appointment period. The class emphasizes critical thinking and problem solving skills in cooperative group environments, and enlists the support of LANL staff as guest lecturers and facilitators. Laboratory tours were also set up for every Wednesday afternoon in order to provide students with additional experiences in technical areas and with technical staff.

A mentoring workshop was organized by the program coordinator, and materials were utilized to aid mentors to better understand their role with students and to provide strategies for effective mentoring. Student training as requested by the mentors was scheduled through Training and Development.

A Matching Funds Verification form was provided to the American Chemical Society (ACS) in order to receive funding for the program. Participants completed the Student Financial Information statement and the Initial Student Survey as required by ACS, and these forms were submitted to ACS.

Summer of Applied Geophysical Experience (SAGE)

SAGE, a field-based undergraduate- and graduate-level geophysics field course, is in progress at the time of this writing. The course is designed to supplement classroom education by providing field experience in the techniques of exploration geophysics. It allows students to gather and interpret data, and to integrate data from a variety of field methods. The program this summer includes 31 students from a range of U. S. and foreign colleges and universities. For the second year in a row, SAGE has coordinated with the TRAC program at Los Alamos to include a high school science teacher whose background is in geology. At the conclusion of SAGE, this teacher will continue his term at Los Alamos by working with Laboratory staff members on a geophysical research project. SAGE 1996 also includes several of last year's students returning to conduct additional research and to help with field activities. SAGE is based at the College of Santa Fe in Santa Fe, New Mexico, which leases classroom and laboratory space and cafeteria facilities. All SAGE participants, including faculty and most visitors, are housed in dormitories at the College.

Several companies have personnel participating in SAGE 1996, including Zephyr Geophysical, Chevron, Mobil, Zonge Engineering, and Kennecott Exploration Company. Industry scientists contribute their equipment and expertise, and many of them work in the field with the SAGE students helping to gather and interpret field data. Among the projects in which SAGE students are participating is a geophysical characterization of an environmental site at Los Alamos. This project will provide experience at a "real" site, and will yield data that the Environmental Restoration Project will utilize to base decisions for future work.

Pipeline Initiative

Staff of the Science Education and Outreach Group met with science education and special employment program providers across the Laboratory for input into the draft design and draft materials for the Pipeline Initiative. Staff also contacted other New Mexico institutions and organizations - including Sandia National Laboratories, Intel, and Public Services Company of New Mexico (PNM) - to identify additional opportunities that the Pipeline Initiative, once launched, may help students access. The Pipeline Initiative will be piloted with a small cohort of students during the latter half of the summer of 1996 and will ensure that promising student participants in the Laboratory’s science education and special employment programs continue to participate in progressively more challenging educational opportunities in science, math, engineering, or technology. Students selected to take part in the initiative will progress through a ”pipeline“ of programs at the Laboratory, and elsewhere in New Mexico, that enhance learning and/or provide work experience in science-related fields.

Critical Issues Forum

A third workshop was held on April 12-13, for the 20 teams participating in the Critical Issues Forum, with each team consisting of 2 students and a teacher. Prior to the workshop, student teams prepared materials about the topic of radiation, and the participants were organized into 5 separate groups in order to analyze separate areas of the problem. Eight LANL mentors participated as subject matter experts to give the group members accurate and conceptually correct content understanding. Each group achieved a consensus on the issues related to the topic, and created a 10-15 slide show about the topic using Powerpoint Presentation software.

Evaluation for the program is being done in cooperation with the Center for Research on Evaluation, Standards, and Student Testing from the University of California at Los Angeles. A series of student, teacher and LANL mentor surveys and content-directed concept maps were developed and revised. These materials were utilized to gather data during the spring semester and throughout the summer institute.

As a culminating event for the Critical Issues Forum 1996, 23 students and 14 teachers assembled at Los Alamos National Laboratory for a two-week summer institute held June 10 - 21, 1996. The purpose of the institute was to involve students and teachers in an in-depth analysis of issues surrounding the disposition of nuclear materials.

The students and teachers were separated into two groups. The teachers worked on the development of an event based science curriculum incorporating issues of nuclear materials disposition. The student group examined a specific real world problem as supplied by the Nuclear Materials and Technology Group (NMT-7), and worked to formulate a group consensus and recommendations. These recommendations resulted in dissemination products in various formats including an official document, press releases and fact sheets, poster session materials, a Powerpoint presentation and a documentary video.

A culminating presentation in each format by the participating groups was held at the Jemez Room of the Study Center on Friday, June 21.

New Mexico Supercomputing Challenge

Approximately 250 participants attended the Awards Day activities in April. At least 95 LANL employees participated by giving talks, giving demonstrations, escorting groups, and doing other tasks. Sixty-six final reports were received and 13 teams were selected for final judging. The winning team was a home-school team from Edgewood, New Mexico. Many awards of computer hardware were given, as well as U.S. Savings Bonds and 5 scholarships to New Mexico universities.

The Challenge coordinators were invited to attend the Adventures in Supercomputing Expo in Albuquerque and were able to learn more about that program.

The Challenge five-year report was reduced from 20 pages to 10 and accepted for publication in the Proceedings of the Taos Community Networking Conference held in

Taos, New Mexico in May. The Challenge five-year report has been submitted as an education paper to Supercomputing '96 which will be held in Pittsburgh in November.

In early May, we traveled to Eastern New Mexico University (Portales) and New Mexico State University (Las Cruces) to prepare for the two Summer Teacher Training Sessions. We met with several people to arrange classrooms, computer labs, housing, and to get curricula, instructors, and graduate credit approved.

In late May, we traveled to Couer d' Alene, ID, to meet with members of the Northwest Regional Educational Laboratory Consortium (NWREL) at their request. We gave a presentation on the Challenge to the members (representing Wyoming, Alaska, Oregon, Idaho, Montana, and Washington) and distributed literature on the Challenge for them to take back to their state. They gave us information about others to contact who would be interested in the Challenge.

We briefed Tom Garcia, assistant to Laboratory Director Sig Hecker, on the Challenge at the request of Sig Hecker.

An attempt was made to meet with a member of the Oregon State Department of Education about the Challenge. Unfortunately there was a conflict in schedules and we were not able to meet with the representative at that time. A video teleconference meeting was tentatively planned for some time in August or September to discuss the Challenge.

We visited the Alaska Staff Development Academy in Anchorage, AK. During this visit, we set up an exhibit on the Challenge, answered questions about the Challenge, and distributed Challenge literature in efforts to promote the idea of a Challenge using the Cray T3D that is located in Fairbanks.

During the last two weeks of June three LANL employees when to Portales, New Mexico (Eastern New Mexico University) and held the first Summer Teacher Training Session of this summer. We had 23 participants. Participants studied C++ programming, UNIX, Internet/WWW, HTML, and NESP. Pre/Post Test scores, Midterm/Final exam scores, and evaluations all look very positive, and 100% of the participants said the training was well worth their time and that they would recommend the STTS training session to other teachers. The pretest scores ranged from 18 to 92 with a mean of 55 and standard deviation of 21. The post-test scores ranged from 70 to 98 with a mean of 90 and a standard deviation of 8.

We allowed one high school student to accompany her parents to the Portales STTS and she thanked us with the following note. "Thanks a lot for letting me attend this Session. I'm really interested in computers and this taught me that there's always more to learn and a good project is going to take time. I was thinking of skipping this session to attend a Garth Brooks concert. After attending the session I realize it was a chance of a lifetime. There will be other concerts. My parents and I thank you for giving me the opportunity to excel in computer programming, and for taking a chance on a kid. I may not have passed, but I gained a tremendous amount of knowledge and skills that will come in handy in everything I do. I plan on seeing you again in Glorieta and then at awards day."

The Challenge, along with Science Education Outreach (SEO), is participating in a teacher training program sponsored by U. S. West. A consortium from around the state is working together on improving K-12 teachers' use and understanding of technology. Our aim is to involve Challenge teachers and recruit new Challenge teachers from the participants. Even though the committee had a proposal ready to be implemented this summer, U. S. West decided to delay it until next summer.

Historically Black Colleges and Universities (HBCU)

The HBCU Program offers summer and one-year internships in a variety of academic disciplines to graduate and undergraduate students and their professors. The goals of the HBCU Program are to improve curricula, enhance the career prospects of its student participants, and increase the number of African-Americans with post-secondary degrees in science and engineering. This is done by exposing them to scientific research and state-of-the-art equipment.

One new HBCU student is among the thirteen total working at LANL this summer. Other students are returning or completing one-year assignments. Lack of funds has drastically reduced the number of participants in these programs.

This quarter was spent in site visits, getting to see the students and mentors in the work place; focused recruitment; exploring ways to improve program effectiveness, and developing checklists for students and mentors.

Site Visits

Prior to the site visit, interns were asked to complete the checklist, submit a brief description of their research project or major assignment with accomplishments and an evaluation, and have a copy of their work statement available. In general, the work and the accomplishments were excellent. Four students received bachelor degrees, two Master of Science degrees, three accepted full-time employment and others have been accepted into graduate schools. The major weakness was with students who did not have work plans nor had they been given an orientation to the group and research or the job assignment. These students did not have mentors. In such cases the evaluations were not good.

A repeated concern from the mentors was the hiring-on procedure. They want to be available when their student arrives in Los Alamos for the first time. As one stated, “a negative impression is hard to erase and can be prevented.” Some mentors or project leaders (PL) were on travel, others were on vacation, and some were not notified of the arrival of their students. Returning students played a big roll in the adjustment of new arrivals.

Recruitment

Two coordinators took a focused recruitment trip to the National Society of Black Engineers Annual Conference held in Nashville, Tennessee during the last week in March 1996. Nineteen newly graduated, African-American Ph.D. Engineers were

entered on RESUMIX and their names given to the Human Resources Division to be included with the candidates for the approximately two hundred and fifty jobs being filled by under-represented groups at LANL. Seven other applicants seeking full-time employment were also entered. The remainder of the sixty-two resumes collected were from students seeking internships. About six weeks lapsed before applicants were put on the RESUMIX database. The results of this trip cannot be measured until information is released on the number of jobs that have been filled and the successful candidates.

Two other general recruitment and program evaluation trips were made during this quarter. One goal for the future is to have a more inclusive HBCU recruitment plan for 108 schools and to measure the success and need for all such trips that relate to the HBCU Program.

Mentorship

The site visits, student and mentor checklists, and work plans (where available) gave us a better understanding of the strengths and weaknesses of the programs. Most of the persons listed as mentors were actually project leaders for large research or major project groups.

A general profile of the PLs is a person who is:

- knowledgeable and an accomplished professional;
- heavily involved in proposal writing , funding, and program development;
- adhering to above-average travel demands and administrative responsibilities;
- patient, participatory, and diverse in his relationship with the students, and;
- often deprived of the free time needed to mentor a student.

To be successful, an intern matched with this PL would have the following qualities:

- a motivated self-starter;
- a strong, basic technical background;
- mature, responsible , and dependable,
- a basic knowledge of LANL operation;
- some presentation skills, and
- basic technical writing and reporting skills.

This advanced level of professional involvement of PL with student has more of an element of directing rather than nurturing their growth.

Undergraduates and interns recently graduated from undergraduate colleges and universities need more supervision and one-on-one nurturing than advanced level graduate students. This is especially true of some HBCU interns from schools that have less developed science and engineering curricula and limited equipment. We found that post-doctoral employees, recent Ph.Ds, and technicians are very effective in mentoring such interns. A general profile of these mentors is a person who is:

- still closely tied to college and university life;
- in daily contact with the intern,
- providing instant feedback to correct procedures and techniques,
- patient in teaching new methods and procedures, and;
- willing to help the intern assimilate into the technical project and research environment.

Most of the published or publishable research was directed by persons with this profile.

The student/mentor checklists provided us with basic information that is centrally located, and allowed us to access the program from an individual student/mentor relationship. Although more valuable to new students, returning students found them to be a good reference document. We will continue to use the checklist.

Funding

The funds for the HBCU program have been exhausted. A plan is in place to keep the students onboard through August 1996. Students were made aware of this situation in February 1996, and told to seek other support from their group, other agencies, find graduate scholarships, or to look for full-time employment.

The HBCU Program will honor in full all outstanding contracts that it has with universities.

We explored the possibility of forming a partnership with national scientific and professional organizations so that their scholarships and grants can be used for internships at Los Alamos. This effort is continuing.

Mentored Collaborative Research With Resident University Teams

Project Objective

The purpose of this investigation is to develop a fundamental understanding of the structural and mechanical properties of both polycrystalline and single crystal Er_2O_3. Er_2O_3 synthesis includes the development of techniques for the fabrication of single crystal and polycrystalline samples. The properties of these materials will then be investigated. A team of students (undergraduate, graduate, and high school) and university faculty are working with LANL staff members to accomplish the research.

Project Approach

To achieve a fundamental understanding of the structural and mechanical properties of Er_2O_3, powders from two different manufacturers, Advanced Materials Resources (AMR) and Rhone-Poulenc (RP), will be used as raw materials. From these powders synthesis of polycrystalline pellets and rods will be obtained by uniaxial and Cold Isostatic Pressing (CIP), respectively. This will be followed by sintering with a high temperature furnace at varying conditions. These include changes in sintering duration,

particle size, temperature, and atmosphere. The pellets will be used to determine optimum density parameters and to study the fundamentals of fracture in Er_2O_3. The rods will be utilized as feed and seed rods for growth of crystals from the melt in the Xenon Optical Floating Zone Unit (XeOFZ).

The single and polycrystalline samples will be characterized using optical and Scanning Electron Microscopy (SEM) as well as X-ray diffraction (XRD) in order to determine their microstructure. Mechanical properties will be studied by indentation analysis using the QM2 high temperature microhardness tester in order to determine hardness and toughness. In addition, previously fabricated Er_2O_3 coated stainless steel samples will be characterized using wear and adhesion testing.

Results to Date

Determination of the optimum density (≥95% theoretical density) of the samples will aid in the stability of single and polycrystalline growth in the XeOFZ unit. By altering the pressure used for the uniaxial pressing and particle size of the pellets, attempts were made to achieve this density. The first trials consisted of using the AMR powder. A series of pellets were pressed using uniaxial pressures of 40.8 to 285.6 MPa. Figure 1 illustrates that the % theoretical density, both before and after sintering, steadily rose with pressure. As the pressure increased above 204 MPa, radial cracks were observed before sintering and were noted to increase as the pressure increased. After the pellets were sintered at 1800°C for 12 hours in flowing air, a dramatic increase in % theoretical density was noted. The peak was calculated to be 91.3% dense. This occurred with sample ET-96-Er2O3-23 at a nominal pressure of 285.6 MPa. The graph also illustrates a slight difference between geometric and immersion density measurements. It was observed that the geometric density was in error due to the lack of symmetry caused by chips and flaws. However, it does provide a quick density measurement at a relatively small error of ≤ 4%.

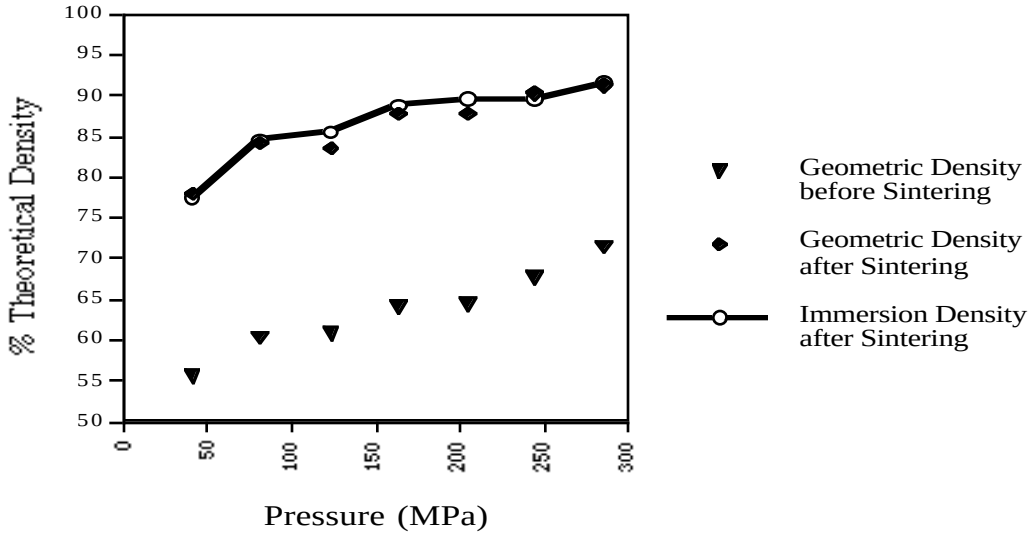

Figure 1.

Et-96-Er203-(17-23)

% Theoretical Density as a Function of Pressure

Figure 2 illustrates the same principle as shown in Figure 1, the exception being that the powder used was RP. Radial cracks were noticed at pressures of 204 MPa or greater, and an increase in brittle behavior was observed when compared to the AMR powder. This is illustrated in Figure 2 where a steep drop in % geometric theoretical density is observed at a pressure of 244.8 MPa. This large error was attributed to the fact that the top of the pellet broke off, leaving it asymmetrical and very difficult to get an accurate geometric measurement. The maximum % theoretical density observed with the RP powder, sample ET-96-Er2O3-29, was noted to be 89.4% dense at a pressure of 204 MPa, less than that of the AMR powder, 91.3%. This was attributed to the extreme radial cracking observed at the higher pressures (≥ 204 MPa), which may have induced a pressure release causing a decrease in density.

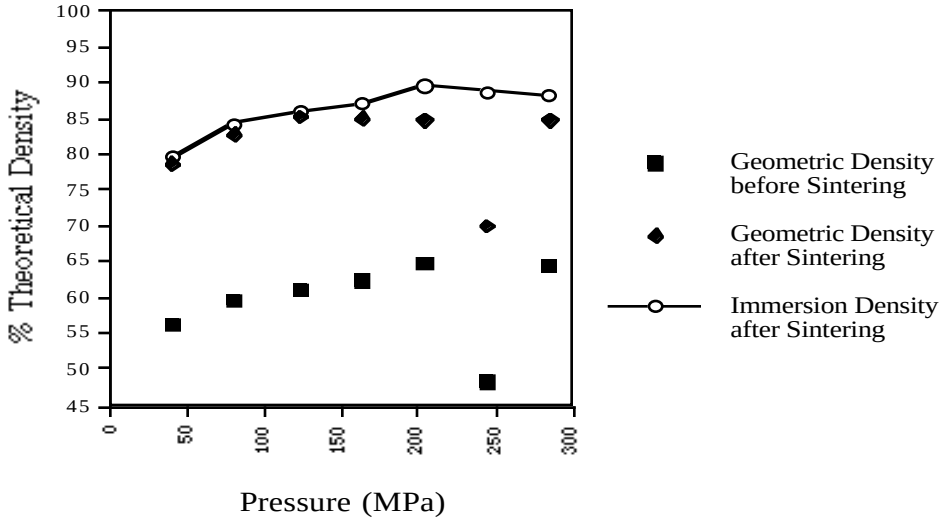

Figure 2. Et-96-ER203-(24-27, 29-30, 32)
Thone-Poulene Powder
% Theoretical Density as a Function of Pressure

It was hypothesized that the radial cracking could be due to the particle size of the different powders, so one gram of each was submitted to the MST-4 powder characterization laboratory (PCL) for powder size distribution, BET surface area, and XRD characterization. The data is not yet in. It was decided that the powders should be spex-milled for different duration. The AMR powder was then milled for 5-30 minutes in increments of 5 minutes. Pellets were then pressed at a pressure of 285.6 MPa. Radial cracking was not observed in the pellets pressed with the milled powder. A small amount of powder was saved (~0.6g) for characterization with the SEM. The AMR powder was found to be better than the RP powder due to its lower crack density after pressing and sintering. Table 1 indicates that the AMR powder improved after initial milling showing a decrease in crack density before sintering and an increase in the green density with respect to the as-received powder.

Table 1: Green density measurements for the AMR powders pressed at 285.6 MPa showing a maximum green density after milling for 25 minutes.

Code	Time Milled (min.)	% Theoretical Density (green)
ET-96-Er2O3-23	0	71.5
ET-96-Er2O3-33	5	68.9
ET-96-Er2O3-34	10	72.6
ET-96-Er2O3-35	15	74.7
ET-96-Er2O3-36	20	74.3
ET-96-Er2O3-37	25	75.5
ET-96-Er2O3-38	30	73.7

Future Work

The RP powders will be spex milled and pressed using the same procedure as that used for the AMR powders. Feed and seed rods will be CIPped for crystal growth in the XeOFZ unit. Melt grown crystals and pressed and sintered samples will then be characterized via high temperature microhardness, indentation fracture, and bend testing. Mechanical property relationships will be determined with respect to micro-structural variables. The effect of temperature on densification will be examined. Finally, Er_2O_3 coated stainless steel samples will be characterized via SEM and wear and adhesion testing.

Regional Science Bowl

The program coordinator escorted the regional winning team, Highland High School, to the National Science Bowl in Washington, DC on April 28 - May 1. The program coordinator also participated as a volunteer in National Science Bowl competition. A follow-up survey for DOE-HQ was completed.

New Mexico volunteered to host one of the national teams in August. In cooperation with Sandia National Laboratories, LANL planned and will coordinate a trip to New Mexico for the second place team at the Nationals, Lowell High School from San Francisco, California. This trip will emphasize the research of both Laboratory facilities and will incorporate hands-on activities designed to engage the students. The trip will be held from August 10-17, 1996.

Underrepresented Minority/Female Initiative

- There are 7 GRA students on board. Four of the seven are on a 50/50 salary cost share basis with their host technical organization and the URMF program.

- There are a total of 45 undergraduate students that will be participating in this summer's research internship program.

- The UNM-LA (1996) eight-week summer institute recruited 20 recently graduated high school seniors to participate.

- The NMSU NSF / Alliance for Minority Participation (AMP) will recruit six students to participate in the university offsite ten-week summer student research program .

- URMF supported LANL Native Americans in several recruiting and conference initiatives.

- We continue to work with several Hispanic Serving Universities (HSIs) and other national laboratories on a memorandum of understanding that will be presented to DOE for possible funding.

- We have been working with LANL's Environmental Management Office in trying to secure funding in order to enhance the faculty / student environmental restoration / waste management program.

- We have met with the UCLA Chemistry Department and discussed the idea of doing a pilot program next summer in New Mexico using their "molecular science" program. The target audience will be intended for two-year post-secondary chemistry instructors.

- We have also discussed with the UCLA people and others the possibility of developing a joint project that would target American Indian students that would be interested in becoming secondary math / science teachers. One avenue of funding that is being explored is the Jacob Javis grants, that are administered out of the Department of Education.

- We have made several university outreach presentations to school, business and community groups.

Atomic, Molecular, and Optical Physics Summer School (AMO)

This quarter covers the final phases of recruitment, the acceptance and orientation process, and the first half of the School session. The program, a joint collaboration between the University of New Mexico (UNM) and the Los Alamos National Laboratory, begins its eighth year. Our final roster showed fifteen students, all but one undergraduates, from universities ranging from California to New York and from Texas to South Dakota. The students represented the top scholars at their respective institutions, competing with over fifty applicants for the final fifteen positions. Nearly 30% are women, which represents a far larger percentage than in upper level physical sciences curricula at most universities. The universities represented include: Nebraska Wesleyan, Oswego State, New Mexico, Rice, Nevada-Reno, Oklahoma, South Dakota School of Mines, Princeton, Michigan, Brigham Young, Creighton, Old Dominion, and Westmont.

The School, which operates for eight weeks [June 3-July 26], has two complementary programs: (1) a full-term mentored research project and (2) lectures on a vast span of topics from distinguished scientists in AMO and related fields.

Staff scientists at the Laboratory and the University of New Mexico serve as mentors for small groups of students [1-3] for an eight-week scientific project that emphasizes research experience. These projects represent on-going endeavors by the scientists so that the students are immersed in a total research environment. By the same token, the projects are tailored to students in order that they may attain certain goals and results by the end of the term. This year, we have twelve mentors supervising eight distinct research programs. The projects include: color vision in birds, experiments with ultrafast lasers for coherent control of molecular processes, quantum optics, collisions of massive atoms, modeling of dense plasma effects, spin-polarized atom collisions, quantum mechanical treatment of systems of heavy particles, and transient quantal phenomena such as tunneling in quantum dots. Most of the projects place special emphasis on using the Laboratory's supercomputers. The students have made significant progress on these projects in the first four weeks of the school.

This year we also witnessed our most ambitious lecture series, which included six participants from UNM, an all-time record, seven from the Lab, and five from outside institutions. The distinguished visiting lecturers came from Harvard (Timmermanns), Rice (Weisheit), Nebraska (Fabrikant), LSU (Rau), and Colorado College (Whitten). The topics, as always, were extremely diverse. While most covered aspects of current intense interest in AMO physics, such as Bose-Einstein condensation, quantum computing, fractals, and Rydberg atoms, several ranged to broader fields such as astrophysics, computational physics, parallel computing, pueblo astronomy, and interrelations of science and art. The lectures function to expand the students' awareness of the great breadth of research science with AMO physics serving as a basis.

We have also arranged informal get-togethers for the students, mentors, and lecturers as well as tours of the Santa Fe Institute, the Advanced Computing Laboratory, and the Los Alamos Neutron Science Center.

The funding for the UNM portion of this program comes from the National Science Foundation as a Research Experience for Undergraduates (REU) site.

Science Engineering Research Semester (SERS)

The SERS program concluded on May 3, 1996 with a very well attended poster session held at the Bradbury Science Museum. Twenty-two students completed the spring semester and fifteen students were asked by their mentors to stay for the summer through the UGS or GRA programs (Special Employment Programs).

The selections for the fall 1996 semester were completed by late May. Twenty-six students have been selected for the fall semester (August 26-December 13, 1996). One student of those selected will be fully funded by the mentor in the Superconductivity Technology Center. The number of applications for the DOE-SERS program remained constant from previous semesters.

In mid-June the SERS executive committee met in Washington, DC to discuss a variety of pressing issues, including future funding. Other topics of the annual meeting included minority recruitment, evaluation, streamlining support processes,

and a new look for the SERS WWW page. The SERS template was finalized, and most importantly, the goals and objectives for the SERS program were revised and updated.

Science and Technology Alliance

The Science and Technology Alliance (S&TA) Program at Los Alamos National Laboratory grew out of the Department of Energy's efforts to support research and education at institutions that have a large population of African-American, Hispanic, and Native-American students. The mission of the program is to increase the representation of these ethnic groups in mathematics, science and engineering. The goals of the S&TA Program are to:

- Provide financial support to faculty and student from participating universities who wish to engage in research at LANL and in the private sector and;

- Enhances communications and collaborations between universities and between LANL and the universities.

Several students had one-year internships at LANL. This quarter we visited the students and their mentors in the workplace. We were very pleased with the quality of the projects and their publications in professional journals. Nearly all students were graduate assistants or applying for graduate school. The formal mentorship emphasis, started a year ago, has made the research and the student's adjustment at LANL much easier. This relation building effort will be continued.

The coordinator traveled to Western New Mexico State University for an "Expand Your Horizon" Conference and to talk to underrepresented groups about choosing science and engineering as majors. Many of them were not aware of the education programs at LANL. More information and publicity will be made available to smaller schools in New Mexico.

Plans were made to hire on summer students and to provide orientation and training sessions for them. Two "Mentor Information" sessions were held during the month of May. Because of the level at which this program was funded in fiscal year 1995-1996, we chose to hire only three new students while continuing the support of students already on board. Nine students are currently participating in this program.

Regional Two-Year College Initiative

- The Northern New Mexico Rural Educators Network started their six month on-line classes for credit pilot program, using the University Online system. Eight school districts are expected to participate offering a total of 100 credit courses.

- The Navajo Community College is working on the continuation of a Geographical Information Systems (GIS) project from last summer. The project will focus on an environmental science issue that is of concern to the community of Shiprock, NM.

The emphasis is on the Shiprock Uranium Mill Tailings Remedial Action (UMTRA) site. LANL is sponsoring this project with some support from LLNL.

- We have been working with LANL property staff in trying to get equipment out to some of the postsecondary schools. The LLNL model of equipment donation is being discussed with the DOE/LAOO and the DOE/ALO to see if we can use the same procedures for equipment donations. We have not been successful in this initiative, but we will continue to work with DOE.

- One graduate student will be an offsite student, teaching courses at the School of Education at New Mexico Highlands University. He is teaching four technology education classes and providing technical assistance to the regional two-year postsecondary institutions.

- Collaborations with New Mexico State University (NMSU) and ten two-year postsecondary institutions have been established in a joint effort to develop a New Mexico advanced manufacturing technology consortium. A two week summer faculty institute will be held at NMSU on July 28 - August 9, 1196.

- The Northern New Mexico Consortium for Advanced technologies (NNMCAT) NSF/ATE preproposal was submitted to NSF on June 14, 1996.

- There are 16 faculty members and 16 undergraduate students that are part of the summer research internship.

Faculty and Student Teams (FAST)

For the summer of 1996, SEO will pilot an educational program to provide a unique opportunity for faculty/student research teams to participate in ongoing scientific research in collaboration with Laboratory staff members. The program is designed to involve faculty/student teams in cutting edge research and increase dialogue between university colleges of Arts and Sciences and colleges of Education to enhance the preparation of science teachers and contribute to scientific literacy.

Each team consists of two faculty members and two students. One faculty member will represent science, math, or engineering departments and the other will represent science/math teacher preparation. One of the students (undergraduate or graduate) will represent a science major, the other a science education major.

Team selections have been made for the pilot summer of the FAST program. The four teams are as follows:

- University of New Mexico (Physics and Education): Working with CST-6 on state-to-state photo detachment in the 2-electron hydrogen ion.

- University of New Mexico (Earth and Planetary Sciences and Education): Working with CST-8 on the geochemistry of volcanic rocks.

- New Mexico Highlands University (Behavioral Science and Education): Working with CST-1 on mass spectroscopy in identification of proteins.

- University of California-Irvine (Physics and Education): Working with P-24 on Plasma Physics – materials coatings.

The teams arrived in June and have begun their collaborative research with Laboratory staff members. Several meetings and seminars have been planned for the teams, including a presentation by Elaine Seymour of the University of Colorado at Boulder, on factors that impact undergraduate attrition in science and engineering and Jerry Pine of Caltech on the role of scientists in education. In addition, several meetings have been planned to assist the teams in designing a plan/strategy to continue to collaborate between the College of Arts and Sciences and Education.

EDUCATIONAL TECHNOLOGY

Teaching Hearing-Impaired Students to Speak

Our system for teaching speech to the hearing-impaired students has been placed at the New Mexico School for the Deaf in Santa Fe, where it has been applied and very favorably received. This quarter three of the teachers devoted a day of their own time to visit our laboratory, at which time they reviewed a variety of projects we are working on and received a guided a tour of the Los Alamos Science Museum. That evening, we (teachers and members of our laboratory) attended a lecture by Steven Pinker, author of "The Language Instinct," a popular book about language acquisition.

The teachers from the School for the Deaf have made a variety of suggestions for modifications, improvements and extensions to our system. Our work this quarter has been substantially in response to their suggestions. In particular, they have suggested that they need means to teach certain basics about the required positions for speech sounds, most notably the positions of articulators not normally visible, and especially the ability to show them in fluent speech. As one of the teachers stated: *"Showing the back of the mouth is nearly impossible [using prior methods]; we often resort to hand gestures which never fully communicate what we want the students to do."*

When we looked at what else might be available to satisfy the teachers' needs on this score, we found at least three glaring defects. First, although there are books of diagrams on how to make various speech sounds, they are (obviously) not animated, and although diagrams are also shown in some computer programs, they are not animated either. Second, the figures that exist do not put speech sounds into complete words and phrases. This point is especially important because when you put speech sounds into the context of fluent speech, they are modified by adjacent sounds (coarticulation) and by overlapping with other sounds (coproduction). Unless students understand and apply these concepts correctly, their speech will never sound natural. Third, existing books and programs require the user to use phonetic notation rather than ordinary English spelling to access the information they contain, which makes them difficult to use for students who do not know phonetic notation.

In view of these issues, we concluded that the teachers' suggestion was outstanding. Therefore, we are working on a dictionary where you can type in a word and see an animated picture of how to pronounce that word. This would be a very innovative product, useful not only to teachers of the hearing-impaired, but to many others as well. Moreover, it complements our prior work excellently. However, study of the matter revealed that the product requires significant innovations of theory as well as practical implementation. The following figures illustrate some of the issues, as well as our current progress.

Figure 3 shows the articulator positions for the /a/ sound as in "father." The tongue shape was derived from our prior work on factor analysis of tongue positions within and across languages.

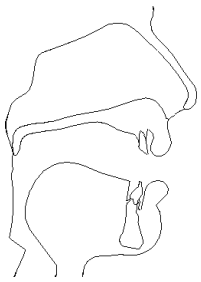

Figure 3. Articulator positions as in "father"

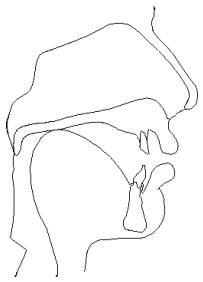

Figure 4. Articulator for the /a/ sound, positions for the /g/ sound in /ugu/

Figures 4 and 5 show the articulator positions for the /g/ in /ugu/, (pronounced "ooggoo") and /igi/ (pronounced "eeggee"), respectively. Notice that the tongue is further back for the /u/ context than for the /i/ context, and that the lips are further forward. These are the natural consequences of the vowel context. The problem is to get all the contextual effects of English correct. Technically speaking, this is a problem of nonlinear interpolation in many dimensions. Again, our prior work on the dimensionality of tongue factors is essential in solving this problem.

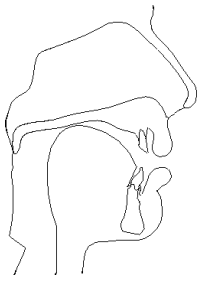

Figure 5. Articulator positions for the /g/ sound in /igi/

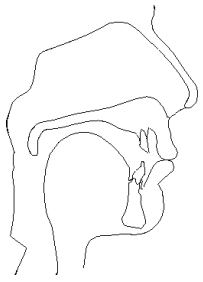

Figure 6. Articulator positions for the /m/ sound in /imu/

Figure 6 shows the articulator positions for the /m/ sound in /imu/. In contrast to the preceding figures, this shows the lowering of the velum required for the nasal /m/ sound, as well as the tongue position and the required lip closure.

Education Networking Support (EduNets)

- *Networking Technology Planning, Consulting, and Implementation Support for Education*
- *Providing Training, Software Tools, and Interfaces for NM Educators to Successfully Use Networking, Internetworking and Intranetworking Resources*
- *Developing and Documenting Models for Successfully Connecting Schools to the Internet and Making Information Available for Educators Nationally*

We actively provided networking advisement, support, and training for Internet support teams from schools in 15 school districts and 12 regional hub training and support sites

in New Mexico through the EduNets Program this quarter. Research, training units, experience gained, and lessons learned in the EduNets program were also actively used as part of the networking support and training being provided to Santa Clara Pueblo through the LANL Northern New Mexico Pueblo support project and to 2 school districts and a community college hub in Laredo, Texas, as part of a DOE/LANL energy research project in Laredo. Our EduNets Internet Education Working Groups (IEWG) continue to grow and we conducted 11 IEWG regional workshops this quarter.

Collaborations and Spin-Offs

The members of the EduNets team are also working on two new DOE/LANL networking support projects. The LANL Computing, Information, and Communications Division is providing networking advisement and support for the Northern New Mexico Pueblos networking project and for a DOE energy research project incorporating Internet communications in Laredo, Texas. The EduNets team is providing Internet specific networking, training, and design support for these projects and is using the knowledge gained in the EduNets program as part of the support provided. One goal already being pursued is to encourage collaborations and connections between school sites, teachers, and community colleges in New Mexico and Texas. Another goal is to involve the Laredo Community College as a site for an Internet interactive conference being supported by LANL in October, using video.

We added La Plaza, a community networking project in Taos, New Mexico, to our list of collaborators. We are working with the La Plaza team to help with training and installation support and they are helping with access and connections for schools through their hub in the Taos, Mesa Vista, and Peñasco districts. We continued to work with the New Mexico State Department of Education developing a central server and database and with the LANL Science Education Outreach programs to provide support to schools in their programs.

Training Hubs Providing Lots of Area Support

The EduNets team is very proud of the support being provided to the area schools and communities by the regional hubs. They have been helping with Internet advisement, training, and technical support. One of the goals of the program is to help develop regional "hubs" for training and access support so that all of the districts will have well-established centers for Internet resources near them.

This quarter we would like to highlight the progress at Northern New Mexico Community College (NNMCC), Española, New Mexico, and at the Kirtland Technology Center, Central Consolidated School District (CCSD), Kirtland, New Mexico. The team has spent a lot of time this year providing support for setting up systems and servers, input for proposals and technology plans, and staff training for these hubs - and it is already paying off big for the schools in the region!

We were able to provide dial-up accounts and training workshops for Internet support teams and working group members from 5 school districts and 2 pueblos through NNMCC this quarter and have helped them design a plan to expand their hub that will enable districts in their area to get 56KB Internet connections through NNMCC at

approximately half the cost they currently have to pay. NNMCC is also providing Internet classes for credit on campus and through Extended Services for their community.

We taught Internet workshops and did demonstrations for the grand opening of the Kirtland Technology Center, CCSD, in April and helped them set up 2 lines for dial-up access through their server. We trained support team teachers from nine schools in the Center and set up Internet access dialing into the Center from five new CCSD schools in June.

EduNets Internet workshops and campus/site sponsored Internet courses were also offered at the UNM-Gallup, Jicarilla Apache Department of Education (JADE) and Navajo Community College (NCC) Shiprock hubs this quarter. The UNM-Gallup hub was used for a Regional Education Technical Advisors (RETA) Fiesta and we are working with UNM-Zuni to provide local dial-up access at that campus for EduNets IEWG members in the Zuni schools.

Dial-Up Hubs

We helped set up servers and local dial-up lines for teachers and district libraries to be able to access the Internet at Kirtland Technology Center, Central Consolidated School District (2 lines), and Pojoaque Independent School District (1 line). NNMCC now has 8 dial-up lines and 8 more are being installed; we issued and tested approximately 40 accounts for EduNets' Internet support team teachers and schools in 5 districts and 2 pueblos this quarter provided by NNMCC. We were able to get 10 more schools in the Española School District connected to the Internet via the NNMCC dial-up this quarter.

NT Server Support and Training

We have helped districts install nine NT servers and have three NT server and software testing sites that we support. Currently, NT support and on-site technical support team training are two of the most requested support areas for our districts. Ken Brown, the EduNets team NT and Novell specialist, is completing special training for NT Network Engineer Certification. We hope to offer NT workshops in the future for certification for the district technology support team members. We already offer Novell sessions twice a year.

A Few Site Highlights this Quarter

Central Consolidated Schools – Kirtland Technology Center Open House – 3 Windows 95 Internet labs up-and-running ... over 100 computers with Internet access, video center, NT server, 56KB line, 2 dial-in lines for other school sites.

Peñasco Independent Schools – First Internet lab up-and-running – IEWG teacher doing local training workshops, 56KB connection through La Plaza community networking project.

Pojoaque Independent Schools – NT Server with dial-in access line – server set up for testing; supports two 56KB lines and two Internet labs, library, office and some classrooms direct access already established earlier this year.

Española Municipal School District – New Dial-up stations at 10 more schools – access provided through NNMCC hub; Internet support team IEWG teachers being trained at each site; added to 56 KB access at 1 school established earlier this year.

Mesa Vista Independent Schools – Dial-up station set up in technology center – access provided through NNMCC hub; working on direct access funding proposals and bids; Internet support team IEWG teachers attending workshops and being trained at each site.

Gallup-Mckinley School District, Zuni Public Schools, Santa Fe Public Schools, Cuba Independent Schools, the New Mexico State Department of Education, Dulce Independent Schools, Mora Independent Schools, Bloomfield Independent Schools, St. Bonaventure Mission Schools, and those listed individually above – Basic Advisement, Workshops, On-Site Training, and Internet Team Support – We helped set up workstations and software, provided 11 regional workshops for IEWG members, provided requested on-site training and support and did site surveys and needs assessments at schools and administrative offices.

Congratulations: Several teachers and faculty supported through the EduNets Program have received national recognition and grants for their work in education using the Internet. This quarter we'd like to start a "teacher recognition" section of our report and congratulate some of our outstanding teachers. This quarter these include: Cuba High School science teacher, Lorenzo Gonzales, who was awarded one of the coveted "Golden Apple" Fellowships for educators; Bloomfield, New Mexico, elementary teacher, Kathy Price, who was chosen as one of the twelve "Annenburg Advisors" to mentor teachers in classroom applications on the Internet (Kathy was also in the NTEP program at LANL last summer); Central Consolidated School District (CCSD) was awarded a NASA Internet Grant and Rick Nussbaum, Chuck Culpepper, and Steve Carr were selected to attend a NASA Internet Applications Workshop in Florida; and, Stan Bippus, Superintendent, and Chuck Culpepper, CCSD, who were presenters at the Alaska Technology Conference.

Distance Learning and Educational Technology

University OnLine

The University OnLine effort was established to provide rural New Mexico educators experience with the possibilities of distance learning. UOL has the rights to distribute courses previously developed by Digital Equipment Corporation under Plato. These courses are accessed via the Internet and include both high school and lower division college courses. UOL agreed to provide 100 courses to New Mexico schools, including registration, distribution, and reporting support. One course equates to one student taking a specific course on-line.

The opportunity and some Laboratory support was offered to the Northern New Mexico Rural Educators Association which opted to try the system out. Eight schools will participate in the program at the high school level. Generally, courses that will be made available to students will be those used and approved in North Dakota for high school credit. Laboratory support to NNMREA has been to defray communications costs and to administer the program.

In July, UOL will conduct a training session for school personnel at the Albuquerque Academy. During this session, school representatives will learn how to use the UOL system, register students, and participate in customizing the Land of Enchantment distance learning network.

MegaMath and Public Service Announcements

While started last fiscal year, certain efforts related to MegaMath have just come to fruition. First, in FY 95, the Lab was approached by EnterLearn Technologies to establish a CRADA for MegaMath. The CRADA would permit EnterLearn to further develop and market MegaMath. During this reporting period, the CRADA was finally approved by the DOE and forwarded to EnterLearn. Unfortunately, delays in the CRADA process resulted in a change in the EnterLearn position in that they must develop new funding sources for the project.

As part of the MegaMath effort in the summer-fall of 1995, a public service announcement was produced. The message was that success is as easy as one-two-three, the allusion being to mathematics. Two hundred tapes of the announcement were distributed to TV stations, split fifty-fifty between large and moderate service areas. Recently, reports have been received of airing of the tape, to include a major network affiliate in San Francisco.

A Non-Euclidean View of Teaching

An article, titled as above, was completed and published as an LA-URA. This paper examines trends in educational technology and distance learning as separate fields and concludes that the fields are merging. Further, based on developments in cognitive science as it relates to teaching and the automation thereof, it suggests an approach toward integrating and adopting educational technology that can potentially improve performance standards of students. Currently, the paper has been submitted for publication and response is pending.

Molecular Science and Educational Technology at UCLA

After visiting the UCLA Department of Chemistry, the opportunity of competing for a US Department of Education Challenge Grant was suggested to Santa Fe Public Schools. After SFPS declined because of internal reorganizations, the opportunity was presented to San Juan College. The Challenge Grant opportunity involved adaptation of many of the UCLA-developed molecular science computer programs for use at the high school and two year college level. While this particular effort did not result in the submission of a proposal, it did serve to introduce the UCLA technologies to a variety of educators.

Systems Modeling for Education

The program is progressing on two parallel tracks. One track involves LANL staff writing JAVA code for the heat transfer simulation component of the larger software package. Dave Modl (CIC-3) and Cecilia Sanchez (SEO) currently are developing the graphical user interface for the simulation package. The next step is to connect the user interface to the physics code. Dave and Cecilia will meet with the teachers at the end of July to present a rough version of the code for feedback and evaluation.

The second track involves teachers developing classroom activities in heat transfer that will support the use of the overall software as well as the simulation. Two teachers are developing activities that use temperature probes to examine heat transfer directly with everyday objects. Two other teachers are developing activities for students to learn about heat transfer as it relates to energy efficient architecture. These activities are now supported by Media Garden software but can easily be adapted to use the new JAVA software we are designing. Both of these student activities will be field tested in classrooms this fall in preparation for piloting the first version of the simulation software.

GEONet/TOPS Electronic Bulletin Board

The third quarter of FY 96 brought about closure for several of the SEO programs using the system. In the early part of the quarter, we continued our support of the Critical Issues Forum, TEAM, TOPS and the Storm Tracking Experiment. The activity of these programs ramped up as the end of the school year approached, and students uploaded final reports and data.

After the close of school, several programs met in Los Alamos to wrap up their activities or to begin a new emphasis for the summer. We took that opportunity to interview the program participants and perform a self-assessment of GEONet. We interviewed both students and teachers in this process.

We found several areas of GEONet on which we can improve by simple measures. One of these is electronic mail. Users commented on the ease of the e-mail editor, but were discouraged by the lack of a directory correlating individuals to their e-mail addresses. Hence, if an individual used a log on name, which is the e-mail address, other than his or her common name, users were left guessing the e-mail address. This can be easily rectified by including a new menu entry on the system that does list this information.

An issue that is more difficult to address is on-site problems and troubleshooting for individual schools. Schools currently receive training at LANL on connectivity, e-mail and file transfer. However, the LANL configuration of phone lines and computer hardware is often not the same as the configuration a teacher has at school. Hence, when problems arise at the school site, troubleshooting is more difficult. Connectivity and file transfer were the two main areas for which on-site help was requested.

The best aspects of GEONet from the users' point of view were the functionality of the bulletin board as a method of communication with other teachers, the organization and structure of the menu system and the technical support they receive from the system

operators. We were very pleased to learn that our users are comfortable asking us questions, regardless of their experience with telecommunications and confidence with computers. With that sense of trust in place, we can help teachers and students have positive experiences with technology and integrate electronic communications into their classrooms successfully.

Model-Nets: A National Study of Viable Models of Networking Technology in K-12 Education

Work continued on the production of an interactive multimedia CD-ROM guide for school districts to disseminate the findings of the Model Nets study, and to help schools with network planning. A technical writer, editor, and program staff are working on the development of the Model Nets Guide. The Model Nets Guide will be a handbook meant to step school districts through the process of network planning, implementation and evaluation. The Guide will be contained on the CD-ROM, and will be linked to the Report and other resources contained in the CD-ROM. The resources include site addresses (URLs) for network planning, policies and educational uses, translation of the Model Nets report into linked HTML files, inclusion of networking software tools, instructions for using software and navigating through the CD-ROM, samples of district technology plans, and selected images from Model Nets study sites. The Guide is being created on a hard drive, and succeeding versions recorded on writeable CD discs for evaluation and correction.

Hypermedia Compact Disc/Fast Tool Servomechanism (FTS)

NCSU came to LANL in June to perform initial tests of the fabricated Fast Tool Servo on our lathe. The tests worked out very well. The noise level and bandwidth measurements taken at our facilities were very good and the test of the electronics interface with our controller was successful. NCSU also took video tape at our facility to be included in the Hypermedia Compact Disk documentation.

The current plan is to have the final installation occur at LANL in August of 1996.

Robotics Workshop

The Los Alamos BEAM Robotic Workshop took place on April 18,19, and 20, 1996. It was held at the Pueblo Complex Gym, where we could provide logistics support for a large number of students. We planned this year on providing a graded approach to building the BEAM robots, where entry level students could build the simplest of robots, the solaroller. Another set of more advanced students were given the next level robot, a two motor photovore called the photopopper. After finishing the solaroller the beginning students graduated to the photopopper. Once the photopopper was done students were encouraged to connect the photovores to the outside world by including touch sensors to detect walls and objects.

We ran a concurrent advanced workshop, in which very advanced students built the pinnacle to BEAM robotics, the microcore walker. Getting a successful walker took between two and three days for these advanced students.

We had approximately 65 students enrolled in the workshop, which was conducted as a three-day affair. Unlike the previous year, when people were encouraged to drop in and build a solaroller, this year we went to the school systems and asked for commitments of three days from the students and their teachers. Also, there were no BEAM Games this year, and all the workshop energy was focused on transferring technical capability to the students. We had students from many Northern New Mexico counties (Sandoval, Los Alamos, Mora, Las Vegas), as well as Albuquerque. We also had several students from the Kayenta Reservation School.

The Workshop was a complete success. One aide described the hum and energy in the room as similar to the feeling in an old church -- so much energy and yet so quiet! Almost every student got their photopopper kits working, and several more than expected graduated to building the walkers on Saturday. We had positive write-ups in all the local papers (Monitor, New Mexican, and Albuquerque Journal), as well as TV coverage by two of the area news teams.

We are presently providing solaroller kits and photopoppers to local students, in the hope of generating more interest in future Workshops. We are also exploring the possibility of having smaller “outreach” workshops in some of the small Northern New Mexico communities.

PUBLIC UNDERSTANDING OF SCIENCE

Practical Applications for Young Scientists (PAYS)

Activity on the PAYS program in this quarter focused on two main areas: academic year program completion and summer program design and recruitment.

Academic-year PAYS Program

The academic year PAYS program culminated on April 24th. Seventeen high school juniors and seniors from high schools throughout northern New Mexico (Mesa Vista, Peñasco, Española, Pojoaque, and Los Alamos) completed the program. In order to prepare for the PAYS summer program experience of working on an interdisciplinary team to develop a science communications project, the academic year PAYS program offered students the opportunity to work on a mini-project.

Each of the PAYS students was on a mini-project team. Each mini-project team was responsible for developing a professional-quality project in one of several areas related to research at the Laboratory in the Human Genome Project. Dr. Julie Meyne (LS-3) of the Los Alamos Human Genome Project was a presenter for the PAYS students about the Project. Student projects included:

- A 250-word article (intended to run in "The New Mexican," "LA Monitor," "Rio Grande Sun," etc.) which clearly communicates what the Human Genome Project is, what the Lab's involvement with it is, and why the HGP is important;

- A brochure which clearly communicates what the Human Genome Project is, what the Lab's involvement with it is, and why the HGP is important;

- A Hyperstudio program which clearly communicates what the Human Genome Project is, what the Lab's involvement with it is, and why the HGP is important;

- A 3-minute video clip (designed to be sent out to television news stations) which clearly communicates what the Human Genome Project is a brief description of what the Laboratory's involvement with it is, and why the HGP is important.

At the final PAYS session on April 24th these projects were on display at a reception held to thank all 1996 PAYS program academic year presenters. PAYS students were also asked to cover a "mock" news conference given by Dr. Joe Martz (NMT-5) and James Rickman (PA-1). James acted as the students' editor, orienting them to the basics of covering a news conference and submitting an article for publication.

Summer PAYS Program

Planning efforts for the summer PAYS program (July 15th-August 2nd) focused on researching Laboratory-related science themes for student communications projects and identifying Laboratory technical resources to assist students in carrying out these projects. Tentative projects for the summer PAYS program include:

- update/redesign the Bradbury Science Museum's WWW Page to be displayed on the Internet as a part of the Laboratory's WWW Pages;
- develop a Hyperstudio program on "ELSI:" The Ethical, Legal, and Social Implications of the Human Genome Project, to be displayed at the Bradbury Science Museum as a part of the current Human Genome Project exhibit;
- design and develop this year's PAYS Journal, a newsletter which highlights the work of PAYS students and their summer projects;
- design and deliver a hands-on presentation on radiation for the Bradbury Science Museum;
- update the ALEXIS (Satellite Operations Center) museum display at the Bradbury Science Museum.

Science Education Information On-line

Work continued this quarter on polishing the new hardware and software for the WWW server. Updates to the statistics program and automatic backup were made. Work is still continuing in several areas. These include:

- assistance to projects to add their resources to the server;
- continuing to update program information to reflect new changes; and
- continuing work for the upgrade to the server hardware and software.

From April 1 through June 30 over 5,420 different sites from 57 countries visited the server. These visitors transferred 18,320 pages representing more than 440 million bytes of data. Detailed statistics on access to the server are kept and summaries are available for viewing on the server. The top ten countries were:

- United States of America 26927
- Australia 506
- Canada 684
- Japan 298
- Sweden 228
- United Kingdom 276
- Germany 216
- Belgium 40
- Netherlands 150
- France 127

The top six subject areas of interest on the server for this quarter were:

- Science at Home
- Science Education Program Information
- TEAM Teacher's Environmental Assessment and Modeling Program
- NTEP National Teacher Enhancement Program
- NM On-line Internet Institute (OII)
- Model-Nets Project Information

The uniform resource locator (URL) for the WWW server is:

http://education.lanl.gov.

The Hydrogen Project

Planning for the New Educators' Workshop continues; the deadline for the final program is August 15, 1996. Preliminary announcements are being distributed to journals and periodicals, appropriate organizations, and educational institutions. In addition, Norfolk State University, the conference organizer, will be mailing over 3500 brochures.

Additional, non-contracted, deliverables will be included in the current activity. These will be:

- Summer 1996: Development of materials for home-page to promote conference and provide pre and post conference materials about mini-workshops and demonstrations/experiments.
- October 1996: Real-time world wide web video conferencing of the hydrogen component of the National Educators' Workshop.
- October 1996: Successful demonstration at NEW of the solar/hydrogen generation unit built during the summer at LANL.
- October 1996: Successful educational demonstration at NEW of the radio controlled fuel cell vehicle built at LANL.

The LANL Outreach activity will be funding the development of the experiment/demonstration activity : *Electrolytic Production of Hydrogen Utilizing Photovoltaic Cells.* This is being done by staff at ESA-EPE in conjunction with MST-11. A source of free solar cells, from government surplus at TRW, has been identified. There will be enough materials to provide packets to all interested conference participants.

Two proposals have been submitted to the DOE Hydrogen Program Office for new activities for next year: "Make Your Own Energy -- A Proposal for a High School Curriculum," and "Make Your Own Fuel/Drive Your Own Car --The Solar/Hydrogen Energy System and Vehicle Competition." Both projects build on the work being done as a part of the National Educators' Workshop and the additional activities including the solar/hydrogen energy unit currently under development at LANL.

An informal site visit was made to the Department of Science Teaching and the Solar Tower at the Weizmann Institute in Rehovot, Israel, on 9 July 1996, at no cost to DOE. The Weizmann Institute is a leader in the field of curriculum development for a variety of ages of students including junior high school, advanced placement, as well as general "science for all " programs. In addition, they are also responsible for extensive teacher training and enhancement activities. The Department of Science Teaching has worked closely with scientists at the Solar Tower facility to develop educational activities on solar energy.

Over the next two months, we will be developing materials about the New Educators' Workshop for the new Hydrogen InfoNet web site at NREL. Real-time video conferencing planning continues.

OTHER

K-12 Equipment for Education Program

During the third quarter of FY 96, 34 items were gifted through the K-12 Equipment for Education Program. These items were given to 29 schools participating in the Critical Issues Forum, TOPS Mentor Program and the TEAM Program. The equipment had a total value of $91,355.11.