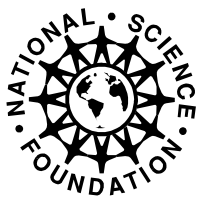
ADVANCED TECHNOLOGICAL EDUCATION PROGRAM

1996 AWARDS AND ACTIVITIES

ADVANCED TECHNOLOGICAL EDUCATION

DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES
Division of Undergraduate Education
Division of Elementary, Secondary, and Informal Education

NATIONAL SCIENCE FOUNDATION



Division of Undergraduate Education

Division of Elementary, Secondary, and Informal Education

The Advanced Technological Education (ATE) Program

FY1996 Awards

TABLE OF CONTENTS

I. Introduction

II. Abstracts of Awards

III. Appendix

ADVANCED TECHNOLOGICAL EDUCATION (ATE)

The ATE program promotes exemplary improvement in advanced technological education at the national and regional level through support of curriculum development and program improvement at the undergraduate and secondary school levels, especially for technicians being educated for the high performance workplace of advanced technologies. *Curriculum development* encompasses the design and implementation of new curricula, courses, laboratories, and instructional materials. *Program improvement* encompasses faculty and teacher development, student academic support, and formal cooperative arrangements among institutions and other partners. ATE projects and Centers result in major improvements in advanced technological education, serve as models for other institutions, assure that students acquire strong backgrounds in mathematics and science, and yield nationally-applicable educational products. All projects and Centers have a vision for technician education used to guide project development. The ATE program is managed jointly by the Division of Undergraduate Education (DUE) and the Division of Elementary, Secondary, and Informal Education (ESIE).

LEADERSHIP AND DEVELOPMENT ACTIVITIES

In the third year of operation of the ATE program, many development and outreach activities occurred. The staff has made efforts to involve all interested parties in the continuing development of the program: two-year colleges, four-year colleges and universities, industry, secondary schools, researchers in both industry and education, and other government agencies. The focus has been on developing partnerships among groups with two-year colleges in leadership roles. Activities included:

- October, 1995: Workshop on *Engineering Technology Education in Two-Year Colleges*; workshop was jointly sponsored by NSF, Accreditation Board for Engineering and Technology (ABET), American Society for Engineering Education (ASEE), and Sinclair Community College and was held at Sinclair.
- November, 1995: DUE-and ESIE, in cooperation with the American Association of Community Colleges (AACC) supported the second Principal Investigator's Conference for the ATE program. The meeting involved approximately 70 active ATE projects and Centers. A pre-conference workshop focused on grant management issues.
- October 1995 - September 1996: Regional ATE workshops were sponsored and were attended by administrators and faculty members. Such workshops were held in Illinois, Mississippi, Virginia, Texas, Maryland, Missouri, Arizona, and the District of Columbia.
- Participation in Professional Society Meetings: DUE-and ESIE staff participated in meetings of many professional societies and made presentations about the ATE programs.
- March, 1996: *1995 Awards and Activities Advanced Technological Education (NSF 96-54)* was published.
- March and June, 1996: Regional Technology Strategies in cooperation with NSF sponsored two ATE symposia in Florida and Massachusetts focusing on the role of two-year colleges in support of high performance manufacturing.
- April, 1996: *Activities in Support of Two-Year College Science, Mathematics, Engineering, and Technology Education: Fiscal Year 1995 Highlights (NSF 96-83)* was published.

- April, 1996: Second Community College Day was held at NSF and featured Fred Haise, astronaut, member Apollo 13 crew, and recipient of AACC Two-Year College Alumni award.
- May, 1996: *Preparing the Knowledge Worker of the Future* national workshop was held in Seattle, Washington supported by the ATE Northwest Center for Emerging Technologies. Bill Gates of Microsoft and Phil Condit of Boeing were featured.
- June, 1996: AACC Round Table of national leaders in Science, Mathematics, Engineering, and Technology Education in Two-Year Colleges was organized and aligned with the videoconference below. AACC Monograph is to be published and distributed in fall 1996.
- June - July, 1996: Two Phi Theta Kappa two-year college honor students served as summer interns at NSF. The program was jointly sponsored by NSF (DUE-and ESIE), AACC, and Phi Theta Kappa. These interns worked on the ATE program and other two-year college activities.
- June, 1996: Special session on ATE was presented at the NSF/EHR Partnership Conference.
- July, 1996: Institutional teams representing ATE Centers participated in and exhibited at the NSF National Conference *Shaping the Future*.
- September, 1996: *Leading the Nation: Innovation in Two-Year College Science, Mathematics, Engineering, and Technology Programs* National Videoconference was sponsored by AACC and NSF.

PROGRAM SUPPORT

The ATE program is supporting projects in instructional materials and curriculum development; laboratory development and enhancement; faculty and teacher enhancement and preparation; and technical experiences for students. The ATE program also supports eight Centers in Advanced Technological Education. The awards cover a wide range of advanced technological education fields including biotechnology, environmental technology, computer and information systems technology, chemical technology, manufacturing technology, electronics, geographic information systems technology, telecommunications, instrumentation and calibration technologies, and laser technology as well as mathematics, physics, biology, chemistry, and other core courses which serve to undergird such programs.

TABLE 1
Award Distribution by Focus Area Applying to ATE Program

	Continuing	New
Science Technologies including Biotechnology, Chemical Technology, Computer Technology, and Environmental Technology	21	10
Engineering Technologies including Manufacturing, Electronics, Aerospace Technology, GIS, and Civil.	32	18
Core Courses including Mathematics, Physics, Technology Education, and Multi/Interdisciplinary	17	8
Total Awards Among Projects submitted to the ATE program	70	36

In FY96, the ATE program supported two new Centers of Excellence in Advanced Technological Education.

- The Maricopa Advanced Technology Education Center (MATE) is focusing on semiconductor manufacturing and related supporting industries. Primary objectives include creating new curricular systems and materials, providing technical support for faculty who prepare students for these technical careers, and increasing the number of students who prepare for and become employed by the semiconductor manufacturing industries. The Center is a joint effort of the Maricopa Community College District; 10 semiconductor manufacturing firms including Intel, Motorola, SGS-Thompson, and Microchip Technology; SEMATECH; two Tech-Prep consortia involving 13 secondary schools; and 3 other community college districts.

- The South Carolina Advanced Technological Education Center is creating a more highly educated technical workforce in advanced engineering technology fields. Objectives focus on curriculum reform, program improvement, and faculty development. Curriculum reform combines development of an integrated/coordinated engineering technology core using a systems-based approach along with advanced specialty courses. Faculty development focuses on use of interdisciplinary teaching teams. The Center involves the SC Technical/Community College System as well as all 16 technical colleges in South Carolina and over 25 other educational institutions, governmental agencies, and businesses in active roles including Clemson University, the SC State Department of Education, the SC NSF SSI, BellSouth, Michelin, Bose, Robert Bosch, and NCR.

The two new Centers join the 6 continuing Centers funded originally in FY94 and FY95.

- The New Jersey Center for Advanced Technological Education led by Middlesex County College is creating a new associate's degree program in engineering technology to meet the demand for multifunctional engineering technicians. This new program being developed by community colleges is derived from combining mechanical, computer, telecommunications, and electronics technological programs. The program begins in grade 11, continues through the associate degree, and articulates with baccalaureate programs at New Jersey Institute of Technology for engineering technology programs and with The College of New Jersey's program in technology education to prepare future secondary teachers.

- The Northwest Center for Sustainable Resources led by Chemeketa Community College in Oregon is a collaborative effort of secondary schools, community colleges, four-year institutions, industries, government agencies, Native American tribes, and applied international research groups. Associate degree natural resource technology programs incorporate higher levels of mathematics and science using an ecosystems approach that emphasizes sustainable methods of resource utilization. Program graduates enter employment as advanced technicians in a variety of science-based occupations including forestry, fishery, environmental restoration, and geographic surveying, or they may continue for baccalaureate and other advanced degrees.

- Bellevue Community College in Washington, in collaboration with industry, government, secondary schools, other community colleges, and four-year institutions, is leading a new Center in Information Technology to respond to industry's need for well-trained technicians. The Center, with strong input from industry, is developing articulation standards and model associate degree programs particularly for information science. Microsoft and Boeing as well as many small to medium size companies in the Seattle area are active partners in the Center, serving to provide both personnel as well as financial resources.

- The Advanced Manufacturing Center, housed on the campus of Sinclair Community College in Ohio, is a joint effort of Sinclair, the University of Dayton, numerous local industries, and secondary schools. It includes community colleges in 3 other states in development activities with other involvement planned in beta testing stages. The Center is acting as catalyst to improve science, mathematics, and advanced manufacturing instruction by developing an advanced manufacturing curriculum that begins in grade 11, continues through the associate degree program, and culminates in a bachelor's degree; writing, pilot testing, and publishing curriculum materials; and disseminating the curriculum, instructional materials, and model program nationally.

- The Environmental Center is a joint effort of Eastern Iowa Community College, Kirkwood Community College, Hazardous Materials Training and Research Institute (HMTRI), and Partners for Environmental Education (PETE) and involves over 500 community colleges in dissemination efforts. The Center is developing nationally validated curriculum models and instructional materials; establishing comprehensive programs of professional development; serving as a clearinghouse for environmental education information; and acting as a hub for the networking of environmental educators, business and industry, federal agencies, and professional societies.

- The Distance Education Center led by Texas State Technical College in Sweetwater involves many institutions in Texas, New Mexico, and Oklahoma. The project is developing the infrastructure and pedagogy to deliver many technical courses through distance learning. These include existing courses in CAD/CAM/CIM as well as new AAS programs in polymer technology and electro-mechanical technology to complement needs of local industry. ATE is pioneering this model for managing distance education among separate and diverse institutions that are collaborating to share their resources and to expand opportunities available to students. Sub-projects within the Center have developed Internet and HTML-based curricular materials to enhance interactive video instruction both synchronously and asynchronously.

In addition to the 2 new Centers, in FY96, the ATE program supported 34 new projects. For example:

- Edmonds Community College in Washington state is developing a ChemCore curriculum which serves as a basis for a laboratory technician program. This program integrates laboratory chemistry with 5 new academic courses in instrumental analysis, information technology, management, technical writing, and applied communications. Goals include development of an interdisciplinary, transferable laboratory curriculum and preparation of students with interdisciplinary knowledge, skills, and experiences required for employment as laboratory technicians.

- Springfield Technical Community College (STCC) is undertaking an ATE project in telecommunications and network engineering technology education. The project is a collaborative effort of STCC with the Universities of Connecticut and Hartford and the Springfield public schools. Its purpose is to develop an integrated curriculum, a teacher training model, and a model laboratory which meets the educational needs of the telecommunications and networking industries in the 21st century.

- Desert Research Institute in partnership with the Community College System of Nevada, Colorado Mountain College, and the University Corporation for Atmospheric Research is developing computer-interactive training modules in atmospheric technology designed to support environmental technology degree curricula at community colleges nationwide.

- Capital Community Technical College, in cooperation with the American Mathematical Association of Community Colleges (AMATYC) and NASA, is designing a series of activities for community and technical college students in mathematics and science based on a collections of real world technical applications from the fields of aeronautics and space.

- The Geological Society of America (GSA) is involving faculty from two-year and four-year colleges and secondary school teachers in a series of workshops which emphasize hands-on experiences in data acquisition, manipulation, and presentation technologies for the earth and space sciences. In particular, the project is exploring such technologies as Geographical Information Systems (GIS), Global Positioning Systems (GPS), multimedia, Internet, and image processing.

- The University of Cincinnati College of Applied Science and the American Chemical Society are developing a project to help provide chemistry-based technicians with the skills and education required for successful careers in laboratories and plants throughout the United States. Activities focus on facilitating the development of networked alliances for chemical technician education, developing and evaluating curriculum and instructional materials based on the voluntary industry standards for chemical technicians, and enhancing two-year college and high school teachers involved in chemical technician education.

The ATE program continues to fund projects begun in previous years.

- Seminole Community College in Florida is developing a new and innovative curriculum for introductory college physics. The course targets students in technology courses while maintaining the rigor that makes it transferable to four-year colleges and universities. It emphasizes a hands-on approach and motivates students to see connections between physics and their chosen fields.

- Wentworth Institute of Technology in Massachusetts is creating, through joint efforts of mathematics and technical faculty, laboratory investigations using engineering laboratories and multimedia simulations that illustrate mathematical concepts.

- Prince George's Community College in Maryland is leading a consortium of 12 community colleges each linked to a NASA Center to conduct faculty enhancement workshops in remote sensing, image processing, and geographic information systems. They are also developing an earth systems science course and interdisciplinary modules which can be infused into science and technology courses.

- Johns Hopkins University is leading a cooperative effort which represents 5 different consortia of community colleges (including over 130 community colleges) to develop instructional modules in science, mathematics, manufacturing technology, and technical communications to infuse into courses that comprise a broadly accepted, portable associate's degree in manufacturing. Curriculum materials are based on Secretary's Commission on Achieving Necessary Skills (SCANS) competencies. These work-based competencies are outlined in a national report from the U.S. Department of Labor published in 1992.

- Texas State Technical College at Waco is leading a multi-state effort to develop curricula and laboratory materials to enhance student learning in advanced technologies for 15 occupational areas supporting American machining and machine tool industries. Key goals include providing highly multi-skilled graduates, producing upgraded and new educational materials, working closely with college and industrial partners to validate competencies and materials, and preparing a national model for apprenticeships and internships.

In addition to projects which were submitted to the ATE program, several projects in other programs were co-funded by ATE. For example:

◊ For the 5 Chemistry Initiative awards, the ATE program contributed funds to ensure that curricula developed through those awards are tested in and adapted for appropriate technical programs such as those that prepare chemical, environmental, or biomedical technicians.

◊ The ATE program participated with Dickinson College in the Workshop Physics project. The methods and materials which emphasize hands-on laboratory exercises are particularly applicable to two-year college technical programs.

◊ ATE contributed to a teacher enhancement project at Mississippi State University which is directed at student transition to the workplace through manufacturing experiences. Physics and Tech-Prep teachers are participating in a 5 week program which includes three weeks with Peavey Electronics Corporation and 2 weeks of material development at Mississippi State.

Special projects supported through the ATE program include:

* The City Colleges of Chicago are planning a national conference which supports partnerships between urban community colleges and industry to prepare students in urban communities to enter and succeed in the workforce. For each of nine major cities, the conference will

involve the city mayor's office, business and industry, Superintendent of the public schools, and Chancellor or President of the community college system.

* Phi Theta Kappa, the honor society for community colleges, is developing and conducting a multi-component faculty enhancement and curriculum development project to strengthen SMET education in two-year colleges. The project is accomplishing its goals through activities which stimulate and assist other community colleges to replicate effective NSF supported community college curriculum materials and faculty development projects.

* The American Association of Physics Teachers (AAPT) is establishing a network of physics faculty in two-year colleges which consists of 15 regional organizations, coordinated and linked by a national steering committee. The purpose is to help improve learning opportunities for students in two-year colleges including those who transfer, those who become technicians in the high-technology workplace, and all students for whom physics serves as part of their college education.

* The American Association of Community Colleges is coordinating a series of activities including (a) a Round Table of national leaders to develop recommendations regarding SMET education in two-year colleges to be published as an AACC monograph, (b) a National Videoconference *Leading the Nation: Innovation in Two-Year College Science, Mathematics, Engineering, and Technology Programs,* and (c) a yearly meeting of persons interested in advanced technological education including all the principal investigators in ATE projects.

AWARD STATISTICS

For FY1996 a total of $23.7 million was awarded for ATE activities. Since ATE funds are divided between the Division of Undergraduate Education (DUE) and the Division of Elementary, Secondary, and Informal Education (ESIE) in the ratio 2:1, approximately $15.8 million was provided by DUE-and $7.9 million by ESIE. As can be seen in Table 2, 120 proposals were received requesting about $186 million. Table 3 provides relevant information about the current year and out-year commitments for the program.

TABLE 2
Proposals Received for the February 1, 1996 Deadline and Reviewed March 14-16, 1996

Type of Proposal	**Number**
Centers of Excellence	18
Projects in Advanced Technological Education	102
Total Number of Formal Proposals Received	120
Dollars Requested:	$186 M

TABLE 3

Fiscal Year 1996 Award Statistics for ATE (Dollars in Millions)

Type	Number	FY96	FY97 (Outyear)	FY98 (Outyear)	Total
Centers New	2	$1.37	$1.39	$1.87	$4.63
Projects New	34	8.26	4.53	1.79	14.51
Centers Cont.	6	5.29	2.90	-	8.19
Project Cont.	17	5.56	1.77	-	7.33
Special Proj.	4	0.45	.40	.26	1.18
Other Programs	15	0.85	.54	.36	1.75
Leadership Actv.		1.52			1.52
Totals	78	$23.30	$11.53	$4.28	$39.11
Contributions from Other Programs		0.37	0.37	0.07	0.81
Total		$23.67	$11.90	$4.35	$39.92

As seen in Table 3, ATE partially or fully supported 15 projects submitted to other programs that directly benefited technician education. These included 3 Course and Curriculum Development projects, 5 Chemistry Initiative projects, 3 Mathematics and Their Applications Across the Disciplines projects, 1 Instructional Materials Development project, 1 Teacher Enhancement project, 1 Young Scholars project, and 1 Research Experiences for Undergraduates project. Other NSF programs contributed funds to 4 ATE projects. The Teacher Preparation Program in DUE-contributed $320,000 to 3 of the ATE Centers for special activities that prepare future K-12 teachers, and the Studies and Indicators Program contributed $50,000 to an ATE special study.

In the third year of the program, 36 of the 120 proposals submitted were funded, for a funding rate of 30%. These new awards went to institutions in 21 states. With ATE projects continuing from FY94 and FY95, those co-funded with other projects, and new awards, ATE projects are currently being supported in 36 states plus the District of Columbia.

PROGRAM IMPACT

The projected national impact of the ATE program is large, especially that of the 8 Centers and large curriculum and faculty enhancement awards. The Northwest Center for Information Technology estimates that it will affect during a 5 year period over 5,000 ATE college students, 350 ATE faculty and high school teachers, and 2,700 high school students. The Environmental Center estimates that in the first 3 years of its award, it will directly impact 300 community college teachers, 300 pre-college teachers, and 5,500 students. The Maricopa Community College District estimates that it will directly impact 360 college faculty, 430 precollege teachers, 2,500 college students, and 6,000 high school students, with many more students affected from secondary efforts in mathematics and science. The South Carolina Technical/Community College Center in

engineering technology is affecting 500 college faculty, 500 high school teachers, 5,000 college students, and 5,000 high school students.

The largest projects are developing and testing curricula nationwide or are engaged in faculty enhancement activities. For example, the Miami University Middletown Ohio project plans to affect 600 pre-college teachers and college faculty in faculty enhancement workshops and 20 in curriculum development efforts. Assuming each teacher or faculty member directly impacts 100 chemistry or chemical technology students per year, this will result in 60,000 students being ultimately impacted by the project.

TABLE 4
Projected Impact of the FY96 Grants in the ATE Program

1st Year Impact (36 new awards):	2,160 Teachers/ Faculty	216,000 Students
3-Year Impact (36 new awards):	6,480 Teachers/ Faculty	648,000 Students
FY96 Impact of all ATE Awards Active in FY96: (105 active awards + 9 special active projects)	6,840 Teachers/Faculty	684,000 Students
3-Year Impact of FY94-96 ATE Projects (234 awards*)	14,040 Teachers/Faculty	1,404,000 Students

* 58 FY94 awards, 71 awards active in FY95, and 105 awards active in FY96

This table assumes that each project funded in FY96 or before will impact an average of 60 teachers or faculty members and that each teacher or faculty member will directly impact 100 students. As can be seen by numbers in preceding section estimated by projects, this is a conservative estimate.

Evaluators of projects are reporting numbers that meet or exceed numbers projected. For example:

- The Northwest Regional Educational Laboratory, which is conducting the evaluation of the Mt. Hood Community College (MHCC) mathematics project, reports that the textbook ***Interactive Mathematics III*** produced by the project and published by Saunders College Publishing is being used in (a) 23 sections at MHCC by 11 different instructors and 805 students, and (b) 42 sections at 18 other community colleges and 1 high school by approximately 1,500 students.

- The Eastern Iowa Advanced Technological Environmental Education Center (ATEEC) evaluator reports that in FY96 (a) 38 teachers and faculty from 21 states participated in an intensive 2 week summer institute, (b) over 600 college and high school educators and environmental practitioners attended six regional two to three day workshops, (c) over 6,500 newsletters were published and disseminated, (d) over 100 models of curriculum materials in environmental education were collected (19 were placed on Websites and over 58 institutions

have reported they have accessed and used these), (e) 30 business and industry leaders participated in a three day workshop to help define environmental technician needs and skills, and (f) over 4,200 copies of the national forum workshop on ***Partnering to Build a Quality Workforce*** were distributed.

- California State Hayward reports on the Faculty and Teacher Enhancement survey form that for the 1996 summer workshop 83 teachers applied for 48 slots and 50 attended. These are intensive workshops involving 10 days each summer for two summers plus 6 days during each academic year. Other teachers and faculty are involved in presenting workshops and seminars.

PROGRAM ISSUES

As work becomes more interdisciplinary and team-oriented, technical education must find a way to educate students more broadly in science, mathematics, engineering, and technology (SMET) and in general workplace competencies. The improved articulation of curricula and classroom experiences in advanced technological education between secondary schools and two-year institutions and between two- and four-year colleges and universities is an important goal of the ATE program. Additionally ATE projects seek to enhance career opportunities for graduates of two-year science and engineering technician programs, as well as maintain currency of teachers and faculty in fields which are undergoing rapid technological transformation. The list below outlines the major issues and describes some of the ATE initiatives which address these issues.

- **OUTREACH TO OTHER EDUCATIONAL INSTITUTIONS**: How can four-year colleges and universities be more involved in the ATE program in appropriate and substantive ways? How can articulation for students among secondary schools, two-year colleges, and four-year colleges and universities in advanced technological education be improved? How can collaboration among institutions be enhanced?

One of the prime issues at the AACC National Videoconference on SMET education was "Transitions" from secondary schools to two-year colleges and from two-year colleges to four-year colleges and universities. Several projects are experimenting with alternative articulation strategies between two-year and four-year institutions to enhance flexibility for students without compromising academic readiness. Four-year colleges and universities are increasingly becoming involved in ATE projects with 11 of the 36 new awards being made to four-year colleges on behalf of a consortium which has both two- and four-year institutions involved. The two new ATE Centers this year have student transition from secondary schools to two-year technical programs as a major focus. The Maricopa Center is working closely with the Phoenix Urban Systemic Initiative and the South Carolina Center is working closely with the South Carolina Statewide Systemic Initiative.

- **INVOLVEMENT BY EMPLOYERS**: What are the implications for ATE programs as more employers are collaborating with educational institutions, but often have their own agendas? What alternative and/or additional industrial support for ATE projects is required? What industrial support is needed to improve the professionalism of technician careers? How can the two-year associate degree become a credential more valued by the workplace? What are the

transitional activities needed to provide students smoother entry into the workplace? What continuing educational activities should be provided for workers in advanced science and engineering technological careers? How can ATE supported programs maintain currency with rapidly changing industrial needs?

All ATE Centers and projects involve industry in active roles. The focus of the ATE conference in November of 1996 was "Partnering with Business and Industry" and projects had one of their industry partners participate in this meeting. Industry representatives participated in the AACC Round Table and the AACC National Videoconference. A major theme of the AACC National Videoconference was Partnering.

- **SECONDARY SCHOOLS:** How does the ATE program encourage two-year college and secondary school connections? How are secondary school teachers educated about programs in technician education? How are students encouraged to consider careers as technicians?

All of the ATE Centers have programs with secondary schools to provide outreach and engage in common activities to schools, including Tech-Prep consortia; to provide information about programs leading to careers as technicians; and to engage in professional development for teachers. Several ATE projects target secondary schools directly. The ATE program has provided funding for projects focusing on technicians in Teacher Enhancement and Instructional Materials Development. During this next year, a study will be conducted to provide details on the variety of interactions with secondary schools.

- **STUDENTS**: How can ATE programs improve the career opportunities for graduates of two-year science and engineering technician programs? How can ATE programs attract, retain, and place students who are underrepresented in science and engineering technician fields? What workplace and other experiences are needed by students so that they are prepared to enter the workplace?

Information on student involvement in ATE Centers and projects is not as readily available as most other types of data. This was a focus of the ATE pre-conference workshop where Center directors and their evaluators met with NSF staff and other professional evaluation experts. A second pre-conference workshop focused on student internships and cooperative experiences. Centers also report data on how classrooms and other educational experiences for students have changed as a result of participating in ATE sponsored programs. All annual reports summarize student outcomes.

- **FACULTY AND TEACHERS**: What support can ATE provide to prepare future faculty and teachers for technological programs? What types of faculty and teacher enhancement activities best serve those currently teaching in technological programs? What workplace experiences need to be regularly provided for faculty teaching in technological programs? How can teachers and faculty remain current in fields which are changing so rapidly?

One of the primary goals is the continued professional development of faculty and students. Data indicate that the ATE program is reaching large numbers of faculty and teachers directly

in program development as well as through workshops and seminars. Activities also include a large number of faculty internships in business and industry. In FY 96, the ATE program sent a survey to all ATE Centers and projects on teacher and faculty enhancement. The survey will be analyzed when all data for FY96 have been submitted.

- **CURRICULUM:** How can the core of mathematics, sciences, and technology be improved so that students are well educated and have the proper skills and knowledge to enter the workplace and also have the necessary background to adapt and change and learn as new technologies emerge? What is the proper balance between core mathematics and science courses and technical courses? What is the balance required between theoretical and applied educational experiences?

The ATE program evaluation to be started in FY 97 will help to address some of these concerns. All ATE projects are working on these issues. The balance between delivering sufficient specific technical skills so that students can go to work immediately while having enough broad education to allow them to continue to learn or to continue in a four-year program is a delicate one.

- **INTERNATIONAL COMPETITIVENESS**: How can the ATE program help ensure that technicians graduating from the ATE funded programs have the high-level skills to compete in the international arena? What skills must ATE graduates possess to help induce employers to stay in the United States? What important new ideas can ATE learn from experiences in other countries?

Program directors are exploring education of technicians in other countries. It is hoped that a preliminary international study will take place in FY97. NSF staff meet with large numbers of foreign visitors interested in technician education and are themselves studying technician education in other countries.

EVALUATION

Evaluation of the ATE program is multifaceted. It includes :

1. **National Advisory Boards and National Visiting Committees**: All ATE Centers and large projects as well as many smaller projects have National Visiting Committees. The National Visiting Committees are expected to serve three primary functions: (a) provide advice to the project staff; (b) prepare annual reports to the NSF and the project which assess the project's progress and plans; and (c) enhance evaluation and dissemination of the project's achievements.

2. **Site Visits by Program Directors and Contractors**: Site visits include those made in association with the National Visiting Committees, pre-award visits to new ATE Centers, and visits to projects and Centers.

3. **Monitoring, Documenting, and Technical Assistance**: A contract was awarded in FY96 to develop a plan to help monitor, document, and provide technical assistance to ATE Centers

and selected projects. Nine ATE sites were visited as part of contract activities. Among the reported strengths of the ATE projects were (a) creative approaches to education that involved students and faculty in hands-on activities that reflect real-world problems; (b) faithfulness to the ATE program in preparing students for high technology positions, particularly through interactions with business and industry; and (c) significant regard to articulation between secondary schools and two- and four-year institutions.

4. **Yearly ATE Principal Investigators' meetings**: Previous meetings were held in 1994 and 1995. In November of 1996 the third ATE PI meeting was held. At the 1996 meeting entitled ***Partnering with Business and Industry*** all projects were required to participate in a Showcase session and demonstrate their progress to date. This was a meeting highlight as it allowed projects to network and learn more about what others were doing. It also gave NSF program directors the opportunity to learn more about all projects. In addition, special sessions focused on project evaluation, student internships, data collection, and financial management.

5. **Annual reports, final reports, and other self-reporting mechanisms**: All ATE projects and Centers are required to submit annual reports. These are read by cognizant ATE program directors with follow-ups as needed. In addition, most of the projects communicate project activities frequently to NSF program directors.

6. **Formal evaluation of the ATE program**: Initial arrangements are being made to conduct a formal evaluation of the ATE program.

FUTURE PLANS

The ATE program has initiated multiple activities for the coming year and beyond.

- It is expected that the ATE program will make awards for up to 5 new Centers of Excellence in Advanced Technological Education and multiple projects to expand and diversify the impact of the program. It is anticipated that the funding level for FY97 will be increased by approximately $4 million.
- The ATE program will continue to co-fund proposals submitted to other programs to help involve multiple institutions and to help ensure that many institutions consider education of the future workforce, including those who will work as technicians, to be an important component of their projects.
- Special projects that address important issues related to technician education will continue to be supported. Among those activities envisioned for FY97 include issues in education of technicians in urban areas, issues in engineering technology education, international issues in technician education, and articulation among two- and four-year institutions in technical fields.
- More involvement by business and industry in the ATE program will be encouraged.
- Appropriate active participation of four-year colleges and universities in ATE issues including project leadership, materials development, quality assurance, faculty and teacher development, and consultancies will be promoted.
- The ATE program will more actively seek projects focusing on preparation of the future secondary school teachers who teach in these fields.

- Additional dissemination by publishers and other distributors, replication by other sites, and dissemination through workshops will be addressed.
- The ATE program will actively seek ways to provide financial and grant management information to Centers and projects as appropriate for their needs.
- In the coming year, a Committee of Visitors will assess management of the ATE program, both technically and administratively, and will evaluate the fairness and openness of the grant process to all proposers.

New FY 1996 ATE Awards by Technology Area*

Type of Technology	Award	State	Type	Length in Years	1st. YEAR AWARD ATE	1st. YEAR AWARD Overall (in 1000s)	TOTAL AWARD ATE	TOTAL AWARD Overall (in 1000s)	Page
BIOTECHNOLOGY									
Rutgers State University	9602356	NJ	PR	3	350	350	350	350	29
Pima County Cmty. College	9602368	AZ	PR	3	330	330	330	330	31
Broward Community College	9602383	FL	PR	3	250	250	250	250	33
SUNY Stony Brook	9602450	NY	PR	2	225	225	450	450	39
	subtotals				**1155**	**1155**	**1380**	**1380**	
CHEMICAL TECHNOLOGY									
Edmonds Cmty College	9602403	WA	PR	3.5	399	399	399	399	36
University of Cincinnati	9602437	OH	PR	3	340	340	1098	1098	38
City Col. of Chicago Truman	9602443	IL	PR	3	140	140	210	210	39
	subtotals				**879**	**879**	**1707**	**1707**	
COMPUTER and INFORMATION TECHNOLOGY									
Middlesex County College	9602375	NJ	PR	2	310	310	310	310	33
	subtotals				**310**	**310**	**310**	**310**	
ELECTRONICS									
Maricopa County CC District	9602373	AZ	CE	3	874	893	2644	2704	21
Albuquerque Technical Voc. Inst. (TVI)	9602349	NM	PR	2	218	218	421	421	27
	subtotals				**1092**	**1111**	**3065**	**3125**	
ENGINEERING TECHNOLOGY									
South Carolina State Board of Technical & Comprehensive Educ.	9602440	SC	CE	3	500	550	1950	2100	21
Purdue University	9602355	IN	PR	3	427	427	1348	1348	29
Queensborough Cmty. College	9602369	NY	PR	3	193	193	600	600	32
Iowa State University	9602370	IA	PR	3	224	224	674	674	32
New Mexico State University	9602430	NM	PR	2.5	169	169	169	169	37
College of the Desert	9602448	CA	PR	2	300	300	300	300	39
	subtotals				**1813**	**1863**	**5041**	**5191**	
ENVIRONMENTAL TECHNOLOGY									
University of Nevada, Desert Res. Inst.	9602351	NV	PR	3	150	150	450	450	28
Partnership for Environmental Tech. Educ.	9602365	CA	PR	2	300	300	600	600	31
Monterey Peninsula College	9602384	CA	PR	1	75	75	75	75	34
	subtotals				**525**	**525**	**1125**	**1125**	
GEOGRAPHICAL INFORMATION SYSTEMS									
University of California - Santa Barbara	9602348	CA	PR	2	188	188	188	188	27
Geological Soc. of America	9602408	CO	PR	3	150	150	595	595	37
	subtotals				**338**	**338**	**783**	**783**	

Key: PR= Project, **CE**= Center, **SP**= Special Project, **ATE**= Advanced Technological Education

* Does not include Special Projects or ATE contributions to other programs

Type of Technology	Award	State	Type	Length in Years	1st. YEAR AWARD ATE	1st. YEAR AWARD Overall (in 1000s)	TOTAL AWARD ATE	TOTAL AWARD Overall (in 1000s)	Page
MANUFACTURING									
West Valley Cmty. College District	9602345	CA	PR	2	251	251	500	500	27
University of Washington	9602360	WA	PR	3	218	218	218	218	30
Wytheville Cmty. College	9602397	VA	PR	2	137	137	300	300	35
Oklahoma State University - Okmulgee	9602390	OK	PR	2	300	300	600	600	35
Edison Industrial Sys. Center	9602431	OH	PR	3	500	500	1200	1200	38
Cleveland State University	9602457	OH	PR	2	300	300	609	609	40
	subtotals				**1706**	**1706**	**3427**	**3427**	
MATHEMATICS									
Center for Occup. Research & Development (CORD)	9602361	TX	PR	1	108	108	108	108	30
Maricopa County CC District	9602386	AZ	PR	3	161	161	353	353	34
Capital Cmty-Techn. College	9602456	CT	PR	3	260	260	260	260	40
	subtotals				**529**	**529**	**721**	**721**	
MULTIDISCIPLINARY									
National Alliance of Business	9602352	DC	PR	2	200	200	400	400	28
Colorado State University	9602376	CO	PR	2	75	75	75	75	33
Harvard University	9602404	MA	PR	2	374	374	374	374	36
Phi Theta Kappa	9602459	MS	PR	1.5	212	212	212	212	41
Harold Washington College-Chicago	9634670	IL	SP	.5	10	10	10	10	61
	subtotals				**871**	**871**	**1071**	**1071**	
TELECOMMUNICATIONS									
Nashville State Tech Inst.	9602401	TN	PR	2	217	217	447	447	35
Springfield Techn Cmty. Col.	9602433	MA	PR	2	200	200	400	400	38
	subtotals				**417**	**417**	**847**	**847**	
(All amounts are in 1000's)	**Grand Total**				**9635**	**9654**	**19477**	**19687**	

Key: PR= Project, **CE**= Center, **SP**= Special Project, **ATE**= Advanced Technological Education

* Does not include Special Projects or ATE contributions to other programs

1994 and 1995 Awards Continuing into 1996 by Technology Area*

Type of Technology	Award Number	State	Type	Length in Years	TOTAL AWARD ATE (in 1000s)	TOTAL AWARD Overall (in 1000s)	Page
BIOTECHNOLOGY							
California State University Haywood	9454502	CA	PR	3	250	250	54
Peralta Community College District	9454657	CA	PR	3	209	209	59
Middlesex Community College	9454642	MA	PR	3	1132	1132	58
Madison Area Technical College	9454555	WI	PR	3	1000	1000	55
Georgetown University	9553661	DC	PR	2	150	250	43
De Anza College	9553708	CA	PR	2	225	225	49
Hawkeye Community College	9553751	IA	PR	3	200	200	51
Nat'l Assoc. of Bio. Teachers	9553720	VA	PR	3	499	499	50
	subtotals				**3665**	**3765**	
CHEMICAL TECHNOLOGY							
American Chemical Society (ACS)	9454564	DC	PR	3	1500	1500	56
Miami University Middletown	9454518	OH	PR	3	1200	1200	54
Southeast Community College	9553674	NE	PR	2	191	191	44
Michigan Technological University	9553671	MI	PR	3	500	500	44
	subtotals				**3391**	**3391**	
COMPUTER AND INFORMATION TECHNOLOGY							
Maui Community College	9454647	HI	PR	3	500	500	58
Center for Image Processing	9454520	AZ	PR	3	1347	1347	55
Bellevue Community College	9553727	WA	CE	3	2992	2992	23
	subtotals				**4839**	**4839**	
ELECTRONICS							
Queensborough Community College	9454613	NY	PR	3	500	500	56
Indiana Univ. - Bloomington	9553694	IN	PR	3	300	300	46
North Seattle Community College	9553726	WA	PR	3	600	600	51
New England Board. of Higher Educ.	9553762	MA	PR	3	365	365	52
Front Range Community College	9553685	CO	PR	3	301	301	45
	subtotals				**2066**	**2066**	
ENGINEERING TECHNOLOGY							
Piedmont Technical College	9553740	SC	PR	3	1444	1444	51
Rose-Hulman Institute of Technology	9553705	IN	PR	3	475	475	48
Middlesex County College	9553749	NJ	CE	3	2566	2766	23
	subtotals				**4485**	**4685**	
ENVIRONMENTAL TECHNOLOGY							
Eastern Iowa Community College District	9454638	IA	CE	3	2999	2999	25
Intelecom Intelligent Telecommunications	9454521	CA	PR	3	1500	1500	55
Mesa State College	9454633	CO	PR	3	400	400	57
University of Alaska SE Juneau	9553680	AK	PR	3	600	600	45
Trident Technical College	9553696	SC	PR	2	250	250	47
Stark Technical College	9553768	OH	PR	3	516	516	53
Chemeketa Community College	9553760	OR	CE	3	2997	3000	24
	subtotals				**9262**	**9265**	

Key: PR= Project, **CE**= Center, **SP**= Special Project, **ATE**= Advanced Technological Education

* Does not include Special Projects or ATE contributions to other programs

Type of Technology	Award	State	Type	Length	TOTAL AWARD ATE	TOTAL AWARD Overall

	Number			in Years	(in 1000s)		Page
GEOGRAPHICAL INFORMATION SYSTEMS							
Kansas State University - Salina	9454618	KS	PR	3	500	500	57
Prince George's Community College	9553662	MD	PR	3	694	694	43
Indiana State University	9553694	IN	PR	3	300	300	46
	subtotals				**1494**	**1494**	
MANUFACTURING							
Sinclair Community College	9454571	OH	CE	3	3000	3000	25
Minuteman Sci, & Tech. High School	9453921	MA	PR	3	185	356	53
Consortium for Adv. Man. Int'l. (CAM-I)	9454655	TX	PR	3	1500	1500	59
Johns Hopkins University	9553664	MD	PR	3	1300	1300	43
Wayne State University	9553692	MI	PR	2	150	150	46
Rio Grande Center for Manufacturing	9553701	TX	PR	2	100	100	47
Colorado Cmty. College System	9553706	CO	PR	2	298	298	49
Texas St. Tech. College - Waco	9553716	TX	PR	3	1550	1550	50
NC State Brd. of Cmty. Colleges	9553709	NC	PR	2	120	120	49
Keene State College	9553767	NH	PR	3	548	548	52
	subtotals				**8751**	**8922**	
MATHEMATICS							
Mt. Hood Community College	9454627	OR	PR	3	470	470	57
Kentucky Community College System	9454585	KY	PR	3	696	800	56
Wentworth Institute of Technology	9553704	MA	PR	3	547	547	48
SUNY Adirondack Cmty. College	9553765	NY	PR	2	234	234	52
	subtotals				**1947**	**2051**	
MULTIDISCIPLINARY							
Amarillo College	9454651	TX	PR	3	630	630	59
Texas St. Technical College-Sweetwater	9454643	TX	CE	3	1612	1680	24
West Valley College	9454513	CA	PR	3	300	300	54
American Assn. of Community Colleges	9552975	DC	SP	1	237	237	61
	subtotals				**2779**	**2847**	
PHYSICS							
Concord Consortium	9454575	MA	PR	3	433	433	56
Seminole Community College	9553665	FL	PR	3	429	429	44
Austin Community College	9553689	TX	PR	2	319	319	46
American Institute of Physics	9453180	MD	SP	36	286	386	61
American Assn. of Physics Teachers	9450160	MD	SP	48	1185	1185	62
	subtotals				**2566**	**2752**	
(All amounts are in 1000's)	**Grand Total**				**45288**	**46177**	

Key: PR= Project, **CE**= Center, **SP**= Special Project, **ATE**= Advanced Technological Education

*Does not include Special Projects or ATE contributions to other programs

Centers of Excellence
New 1996 Awards

Title: Maricopa Advanced Technology Education Center

Alfredo de los Santos
Maricopa County CC District
Department of Education &
Student Development
2411 W 14th Street
Tempe, AZ 85281-6941
delossantos@maricopa.edu

DUE-9602373
FY 1996 ATE $873,878
(TOTAL $892,878)
FY 1997 ATE $872,940
(TOTAL $892,940)
FY 1998 ATE $898,228
(TOTAL $918,228)
Electronics

The Maricopa Advanced Technology Education Center (MATEC) is being operated by the Maricopa County Community College District (90,000 students), the nation's second largest community college system, in partnership with ten semiconductor manufacturing/supporting industries, including giants like Intel, Motorola, SGS-Thompson, and Microchip Technology; two Tech-Prep consortiums with 13 secondary school districts (60,000 students); Arizona State University, the nation's largest public university (43,000 students); three other Community College Districts (Arizona/Oregon); and Albuquerque Technical-Vocational Institute. Primary objectives are 1) to create new curricular systems/materials which reduce the gap between what is taught and learned in schools and what is needed by technicians in semiconductor manufacturing/related supporting industries; 2) to provide technical support, instructional support, and access to resources that faculty/trainers who are preparing students for careers as technicians need to ensure continuing relevance to workplace needs; and 3) to increase the number of students, especially women and minorities, who prepare for and become employed as technicians in the semiconductor manufacturing/supportive industries. Targeted programs are Semiconductor Manufacturing and Processing Technology, Circuit Design Technology, and Facilities Maintenance Technology. MATEC's three components are: Curriculum/Materials Development, Staff Development/Support, and Workforce Development Support. Examples of strategies are Computer-Based Instructional Design System, Continuous Quality Curriculum System, Multimedia "Virtual" Materials, Electronic Resource Center/Form, On-line Q/A, Faculty Internships, Scholarships, and Workshops/Seminars for a national audience. Outcome evaluation uses gap reduction model with measurement instrument to be developed by American College Testing based on specific job profiles of skill levels necessary in workplace.

Title: South Carolina Advanced Technological Education (SC ATE) Center of Excellence

Elaine Craft
South Carolina State Board of
Technical & Comprehensive Education
111 Executive Center Drive
Columbia, SC 29201
crafte@a1.sbt.tec.sc.us

DUE-9602440
FY 1996 ATE $500,000
(TOTAL $550,000)
FY 1997 ATE $500,000
(TOTAL $550,000)
FY 1998 ATE $950,000
(TOTAL $1,000,000)
Engineering Technology

The South Carolina Advanced Technological Education (SC ATE) Center of Excellence addresses expanding the pool of skilled technicians in advanced engineering technology fields to aid the state's and the nation's manufacturing industries in remaining competitive in the global marketplace. The SC ATE Center seeks to create a learning environment which models the new technologically sophisticated work milieu rather than simply teaching about it. Objectives are focused in three broad areas including curriculum reform, program improvement, and faculty development. Curriculum reform centers on developing integrated engineering technology core curricula using a systems-based approach; program improvement encompasses recruitment/retention reforms as well as the development of an electronic communications infrastructure for state-wide curriculum design and delivery; and faculty development emphasizes the use of interdisciplinary and intercampus teams for designing and implementing curriculum reforms. Experienced faculty teams also serve as trainers for external audiences and throughout the South Carolina Technical College System.

The Center seeks to impact the educational pipeline from middle school through the baccalaureate level. A seamless educational pipeline for students is resulting from collaboration with middle and high schools on pre-engineering technology studies and through articulation agreements with colleges and universities for students pursuing bachelor's degrees in engineering technology or

technology education. A particular emphasis involves working with Clemson University and other four-year colleges to help prepare the middle and secondary school technology teachers of the future. The primary target audience of the SC ATE Center is technical college students enrolled in, or desiring to enroll in, engineering technology programs with a particular emphasis on attracting women and underrepresented minorities.

To achieve project objectives three Oversight Teams are directing the activities of multiple smaller Work Teams. The flow of project work is based on a concurrent engineering model, and Work Teams address designated portions of an objective during an assigned time frame. Project Work Teams are made up of industry representatives, high school teachers, college and university faculty, and others as expertise is needed in different scholastic or other areas.

Collaborative partnerships encompass over twenty-five educational, governmental, and business/industrial entities including the State Department of Education, Clemson University, South Carolina State University, the Virginia Community College System, the Governor's Math/Science Advisory Board, the Governor's Commission on Women, the SC Department of Commerce, AMP, Inc., BellSouth Telecommunications Inc., Michelin North America, Bose Corporation, Robert Bosch Corporation, and NCR Corporation. A strong evaluation component, headed by the Academy for Educational Development, will facilitate the development of program improvement processes and curriculum products which will have a significant impact on engineering technology education nation wide.

Centers of Excellence
Continuing Awards

Title: Northwest Center for Emerging Technologies: New Designs for Advanced Information Technology Education

Neil Evans
Bellevue Community College
3000 Landerholm Circle SE
Bellevue, WA 98009
nevans@bcc.ctc.edu

DUE-9553727
FY 1995 $999,737
FY 1996 $992,386
FY 1997 $999,931
Computer and Information Technology

The Northwest Center for Emerging Technologies (NWCET) recognizes that technologists in emerging industries must be independent, creative problem solvers. The pace of technological change increasingly requires that such workers have a strong fundamental education in math and science together with interpersonal communication and critical thinking skills. NWCET is developing national certification models for strengthening Information Technology (IT) education through its focus on seven objectives:

- New Partnerships. Development of the Regional Advanced Technology Education Consortium (RATEC), representing high schools, two- and four-year colleges, businesses and governmental agencies, to respond to the education needs of technological industry. Major partners include NSF, Boeing, Microsoft, US West and the State of Washington.

- New Degree Structures. Development of new Associate and Baccalaureate of Advanced Technology degrees providing a seamless path from high school to two- and four-year college programs, and to employment. This process includes the first national standards for IT job categories and degree curricula.

- New Curricula. Development of an innovative inter-disciplinary core curriculum and specialized technical curricula for IT. Both curricula are developed in close collaboration with industry and organized around real-world, team-based problem solving skills and integrated with internships and other workplace experience.

- Student Success. Development of a comprehensive approach to recruitment and retention of students in technical programs, monitoring and assessing their progress, job placement and career advancement. Special attention is paid to the needs of traditionally underrepresented populations.
- Electronic Courseware. Development of multimedia and other electronic courseware to support both the core and specialized technical curricula.

- Professional Development. Faculty-Industry Fellowships and other opportunities for high school and college teachers coordinated with continuing education of practicing technologists.

- Evaluation & Dissemination. Program evaluation by the Northwest Regional Educational Laboratory and the NWCET National Advisory Board. Modes of dissemination include regional and national conferences, electronic publishing and Internet consultancy through the NWCET WWW home page, video documentaries and teleconferences, and commercial print and CD-ROM publication.

Title: New Jersey Center for Advanced Technological Education

Jack Waintraub
Middlesex County College
155 Mill Road
Edison, NJ 08818
waintrau@pilot.njin.net

DUE-9553749
FY 1995 ATE $785,997
(TOTAL $985,997)
FY 1996 $982,931
FY 1997 $997,544
Engineering Technology

"Mecomtronics" describes a new program in engineering technology being created to meet the demand for a multifunctional engineering technician. "Mecomtronics" is derived from **ME**chanical/**COM**puter/ tele**COM**munications/ elec**TRONICS** which identify the functional areas. To accomplish this, the New Jersey Center for Advanced Technological Education (NJACTE), through its member institutions is restructuring engineering technology education beginning in grade eleven, continuing through the associate degree, and articulating with baccalaureate programs. During each of the three years of this project, work is being done on interrelated curriculum, instructional materials development, faculty and teacher enhancement, and student outreach. The Advanced Technological Education Center is located at Middlesex County College in New Jersey. Other academic institutions which are members of the consortium include: Essex County College (ECC), Mercer Community College (MCC), County College of Morris (CCM), Raritan Valley Community College (RVCC), the New Jersey Institute of

Technology (NJIT), and The College of New Jersey (CNJ). Each component of Center effort is being coordinated by a member institution: the curriculum development component by Middlesex County College; faculty development by CCM; the Student Outreach by ECC; articulation of high school associate degree and baccalaureate collaboration by CNJ; strengthening partnerships with business and industry by NJIT; the NJCATE communications clearinghouse by MCC; and, social, environmental and ethical issues by RVCC. An articulation agreement between the Mecomtronics program and The College of New Jersey's baccalaureate program in technology education is helping to prepare secondary school teachers of tomorrow.

Title: Northwest Center for Sustainable Resources (A National Center for Advanced Technology)

Wynn W. Cudmore
Chemeketa Community College
4000 Lancaster Drive, NE
P.O. Box 14007
Salem, OR 97309
wync@chemek.cc.or.us

DUE-9553760
FY 1995 ATE $996,663
(TOTAL $999,663)
FY 1996 $999,553
FY 1997 $999,227
Environmental Technology

The Northwest Center for Sustainable Resources (NCSR) is a collaborative effort of partners from Washington, Oregon, and northern California to create a national Advanced Technology Center of Excellence. The goal of the Center, coordinated from Chemeketa Community College, Salem, OR, is to enhance natural resources technology education programs at community colleges and secondary schools. Programs are expanding current math and science core requirements, particularly through the development of an environmental science core curriculum. As a nucleus for programmatic change, principles of environmental sciences emphasize an ecosystems approach to natural resources technology education. The Center's technician programs are graduating technicians who can contribute to a workforce supporting sustainability in natural resources management. Employers in the Pacific Northwest and the nation from both private sectors and government agencies require employees with a broader understanding of biological and physical sciences, advanced skills in data collection and analysis, and abilities to utilize cutting-edge tools such as Geographical Information Systems and other computer-aided technologies. These technicians are being increasingly sought by employers, and the NCSR is catalyzing programmatic changes necessary to meet these needs. Faculty and student internships bring real-world experiences to the programs. The project is accomplishing the following objectives:

1. Development and enhancement of natural resources curricula in forestry, fisheries, wildlife, agriculture, and other natural resources-based fields in a collaborative effort of community colleges and partners in the three-state region; dissemination of products produced by this project nationally and internationally.
2. Creation of a world-class electronic network to serve as an information exchange site for NCSR partners and others, as well as a national clearing house for scientific information supporting natural resources technologies developed by researchers and educators.
3. Connection of NCSR programs with programs leading to bachelors and advanced degrees to produce "seamless delivery" of natural resources programs, improving articulation between all levels of education.

The NCSR is providing the leadership to enable NCSR partners to develop frameworks for advanced technological education, share innovative teaching methods, incorporate new technologies into existing programs, and serve as a repository and dissemination site for emerging information in environmental sciences and natural resources management.

Title: Southwest Regional Center for Advanced Technological Education

Robert L. Musgrove
Texas State Technical
College - Sweetwater
300 College Drive
Sweetwater, TX 79556
rmusgrove@tstc.edu

DUE-9454643
FY 1994 $565,872
ATE $465,872
ILI $100,000
FY 1995 $585,290
FY 1996 $560,475
Core and One or More
Specific Technologies

The Southwest Regional Center for Advanced Technological Education is a collaboration among two-year colleges, four-year colleges and universities, industries, and Tech-Prep consortia in West Central Texas, New Mexico, and Oklahoma to provide technical education in a vast rural region through distance education. The project is developing the infrastructure and the pedagogy to deliver many technical courses through distance learning. These include existing courses in CAD/CAM/CIM which are being converted for delivery via distance learning to two-year institutions and secondary school sites. Faculty at two-year colleges are working with the Department of Education at Texas Technical College to develop new instructional materials. In particular, the Center is developing new AAS programs in polymer technology and electro-mechanical technology to complement needs of industry in the area.

Through an intensive effort at developing distance education and electronic networking in the consortium, the Center is enabling the member institutions to share their substantial resources, to deliver quality instruction throughout the area,

and to exchange data and information rapidly and efficiently. This "center without walls" addresses the intertwined problems—distance, expense, and limited resources—inherent in delivering advanced technological education in such a large region. Its findings, strategies, tactics, materials, and methodologies constitute a significant contribution to technical education in the nation.

Title: Advanced Technology Environmental Education Center - (ATEEC)

Ellen Kabat
Eastern Iowa Community College District
500 Belmont Road
Betterdorf, IA 52722
ekabat@eiccd.cc.ia.us

DUE-9454638
FY 1994 $999,961
FY 1995 $999,907
FY 1996 $999,998
Environmental Technology

The Advanced Technology Environmental Education Center (ATEEC), which is a joint effort of Eastern Iowa Community College, Kirkwood Community College, Hazardous Materials Training and Research Institute (HMTRI), the Partnership for Environmental Technology Education (PETE), and the University of Northern Iowa, involves over 500 community colleges in their dissemination efforts. The Center is developing nationally validated curriculum models and instructional materials; establishing comprehensive programs of professional development; serving as a clearinghouse for environmental education information; and acting as a hub for the networking of environmental educators, business and industry, federal agencies, and professional societies.

The Center is providing leadership to: (a) enhance core and advanced mathematics and science and technology components of environmental education; (b) utilize advanced electronic communications networks; (c) focus upon meeting the needs of diverse learners; (d) encourage instructional materials which utilize advanced technologies; and (e) develop teaching and curriculum standards for environmental education. ATEEC is enhancing hundreds of faculty and teachers and improving the education of thousands of students throughout the nation.

Title: National Center of Excellence for Advanced Manufacturing Education (NCE/AME)

David T. Harrison
Sinclair Community College
444 West Third Street
Dayton, OH 45402
dharriso@sinclair.edu

DUE-9454571
FY 1994 $1,000,000
FY 1995 $1,000,000
FY 1996 $1,000,000
Manufacturing

The Advanced Integrated Manufacturing Center is a joint effort of Sinclair Community College and the University of Dayton to create a National Center of Excellence for Advanced Manufacturing Education (NCE/AME). The goal of the Advanced Integrated Manufacturing Center, located on the campus of Sinclair Community College, is to redesign the infrastructure of technological education in manufacturing. The NCE/AME is a catalyst for educational change to improve science, mathematics, and advanced manufacturing instruction at secondary school, community college, and university levels. The program is accomplishing the following objectives:

1. Developing a new competency-based, occupationally verified, seamless curriculum beginning in grade 11, through the Associate of Applied Science degree, culminating with the Bachelor of Science degree using advanced manufacturing as the focus, with gateways to and from industry employment throughout.
2. Writing, pilot testing, and publishing curriculum materials (laboratory manuals, video, software, and other ancillary materials) to improve mathematics, science, and manufacturing engineering technology instruction.
3. Disseminating the curriculum, instructional materials, and model program nationally.

PROJECTS
New 1996 Awards

Title: Pac-Tec II: Pacific Technological Education Project

Charlotte Behm
West Valley Mission Community
College District
Department of Engineering
Santa Clara, CA 95054
cbehm@rio.com

DUE-9602345
FY 1996 $250,753
FY 1997 $249,247
Manufacturing

The future of the United States depends on our producing well-educated and talented science and engineering technicians; however, student interest in technical fields has declined. Students in traditionally underrepresented groups comprise 65 percent of the student population yet continue to be severely underrepresented in these fields. The Phase I of the Pac-TEC Project is a grassroots, collaborative network of 24 faculty from eleven schools, from middle school grades through university level. In Phase I of Pac-TEC , teachers are defining learning and teaching styles and preferences typical of many people in the underrepresented groups. From this definition, the project is building and testing solutions for classroom teachers--teaching methods that are inclusive but that do not require major changes in course content, but instead, revolutionize new teaching methods within existing content. Phase II of the Pac-TEC project is expanding the network of participating teachers and other professionals who together focus on disseminating working solutions. This project is also broadening its research, establishing a center that coordinates and disseminates information, training preservice teachers, presenting models for authentic student assessment tools, and producing a second edition of its innovative manual for national distribution.

Title: A GIS Core Curriculum for the 2-Year College

Michael Goodchild
University of California
-Santa Barbara
Department of Geography
Santa Barbara, CA 93106
good@geog.ucsb.edu

DUE-9602348
FY 1996 $188,469
Geographical Information Systems

An increasing number of Geographic Information System (GIS) technician positions are being created by industry and public sector users of GIS. Community colleges are attempting to create GIS programs that meet this demand. This project addresses the need for a supporting resource for the GIS curriculum design and course building activities taking place in a number of the two-year colleges. The National Center for Geographic Information and Analysis (NCGIA) in collaboration with a number of community colleges and current NSF Advanced Technological Education Projects are developing a GIS Core Curriculum for Technical Programs (CCTP). This World Wide Web-based resource support efforts to develop discipline specific GIS materials by providing access to the fundamental elements of GIS theory and practice as they relate to efforts to provide GIS technician education in the community colleges. The CCTP is patterned after the successful NCGIA Core Curriculum in GIS developed for university level GIS curriculum development and also draws from the experience of the current effort to update and create a World Wide Web (WWW) version of the Core Curriculum in GIS. NCGIA and an Advisory Council, including GIS specialists from community colleges, the GIS industry, and the GIS user community, are selecting GIS educators from the community colleges to participate in a week-long work session to create a framework for the CCTP. The framework outlines the essential units of material and a format for the CCTP. Following this session, each unit is being written by an individual with expertise in the unit topic. The completed set of GIS curriculum development and GIS instructional activities will be compiled as a WWW resource and tested in a number of community college. Following a detailed evaluation from the sites testing the CCTP, it will be edited and made widely available via the WWW and CD-ROM.

Title: Project TIE: Training for Industry Education

Mary Jane Willis
Albuquerque Technical Vocational
Institute (TVI)
Department of Technologies
525 Buena Vista SE
Albuquerque, NM 87106-4023
mjwillis@tvi.cc.nm.us

DUE-9602349
FY 1996 $218,227
FY 1997 $203,091
Electronics

As the semiconductor manufacturing and wafer fabrication industries expand throughout the western US, the demand for

highly-skilled technicians grows. This expansion creates the difficult challenge of upgrading course content and pedagogy and providing adequate faculty development opportunities among community colleges, the primary workforce providers, and high school Tech-Prep programs. The Albuquerque Technical Vocational Institute's (TVI) Project TIE, Training for Industry Education, is addressing this problem by holding twelve, five-day seminars in which up to 120 community college and high school faculty perform semiconductor manufacturing processes in a clean room environment. TVI's Regional Semiconductor Manufacturing Training Laboratory (RSMT Lab) is a cleanroom that has been built to meet industry demands for well-trained semiconductor manufacturing technicians. Seminars, planned by an administrative team of industry (Intel) and educational (TVI) representatives, are being designed to provide hands-on work in TVI's RMST Lab, dialogue about pedagogy, and discussions with semiconductor manufacturing engineers, scientists, and technicians. Participants receive a resource packet containing a technical manual, bibliography, and information on developing SMT degree programs and laboratories. The target audience is community college and Tech-Prep high school faculty. TVI's primary partner in this project is Intel Corporation, which has built Fab 11, its largest plant, in Albuquerque. Sandia National Laboratories is a secondary partner. Project TIE provides faculty a rare opportunity to acquire hands-on experience in a cleanroom environment. Improved and enhanced instruction and communication among community colleges throughout the US are anticipated results as faculty take newly-acquired skills and resources to their schools.

Title: A Partnership for Computer-Based Curriculum Development in Atmospheric Technology

Melanie Wetzel
University of Nevada
-Desert Research Institute
Department of Atmospheric Sciences
P.O. Box 60220
Reno, NV 89506-0220
wetzel@sage.dri.edu

DUE-9602351
FY 1996 $150,000
FY 1997 $150,000
FY 1998 $150,000
Environmental Technology

The objective of this project is to develop computer-interactive training modules in atmospheric technology which are designed to significantly involve environmental technology degree curricula at community colleges nationwide. The project addresses each of the three activities described for an ATE Project (a) curriculum and instructional materials development, (b) teacher and faculty enhancement, and (c) instrumentation and laboratory improvement. Project goals are to: (1) provide training in atmospheric technology which adequately prepares students for employment in careers such as air quality monitoring and meteorological data applications; and (2) develop a summer workshop program to prepare community college teachers to incorporate the computer-based training modules with field and laboratory instrumentation for environmental technology applications. The project is a collaborative effort of the Desert Research Institute (DRI), of the University and Community College System of Nevada, the Colorado Mountain College (CMC), and the University Corporation for Atmospheric Research (UCAR). The DRI operates a mountaintop research laboratory on a 10,500 ft. peak, within 5 miles of the CMC Alpine Campus, which serves as a field and classroom location for the development of instructional graphics, video, and data sets for the training modules. The laboratory and co-located community college campus host the teacher workshops. The partnership between the CMC, DRI and UCAR scientists and faculty includes the design, development, assessment and dissemination of the computer-based modules. A minority population group, Native Americans, is specifically identified for enhanced outreach activities. In addition, an advisory committee with members representing industry, government agency, and environmental education groups provides guidance on the technology curriculum content and employment targets.

Title: Business Alliance for Advanced Technological Education

Peter Joyce
National Alliance of Business
1201 New York Avenue, NW
Washington, DC 20005-3917
info@nab.com

DUE-9602352
FY 1996 $199,986
FY 1997 $199,986
Multidisciplinary

This two year project is establishing the Business Alliance for Advanced Technological Education. It is developing school-to-work projects focused on technician education at four partnership sites: Siemens and East Wake High School in Raleigh, NC; Novell and Ford and the Virginia Beach Public Schools in Virginia Beach, VA; Pratt and Whitney/UTC and the Manchester Public Schools, and the Hartford Community and Technical College in Hartford, CT; and Procter & Gamble and the Northern Tier Industry Education Consortium in Mehoopany, PA. The project is guided by a national advisory committee of educators, business people, and policy-makers. The alliance is being supported by an on-site assistance group which conducts site visits, provides technical assistance, facilitates cross-learning among sites, and ensures that worksites are connected with local postsecondary institutions. A project team coordinates the development of curriculum and

instructional materials, teacher and faculty enhancement and creation of technical experiences for students. Each year's activities are centered on a theme.

Title: The Midwest Consortium for Advanced Technology Education

Dennis Depew
Purdue University
Department of Technology
West Lafayette, IN 47907
ddepew@it.purdue.edu

DUE-9602355
FY 1996 $426,570
FY 1997 $452,189
FY 1998 $469,632
Engineering Technology

The Midwest Regional Consortium for Advanced Technology Education supports a new focus for promoting excellence in faculty development in engineering technology education. This focus enhances America's competitive position as world-class in manufacturing and industrial distribution technology by developing the technical and pedagogical skills of faculty members from high schools, community colleges, and universities. This project is providing an opportunity for faculty development through workshops and seminars offered at numerous locations in the Midwest. The faculty involved in these seminars benefit from the existing laboratories and facilities available in Purdue's School of Technology. Faculty and teachers are learning new technologies and pedagogical skills which benefit students in advanced technology fields from high school through graduate study. This provides an opportunity to better educate the future industrial work force and develop technology faculty members for the future. In addition to the faculty development, the project is creating and adapting innovative curriculum and instructional materials to benefit advanced technological education. Project partners with Purdue include Cincinnati State Technical Community College in Ohio, Macomb Community College in Michigan, Parkland and Triton Community Colleges in Illinois, St. Louis Community College in Missouri, and Vincennes University in Indiana, as well as numerous secondary schools and industries.

Title: Modular Approach to Biotechnology Laboratory Instruction Based on a Novel Green-Fluorescent Protein

William Ward
Rutgers the State University of New Jersey
Department of Biochemistry & Microbiology
New Brunswick, NJ 08903

DUE-9602356
FY 1996 $350,000
Biotechnology

This project is developing laboratory modules in biotechnology for secondary school and undergraduate students and their teachers, based on a unique protein, the green-fluorescent protein (GFP), which serves as an easily visualized reporter for gene expression and all steps in protein purification. Detection requires only a long-wave UV lamp, making the system adaptable to low-budget curricula. Because the protein is so easily visualized, it enhances the students' understanding of molecular biology and biochemistry making each step in the laboratory exercise an exciting experience. Initial concepts for GFP-based laboratory modules were developed at Rutgers in 1989 and have been successfully "field tested" for five years. Nine other institutions including one other major research university, one four-year college, two county colleges, three high schools, one major biochemical supply corporation, and one national laboratory are joining Rutgers in an informal consortium to advance the GFP-based laboratory module concept. Originally isolated from a bioluminescent jellyfish. GFP can now be cloned into other organisms. Thus. the gene and its protein are available for widespread use. The project is developing GFP-based laboratory modules geared for the advanced secondary school and community college levels. The modular "kit" approach to teaching biotechnology techniques allows both protein purification and recombinant DNA techniques to be transferred to all appropriate settings with only minor modifications. This GFP-based modular approach provides major changes in the way technicians are trained and can be projected on a national scale to be widely applied in the biotechnology community.

Title: Materials Aspects of Manufacturing Technology Institute

Thomas Stoebe
University of Washington
Department of Materials
PO Box 2120
Seattle, WA 98195-2120
stoebe@u.washington.edu

DUE-9602360
FY 1996 $218,154
Manufacturing

This Materials Aspects of Manufacturing Technology Institute is developing a set of instructors with sufficient background and understanding of the materials processing aspects of manufacturing technology to serve as leaders to enhance technology education in the U.S. It is also aimed at providing a model interactive program involving high school and community college instructors and students and industry. This model is demonstrating successful interactive curricular, laboratory and project programs as well as assisting in the transition for technology students across the high school-community college boundary.

This Institute is being developed by the University of Washington in partnership with high schools, community colleges, and industry in the Pacific Northwest. Over a three-year period, it is providing 60 instructors at the high school and community college level with an understanding of the principles and applications of materials as they are used in the manufacturing technology field. It consists of a 15 day intensive program in materials science and technology, including lectures, labs, discussion sessions, independent research and projects for community college and high school instructors from the Pacific Northwest. Each year of the 3-year program includes 20 new participants; of the 3-year total of 60, approximately 40 participants will be from high schools and 20 from community colleges. Generally, one community college instructor and two high school instructors from the same geographical area form a team for project and follow-up work. Selected participants are allowed to return for a second year at their own expense.

Academic year follow-up programs consist of two, 1-day meetings on campus. Participants develop interactive high school--community college projects, performed jointly by a team of students from nearby schools with local industry involvement. Evaluation tools are being developed, and evaluation data is being collected annually and analyzed by the project team.

Title: Building on the Crossroads in Mathematics Standards: A Project to Develop Introductory Mathematics Curriculum Materials

John Souders
Center for Occupational Research & Development
Department of Curriculum Material Development
601 Lake Air Drive
Waco, TX 76710-5878
jsouders@cord.org

DUE-9602361
FY 1996 $107,817
Mathematics

Most students entering postsecondary education lack the mathematical skills needed to succeed in advanced technology education, engineering, and mathematics- and science-related programs. Curriculum materials are needed for introductory college mathematics to engage students and prepare them for the workplace or further education. In this development project the Center for Occupational Research and Development (CORD) and the American Mathematical Association of Two-Year Colleges (AMATYC) have formed a partnership with faculty from two-year colleges and professional societies who are experts in contextual learning, learning technology, and professional development. The goals of this project are to identify a core set of mathematical topics and themes that are essential for students preparing for careers in the advanced technological workforce and to select one such theme or topic and develop a rich collection of learning materials around that theme that are based on real-world applications together with supporting pedagogical materials. This modular set of material reflects the AMATYC content standards for introductory level mathematics which include topics in college algebra, trigonometry, introductory statistics, finite mathematics, precalculus, and foundation topics often characterized as developmental mathematics. Furthermore, the materials are being designed to serve the varying needs of all students who need a foundational knowledge of mathematics for engineering, advanced technology, and other technical and non-technical related careers.

Title: The Faculty Associates in Science and Technology Leadership Corps Project for Enhancing Environmental Technology Education

Paul Dickinson
Partnership for Environmental Technology Education
Suite 235
6601 Owens Drive
Pleasanton, CA 94588

DUE-9602365
FY 1996 $300,000
FY 1997 $300,000
Environmental Technology

The Partnership for Environmental Technology Education (PETE) is a national non-profit public-private partnership designed to link the resources of federal laboratories, federal and state agencies, private industry and professional societies with community and technical colleges. The primary goal is to assist approximately 460 participating colleges in developing quality programs for the education of environmental technicians and transfer students to four-year institutions. Faculty development has been and remains a key element of the PETE program. PETE is a partner in the NSF/ATE Program-funded Advanced Technology Environmental Education Center (ATEEC). This proposal is closely linked with ATEEC's programmatic objectives. This project is establishing within PETE a Faculty Associates in Science and Technology (FAST) program. Under this initiative, up to 60 community and technical college faculty are being placed annually in 4 to 8 week summer internships in private industry, national laboratories, DoD facilities, remediation sites, and regulatory organizations. Four phases of this program are defined in the project, including providing environmental technology faculty with real world experiences which translates into improved community college curricula and the development of a nationwide network of experienced professional educators (FAST Leadership Corps) to serve as a resource to other community and technical college faculty delivering environmental programs. PETE provides the organizational framework for a national impact of program results. The FAST Project is based upon four years experience with the faculty internship program developed in the Western PETE region.

Title: Teamed Internships: Innovative Education Program for Environmental Technicians and Engineers

Gregory Ogden
Pima County Community College
Department of Environmental Sciences
8181 East Irvington R.
Tucson, AZ 85709-4000
gogden@east.pima.edu

DUE-9602368
FY 1996 $330,000
Biotechnology

The project is creating multi-disciplinary internships encompassing regional industries, federal research facilities, and two and four-year educational programs. Teams of technicians from the Environmental Science Department at Pima Community College and engineers from the Department of Chemical & Environmental Engineering at the University of Arizona are working on industrial and academic projects under the direction of full-time faculty from both institutions. The project fosters teamwork and communication skills for technician and engineering students, includes the development of instructional materials, provides a basis for upgrading curriculum at both the two- and four-year levels as well as teacher and faculty enhancement. Perceptions and insights and educational modules developed during the project are being disseminated to local secondary schools to foster interest in environmental technology/environmental science. High schools with high percentages of minorities in particular are being targeted. Dissemination on a regional/national level is being accomplished through participation in engineering, environmental and educational conferences and educational forums, publication of results, and collaboration with other NSF sponsored ATE centers or programs. Formative and summative evaluation tools are used to direct the course of the project and demonstrate its effectiveness on student outcomes, The project is designed to bridge the gap between technicians and engineers to facilitate smooth introductions of new technologies and foster teamwork between operations and management. The project also stresses industrial educational needs including students capable of working in teams, aware of their community and possessing excellent written and oral communication skills. The increased cooperation and understanding between engineers and technicians lead to increased industrial productivity and personal development.

Title: Technology Instruction for the 21st Century - Phase II

Bernard Mohr
CUNY Queensborough Community College
Department of Electrical & Computer Engineering Technology
56th Ave., Springfield Blvd
New York, NY 11364
bemohr@delphi.com

DUE-9602369
FY 1996 $193,010
FY 1997 $203,502
FY 1998 $203,488
Engineering Technology

Rapid advancements in telecommunications--data communications and distributed information systems technology--have significantly increased the scope of knowledge and skill required of science and technology students. Using telecommunications technologies as a vehicle for instructional change, this project integrates four components: curriculum and instructional materials development, instrumentation and laboratory improvement, faculty enhancement and dissemination of instructional materials, and distance learning and remote access technology. The anticipated outcomes of this project are: (a) improvement of marketable skills for science and technology students; (b) development of methods to keep curricula in pace with cutting edge technology through development, delivery, and dynamic revision of instructional materials; and (c) promotion of activities that significantly improve faculty skills. Curriculum and instructional materials are being developed for courses and laboratories in the telecommunications technologies. Courseware is in the form of on-line (networked) laboratory manuals, instructional multimedia presentations, and innovative uses of converging technology as instructional tools. Interactive multimedia courseware on high speed networks serves as a textbook and laboratory manual for the twenty-first century. Revisions are being made dynamically to keep all materials current. Products resulting from project activities also support the NYNEX Next-Step AAS degree program in telecommunications technology and the consortium of SUNY and CUNY colleges developing the program. Because network technology is a core project tool, dissemination of project materials occurs via local and wide area networks and by faculty who utilize telecommunications technology to promote ongoing dialogs and exchanges.

Title: North Central Collaboration for Advanced Engineering Technology Education in NDE/NDT

David Holger
Iowa State University
Department of Engineering Administration
104 Marston Hall
Ames, IA 50011
holger@iastate.edu

DUE-9602370
FY 1996 $224,208
FY 1997 $224,647
FY 1998 $224,850
Engineering Technology

Increased requirements for improved reliability of machines and structures in a wide spectrum of industries have created a growing demand for educational and training opportunities in non-destructive evaluation and non-destructive testing (NDE/NDT). NDT technician programs have developed in various parts of the country, largely in response to specific and urgent technical requirements of local industries. The Center for Non-Destructive Evaluation at Iowa State University, in collaboration with five community colleges, together with industrial partners, is developing materials and providing professional development for faculty to improve the education of technicians with specialization in NDE/NDT. The primary activities include the development and dissemination of new curriculum materials for use in new and existing courses as well as the redevelopment of existing materials to increase their mathematics, science, and engineering content. Simulation of ultrasonic, radiographic and eddy current NDE techniques, previously developed at Iowa State University, are being transferred to personal computers for use in technician programs to allow students to develop a physical feel for how parameters of interest influence inspection results. Community college faculty are being provided enhancement opportunities to enable them to implement the new industrial and research developments in NDE. Workshops provide professional development for two year college faculty in development of frameworks, assessment, and upgrading the mathematics, science and engineering. Industrial partners are participating in the workshops and providing guidance to the project.

Title: Telemedia Communications Technology

David Beyer
Middlesex County College
Department of Physics/Electrical Engineering Technology
Edison, NJ 08818
dbeyer@pilot.njin.net

DUE-9602375
FY 1996 $309,983
Computer and Information Technology

The convergence of computer, interactive television systems and telecommunications is creating a new employment market in multimedia communications technology. Networked multimedia communications will have a broad impact on business, on education, and on communications in general. Examples of networked multimedia communications include videotelephony and videoconferencing, real-time video on demand, interactive video and multimedia messaging, remote collaborative work, interactive information services, and multimedia education and training.

Middlesex County College and the Carteret public schools are working with representatives from the Siemens Rolm Corporation and York Telecom to develop and implement an articulated curriculum to prepare telemedia communications technicians for employment and continuing education. Building on an established electrical engineering technology program with a computer electronics option, the goal of the project is to develop and implement a high school through associate degree program in Telemedia Communications Technology to satisfy the needs of business and industry for highly-skilled, well-educated technicians, and, at the same time, prepare graduates for further education. An existing articulation relationship with the New Jersey Institute of Technology serves as a vehicle to extend Telemedia Communications Technology through the baccalaureate degree.

Collaborative learning, project-centered instructional activities and authentic assessment derived from the completion of real-life projects forms the curricular framework for the Telemedia Communications Technology program. The telemedia communications technician must have a background rooted in electronics and computer technology, with a strong foundation in mathematics, science, and written and oral communications, as well as the ability to participate as a team member in a quality-focused work environment. This background, coupled with a knowledge of graphic design, prepares telemedia communications program graduates for careers in this new field.

Title: Advancing Scientific and Technological Education in American Indian Communities

Keith James
Colorado State University
Department of Psychology
Fort Collins, CO 80523
kjames@lamar.colostate.edu

DUE-9602376
FY 1996 $75,000
Multidisciplinary

This conference promotes increased involvement of American Indian people in scientific and technological areas so as to improve the lives of native individuals and communities while also promoting their creativity in scientific fields and society at large. The intensive conference on this topic involve national Indian organizations, Native American community leaders and members, leading American Indian scientists and educators, and some representatives of main-stream (i.e. non-Indian) science and technology organizations. Focused, prepared presentations at the conference serve to stimulate deliberations and planning by small breakout groups. Indian college students trained in facilitating group discussions help catalyze those deliberations. A final plenary session considers and integrates the work of the small groups generating plans for partnerships of communities, national Indian organizations, higher educational institutions, and industry. There will be a document of the proceedings of the conference with all of the recommendations and summaries of the presentations.

Title: Biomedical Engineering Technology Program Development

Sandra Sanders
Broward Community College
Department of Engineering/Technology
225 East Las Olas Boulevard
Fort Lauderdale, FL 33301-2208
a021136t@bcfreenet.seflin.lib.fl.us

DUE-9602383
FY 1996 $250,000
Biotechnology

Broward Community College (BCC) is leading a consortium composed of the University of Miami, Broward County Schools, Broward Hospital District, Hewlett Packard, Advantage Medical Electronics, Motorola, ABC Computers, Asea Brown Boveri Corp., and the Biomedical Engineering Technology (BMET) Advisory Board in developing a program in BMET. BCC offers a well-established Electronics Engineering Technology program, in existence for more than

28 years, supported by industry, and very highly recognized throughout the state of Florida and nationally. BCC's electronics program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology, and received the Secretary of Education's Award for the best technical program in the southeastern U. S. in 1992. The target audience is students from public and private high schools, employees of Biomedical Engineering companies, and other persons seeking technical training/retraining. The goal of the project is to produce qualified Biomedical Engineering technicians who can provide a critical link between the clinical application and the electronic technology of today's medical equipment. Laboratories and laboratory practices are being developed to give students state-of-the-art experiences with a wide range of biomedical equipment. The principal investigator serve as a role model as she promotes the program in high schools and industry. A `2+2+2` model is being created that can be replicated on a nationwide basis. The first two years prepare the students at the high school level for a smooth transition to the community college program. The second two years provide students with Associate of Science degree components with the necessary skills to enter the workplace. In addition, interested students have access to a parallel track with higher levels of mathematics and science for a bridge to the final two years of a bachelor's degree program at the University of Miami.

Title: MATE - Marine Advanced Technology Education

Nicole Crane
Monterey Peninsula College
Life Sciences Division
980 Fremont Street
Monterey, CA 09394-04704
ncrane@earth.mpc.cc.ca.us

DUE-9602384
FY 1996 $74,841
Environmental Technology

Monterey Peninsula Community College is hosting a National Forum on Critical Issues in Marine Technology Education. It is bringing together stakeholders from the academic research, education and employment sectors. The focus areas of the conference include: (a) needs for technician in marine, oceanographic and coastal fields; (b) job descriptions that define what technicians in these areas can best do; (c) programs and curricula which currently exist on which these programs can build; (d) common and distinct elements for coastal, marine and oceanographic technician; (e) involvement of employers in curriculum development, faculty and student development, and research; and (f) what education these technicians need and who should provide it.

Title: MMATE 2000 Project - Maricopa Mathematics Advanced Technology Education 2000 Project (MMATE 2000)

Alan Jacobs
Maricopa County CC District
Department of Education Development
2411 W 14th Street
Tempe, AZ 85281-6941
jacobs@sc.maricopa.edu

DUE-9602386
FY 1996 $161,440
FY 1997 $160,891
FY 1998 $30,904
Mathematics

The current mathematics curriculum does not adequately align with the needs of technicians and future technicians in an advanced technology workplace. The objective of the Maricopa Mathematics ATE 2000 (MMATE 2000) Project is to close the gap between what is taught and what students need for the workplace, and to continually examine that gap by applying continuous improvement methodologies. The project is engaging community college and university faculty from mathematics and related disciplines and representatives from 12 semiconductor manufacturing industries in the Phoenix area, collaborating to develop course materials for 8 modules (15 class hours each) that emphasize how mathematics is used in the high-performance workplace. Through mini-internships in industry and MMATE 2000 workshops, faculty are increasing their awareness of how mathematics is used in an advanced technology environment and learning how to use the course materials in the classroom. Faculty work with industry on a continual basis to review the mathematics content of the curriculum and maintain the currency of the applications that drive the course materials. The materials are being disseminated through a publisher with a national sales force. The target audience is all mathematics students who take courses below college algebra, especially those preparing for jobs as technicians in an advanced technology workplace. MMATE 2000 improve the quality of the human resource base for advanced technology industries by significantly improving the way technicians are educated in mathematics.

Title: An Innovative Approach for Advanced Technological Learning in Distinctive Manufacturing

Rick Allison
Oklahoma State University-Okmulgee
Department of Manufacturing Technology
1801 East 4th Street
Okmulgee, OK 74447-3901
rick@galstar.com

DUE-9602390
FY 1996 $300,000
FY 1997 $300,000
Manufacturing

For employers to compete successfully in the increasingly complex, technological, entrepreneurial global competition, they must have an ample supply of high-performance technicians. The traditional educational approach does not supply sufficient numbers of qualified employees to meet the demand. In response, OSU-Okmulgee and its partners are reengineering technological education to prepare technicians to add customer value in world-class, competitive distinctive manufacturing firms. To build a larger base of more competent technicians, the program is recruiting members of underrepresented groups and other students who typically overlook career opportunities in advanced manufacturing. The partnership consists of advanced technological employers, educational institutions, national resource organizations, and Native American tribes. The innovative approach infuses the content of a 90-semester-credit-hour Associate in Applied Science degree into a set of systematic learning experiences that occur in a real-world manufacturing environment to form a holistic, simultaneous, synergistic learning program. The program demands mastery of competencies in mathematics, science, and technology; ensures a competent faculty by selecting capable candidates and professionally preparing them to implement their roles in the new approach; recruits and capacitates members of underrepresented groups; articulates the program across secondary and vocational schools, associate degree and bachelor degree granting institutions; and disseminates and communicates the project's deliverables and lessons learned. The depth and breadth of this 90-semester-credit-hour Associate in Applied Science degree program is preparing high-performance technicians for distinctive manufacturing.

Title: Faculty Enhancement and Curriculum Development Activities to Improve Advanced Technology Education

John Tice
Wytheville Community College
Southwestern Virginia Advanced Manufacturing Technology Center
1000 East Main Street
Wytheville, VA 24382-3308

DUE-9602397
FY 1996 $136,820
FY 1997 $162,874
Manufacturing

Rapid advances in technology have made it difficult for faculty in disciplines driven by advanced technologies to remain current. At the same time manufacturers recognize the importance of modernizing their processes to remain competitive in the global marketplace. The highly skilled workers who that are needed to meet the changing demands of industries will have to be trained by community colleges or by industry itself. In response to this need, the project seeks to improve the quality of advanced technological education provided by a consortium of five community colleges in southwestern Virginia. The primary goal of the project is to enhance skills and knowledge of the faculty. The project consists of four primary activities including "Back to Practice" experiences for community college faculty, a "Back to Practice" regional study and national dissemination conference, conference/workshop participation, and faculty development summer workshops focused on enhancing the curriculum development and student assessment skills of technical college faculty. The project is demonstrating that the individual strategies can be welded into a fully integrated process which assesses industry needs, relates these needs to required employee skills, defines the curricular material which establishes those skills, and provides quality training for students and industrial technicians in a timely fashion.

Title: Tennessee Exemplary Faculty for Telecommunications Technology

Sydney Rogers
Nashville State Technical Institute
Department of Technologies
120 White Bridge Road
Nashville, TN 37209
rogers@nsti.tec.tn.us

DUE-9602401
FY 1996 $216,622
FY 1997 $229,972
Telecommunications

To prepare faculty to create a work-based learning environment that supports the telecommunications industry, a consortium of six community colleges in Tennessee, together

with industrial, four-year college and secondary school partners, is implementing a professional development project. The project creates a network and a process that encourages faculty from different disciplines to develop and disseminate a communications technology curriculum framework. The faculty obtain an understanding of curriculum development techniques and practices. The teams at each college consist of seven to ten members including faculty from different departments and representatives from industry, four year universities, and secondary schools. The teams encourage the faculty to consider cross disciplinary needs of the curriculum and provide direct access to industrial and four-year college input. In addition, the faculty members are provided industrial internships. The outcomes include a system with strong linkages among secondary schools, colleges, industry, and government within the communications technology discipline that educates students for the future needs of the industries served.

Title: ChemCore: An Interdisciplinary Approach to Real-World Laboratory Chemistry

Mary O'Brien
Edmonds Community College
Department of Chemistry
20000 68th Avenue West
Lynnwood, WA 98036-5912
mobrien@edcc.ctc.edu

DUE-9602403
FY 1996 $399,470
Chemical Technology

In response to local needs, Edmonds Community College (EEC) is developing a curriculum development/pilot project impacting 250 people. The goals of the project are to 1) reconfigure the 12.5-credit laboratories for general and organic chemistry to use project-based modules and 2) create a new ChemCore curriculum, part of a combined Associate of Technical Arts/Associate of Arts and Sciences Laboratory Technician program. Developed in close cooperation with government and industry through an advisory board, ChemCore integrates laboratory chemistry with 5 new applied academics courses, 25 credits in all: instrumental analysis, information technology, management, and technical writing/applied communications. The project also introduces a new laboratory setting simulating the tasks, customer requests, on-the-job skills training, and working conditions of a commercial laboratory performing chemical analyses; creates a series of increasingly sophisticated and open-ended requests for services to replace traditional laboratory exercises; and uses outside professionals offering demonstrations and related instruction. The project targets high school recruits, pre-professional science and engineering, Work Force Training, and other vocational students, with special efforts to enroll women and students from other underrepresented groups. Its principal goals and objectives are to 1) develop an up-to-date, interdisciplinary, transferable laboratory curriculum at ECC; 2) attract additional chemistry students, especially from underrepresented populations, through the appeal of applied chemistry in real-world situations; 3) prepare students in a 2-year program with the interdisciplinary knowledge, skills, and experience required for full-time employment as lab technicians and/or part-time jobs while they pursue further study; and 4) submit ChemCore and the technician program design to the NSF-funded Northwest Center for Emerging Technologies for approval as a model Associate of Advanced Technology degree program.

Title: Project ComTech: A Curriculum in Technology and Science

Philip Sadler
Harvard University
Department of Science Education
Holyoke Center 458
Cambridge, MA 21383-826
psadler@cfa.harvard.edu

DUE-9602404
FY 1996 $373,927
Multidisciplinary

The need for innovative technology education curricula for students at all school levels is now well documented. While the calls for reform in the science and mathematics communities have resulted in widespread changes in the way these subjects are taught. similar calls in the field of technology education are just beginning to take effect. The Science Education Department (SED) is developing, over a two-year period, a pilot unit on light communication. The goal of Project ComTech is to improve the quality of education for students taking either a required or elective course in technology. Specific learning objectives include having students learn and master a limited number of powerful technology and science themes; sense the excitement, challenge, and career potential of technology; and develop critical thinking and reasoning skills. The alliance--technology educators, community and four-year colleges, public school administrators, private-sector partners, and state and national technology education advocates--represents a continuum of stake-holders in technology education. The advisory panel and development team includes representatives from all partners. The project draws upon the experiences of all partners and the SED's success in curriculum development to complete a discovery-based curriculum unit built on contemporary learning theory. The units include activities that can be used in classrooms for four to six weeks. A teacher resource guide is being prepared for publication and kits of optical and electronic parts are being readied for commercial distribution. The three primary objectives of the evaluation plan are (a) to develop a profile of an `ideal` technology

activity; (b) to assess changes in students' critical thinking and conceptual growth; and (c) to assess changes in classroom teaching strategies of field-test teachers.

Title: The Earth and Space Science Technological Education Project (ESSTEP)

Edward Geary
Geological Society of America
Department of Educational Programs
Boulder, CO 80302
egeary@geosociety.org

DUE-9602408
FY 1996 $149,944
FY 1997 $179,975
FY 1998 $264,950
Geographical Information Systems

The Earth and Space Science Technological Education Project (ESSTEP) is joining undergraduate faculty from two- and four-year institutions and secondary school faculty with professional societies, businesses, and government agencies in a partnership to provide faculty in levels 8 through 14 with: (1) hands-on experience in state-of-the-art data acquisition, manipulation, and presentation technologies for the earth and space sciences, (2) innovative strategies for using technology in classrooms and laboratories, (3) internship opportunities in earth and space science technology fields, and (4) improved access to a wide-variety of technology-based education resources. More specifically, ESSTEP assists faculty in exploring ways that technologies such as the Internet, Geographical Information Systems, Global Positioning Systems, multimedia, image processing, CD-ROMs and laserdiscs can be used to enhance student learning, promote science and technology careers, catalyze the development of new courses and materials, and better articulate the grade 8-14 earth and space science curricula. Through earth and space science technology training institutes and a World Wide Web site, ESSTEP directly serves 120 faculty. These faculty in turn provide in-service opportunities for an additional 1100 to 1500 faculty.

Title: Development of User-Friendly Microcomputer-Based Instructional Aids for Introductory Courses in Electrical Engineering Technology

Howard Smolleck
New Mexico State University
Department of Electrical & Computer Engineering
Box 3699
Las Cruces, NM 88003-3699
hsmollec@nmsu.edu

DUE-9602430
FY 1996 $169,177
Engineering Technology

Issues concerning advanced technological education relating to quality of learning, retention of at-risk students, and the successful availability of such programs to traditionally underrepresented groups have received national attention. Such issues are of significant concern in New Mexico and other states where a substantial number of students come from backgrounds which often include neither role models nor incentives to pursue technical careers. This project is addressing these concerns through development, implementation, and evaluation of a program of interactive, animated software aids for enhancement of two-year technological instruction. Primary areas of attention include vector analysis of AC circuits and demonstration of electromagnetic devices and principles, which form the basis of many courses taken not only by electrical technology students but also by those in mechanical, civil, and other branches of engineering, technology, and the sciences. Based upon extensive experience in successfully applying these techniques to upper-division and industrially related instructional programs, the developers are extending these ideas to the lower-division undergraduate technology curriculum. The project is being conducted in partnership with five two-year New Mexico institutions and two national laboratories, with New Mexico State University (NMSU) serving as the lead partner. NMSU historically attracts many students from these partner schools and is the lead university in the NSF-sponsored New Mexico Alliance for Minority Participation (AMP) program.

Title: Toledo Technology Academy

Lionel Sully
Edison Industrial Systems Center
Department of Technology
1700 N Westwood Ave.-Suite 2286
Toledo, OH 43607-1241
lionel.sully@eisc.org

DUE-9602431
FY 1996 $500,000
FY 1997 $400,000
FY 1998 $300,000
Manufacturing

Toledo's award winning Manufacturing Engineering Technology Program, located at the Libbey Skill Center, provides an effective school-to-work path for high school students, drawn from throughout a major industrial city with its many attendant problems. Through a non-coercive, cooperative learning environment, students acquire competencies in design, construction, and maintenance of automated manufacturing machine systems. Supported by over 80 companies, the two-year, half-day program forms the model for a proposed full four-year, all-day high school program encompassing two of the five Tech-Prep manufacturing engineering technology competency profiles. The project addresses a key industrial need to replace today's aging employees with tomorrow's skilled technical workforce. An integrated curriculum, adapted from many existing proven models, emphasizes cooperative learning strategies, the Quality School techniques of Glasser and others, a full spectrum of real-world work experience for students, laboratory expansion, and marketing to solve low student enrollment. Evening adult education components, allow special laboratories provided by industry to be used by a larger community population. The Community and Technical College offers fully articulated associate degree programs for graduates. The new technology based high school program is being developed by a strong community team consisting of: Edison Industrial Systems Center, Toledo Public Schools, The University of Toledo, Toledo area industrial companies, and the Toledo Chapters of the Societies of Manufacturing Engineers and Plastics Engineers. Industry support and leadership are vital to the success of this initiative providing input into curriculum, as well providing student and instructor mentoring, technical assistance, and product and monetary assistance.

Title: Telecommunications and Networking Engineering Technology Education Project

Gary Mullett
Springfield Technical Community College
Department of Electronics Technology
Armory Square
Springfield, MA 01105

DUE-9602433
FY 1996 $200,000
FY 1997 $200,000
Telecommunications

Springfield Technical Community College (STCC) is undertaking an Advanced Technological Education (ATE) in Telecommunications and Networking Engineering Technology Education. The project is a collaborative effort with STCC joined by partners: the University of Connecticut, the University of Hartford (CT), and the City of Springfield (MA) Public Schools. Its purpose is to develop an integrated curriculum, a teacher training model, and a model laboratory which meets the training needs of the telecommunications and networking industries in the 21st century. Development of the project also includes the active involvement of both private industry and other public sector agencies. STCC currently offers highly successful programs in Electronic Systems Engineering Technology, Computer Systems Engineering Technology, Laser Electro-Optics Technology (which also includes photonics and fiber optics) and a variety of other cutting-edge high technology programs. The project is developing a national innovative model featuring traditional test equipment, evolving equipment, a "virtual instrumentation" lab and simulation software to present to students both real and simulated field experiences. Further, STCC is developing articulation agreements with secondary schools and baccalaureate institutions, providing instructors and facilities for teacher training workshops, evaluating and assessing the project, and disseminating project results. The Project includes a concerted effort to involve women and minorities as students in this new technology offering.

Title: Advanced Technological Education in Chemical Technology

Fritz Kryman
University of Cincinnati
College of Applied Science
Mail Location 627
Cincinnati, OH 45221
kryman@mozart.cas.us.edu

DUE-9602437
FY 1996 $340,129
FY 1997 $378,283
FY 1998 $379,864
Chemical Technology

The American Chemical Society and the College of Applied Science at the University of Cincinnati are developing a

project to help provide chemistry-based technicians (ChT) with the education and skills required for successful high-level careers in laboratories and plants in chemistry-based industries throughout the United States. The mission calls for three goals: (1) development of human resources so that chemical technicians possess the skills and knowledge required for employment in laboratories and plants that require ChTs to the mutual benefit of employee and employer, (2) creation of a system that effectively supports local efforts that address local needs, and (3) provision of a forum for employer, academe and community awareness of the roles and functions of ChTs, and effective information exchange among all stakeholders. To achieve these goals the project is concentrating on three primary activity areas: (1) facilitating the development of networked alliances that nurture and support ChT education at the local level and sharing of ideas and experiences at the national level; (2) developing and evaluating curriculum and instructional materials for ChT education; and (3) enhancing two-year college and high school faculty members involved with ChT education.

Title: Chicago Chemical Laboratory Technology Education Partnership

Donald A. Soucek
Department of Physical Science and Engineering
City College of Chicago Truman
1145 West Wilson
Chicago, IL 60640-5616

DUE-9602443
FY 1996 $139,918
FY 1998 $70,163
Chemical Technology

Truman College, one of the City Colleges of Chicago, is establishing a partnership of secondary schools, community colleges, universities, and industries that focuses on Chemical Laboratory Technology education with an emphasis on such education for minority students. The project is: (a) coordinating the chemistry curricula of secondary schools, community colleges and universities in Chicago, (b) recruiting students from the secondary and community college level into the program, (c) providing chemical technology enhancement opportunities for secondary school teachers and community college faculty, (d) developing curriculum for advanced Chemical Laboratory Technology education, in particular a course in instrumental analysis, and (e) integrating the program with Chicago area industries and professional societies. This project is creating an urban model for advanced technology programs, addressing both the unique problems of inner city students, and their preparation for entry into high tech careers.

Title: Environmental Transportation Technology

Dan Baxley
College of the Desert
Department of Science & Technology
43-500 Monterey Street
Palm Desert, CA 92260-9305
bax@ccd.cc.ca.us

DUE-9602448
FY 1996 $299,980
Engineering Technology

In response to environmental concerns and nation's dependence on foreign produced oil, government mandates have forced the transportation industry to identify, develop, and employ alternatives to the internal combustion engine. At the same time, development of new fuels and technologies has outpaced the supply of adequately educated technicians to satisfy industry demand. Traditionally, transportation technicians have been trained in short term programs, but these programs are no longer adequate since the new technologies require a different core of knowledge. This project is developing a new 11 - 14 program leading to an associate degree in environmental transportation technology with particular emphasis on a new curriculum in technical areas in gaseous fuels technology combined with a broad general education component in science, information science, communications, mathematics, and applied physics. Participating directly with College of the Desert to create and test this new program are three other community colleges in California (San Diego Mirimar, Alameda, and Rio Hondo). These institutions are joined in this effort by five other California community colleges who form the Advanced Transportation Technology Initiative, the Desert Tech-Prep Consortium, the American Society of Advanced Fuels Technology, and numerous industrial and government partners. Workshops for two-year college faculty and secondary school teachers are being conducted to develop expertise in this new curriculum.

Title: LIGASE: Long Island Group About Science Education

R. David Bynum
SUNY Stony Brook
Department of Biochemistry
Stony Brook, NY 117940001
dbynum@life.bio.sunysb.edu

DUE-9602450
FY 1996 $225,000
FY 1997 $225,000
Biotechnology

The goal of LIGASE (Long Island Group about Science Education) is to educate a highly skilled work force for the growing biotechnology industry on Long Island. A

consortium consisting of SUNY Stony Brook, Nassau Community College, Suffolk Community College, Brentwood High School, Uniondale High School, and firms utilizing the Long Island High Technology Incubator has been formed to accomplish this goal. Three different strategies are being used to develop and deliver the curricula: 1) the Teacher Enhancement Institute, located in the School of Professional Development at Stony Brook, is educating high school and community college faculty in current concepts and laboratory techniques in biotechnology, 2) with the assistance of the biotechnology industry, innovative curricula are being developed at the high schools and community colleges, 3) academic year and summer programs are being established that allow faculty and students to gain hands-on experience at the participating institutions. Campus based teaching is being supplemented by off-campus electronically delivered curricula. All developed materials are being made available to other institutions via the LIGASE home page, publications and workshops. Additional activities stress the recruitment of underrepresented minorities and women. Imaginative approaches to broaden instructional capability, including teaching with representatives from both education and industry are also being emphasized. An ongoing outside evaluation allows for positive feedback, modification and change on a regular basis. The overarching structure is provided by the LIGASE Steering Committee, consisting of teachers, faculty and industry representatives.

Title: Reformed Mathematics Pedagogy and Laboratory/Technical Activities in Support of Aeronautics and Space Technical Education for Community and Technical College Students

John Pazdar
Capital Community-Technical College
Department of Science & Mathematics
401 Flatbush Avenue
Hartford, CT 61063-757
pazdar@apollo.commnet.edu

DUE-9602456
FY 1996 $259,914
Mathematics

The reform pedagogy advocated by the Standards of AMATYC's (American Mathematical Association of Two-Year Colleges) "Crossroads In Mathematics" implies significant shortcomings in the way mathematics is currently taught in community/technical colleges. Two-year college students do not have sufficient access in their mathematics courses to real world applications from aeronautics and space technology. The goal of this project is to develop a collection of laboratory/technical activities (LTAs) that significantly contribute to the way in which mathematics from prealgebra through calculus is perceived, taught, and learned in community/technical colleges. The LTAs will be developed by community/technical college faculty working with NASA Scientists/Engineers at the Kennedy Space Center. The LTAs are based on a wide range of technical problems generated from the science of aeronautics and space. In addition, the project is developing Spin-offs from the LTAs that extend them into other related mathematical areas. The targeted audience includes all community/technical college students of whom significantly more than 50% are women and minorities. "NASA-AMATYC PC" is a project coalition involving three organizations: NASA (National Aeronautics and Space Administration), AMATYC (American Mathematical Association of Two-Year Colleges), and CC-TC (Capital Community-Technical College). This project provides community/technical college students with a collection of real world technological applications. These applications are embedded in a pedagogical structure that supports AMATYC's Standards. Evaluation, occurring at every stage of the development process, articulates the LTAs with mathematics education at the secondary school, two and four-year college levels. Dissemination takes place nationally via brochures, booklets and presentations, and globally on the Internet.

Title: Technological Education for Advanced Manufacturing

Frederick Schoenig
Cleveland State University
Advanced Manufacturing Center
East 24th and Euclid Ave.
Cleveland, OH 44115
fschoenig@csuohio.edu

DUE-9602457
FY 1996 $299,880
FY 1997 $308,876
Manufacturing

Northeast Ohio has more than 7,000 manufacturing firms and ranks as one of the largest concentration of manufacturers in the world. The region is experiencing a work force crisis; manufacturers are now struggling to find appropriately skilled workers, technicians, and engineers. On the other hand, the region has a large population of undereducated, underexperienced, unemployed or underemployed residents, predominately minority, who are ill prepared to take advantage of employment opportunities in manufacturing, primarily because of skill deficiencies. This team is developing the Technical Education for Advanced Manufacturing (TEAM) project which integrates the manufacturing education efforts of ten regional partners and establishes a seamless approach to manufacturing education that addresses the needs of a target audience of high school, community college, and university students as well as the unemployed or underemployed or undereducated residents of the region. The heart of this project is the extension of Cleveland's Manufacturing Learning Center (MLC), a hands-

on educational model which has been highly successful at the community college and university level, downward to include not only high school students and teachers but to the undereducated residents of the region. MLC activities are being expanded to include two additional community colleges, Lakeland and Lorain County Community College, and their associated Tech-Prep programs. Faculty and students from the partnering organizations team with MLC associates at Cleveland State and the community colleges to work on productivity-improving process and product development projects sponsored by more than fifty regional companies under the mentorship of industrial personnel or MLC associates. Additional goals are to:

1. Design and implement a model for professional development of university and community college faculty and secondary teachers, especially math and science, that focuses on cross-institutional mentoring relationships and hands-on team experiences in industry sponsored projects.
2. Upgrade the manufacturing curriculum at all partner institutions and infuse it with real-world manufacturing applications and ensure seamless progression and articulation through the partner institutions.
3. Evaluate the curriculum development and reform efforts in all partnering organizations and validate the best practices at additional sites among the partners. This includes the Urban Systemic Initiative within the Cleveland Public Schools.
4. Create computer-simulation instructional materials that can be utilized at any level of learning--high school, community college, and university--by utilizing input and applications from industrial partners

Title: Improving Science and Engineering Technology Education at Community Colleges

Rod Risley
Phi Theta Kappa Headquarters
Office of the Executive Director
460 Briarwood Drive Suite 415
Jackson, MS 39206
risleyra@phithetakappa.jackson.ms.us

DUE-9602459
FY 1996 $211,982
Multidisciplinary

Phi Theta Kappa, the honor society for community colleges, in cooperation with the American Association of Community Colleges (AACC) is developing and conducting a multi-component faculty enhancement and curriculum development project to improve and strengthen the teaching of science, mathematics, engineering, and technology (SMET) at the nation's community colleges. The project is accomplishing its goals through a set of activities designed to stimulate and assist other community colleges to replicate a set of effective NSF-supported community college curriculum materials and faculty development projects; thereby improving SMET education on their campuses and ultimately to two-year colleges nationwide through dissemination activities. The activities to be conducted include: (a) Establishing of a corps of seven mentors drawn from NSF-supported projects at community colleges including Sinclair Community College (manufacturing), Eastern Iowa Community College (environmental education), Chemeketa Community College (sustainable resources), and Prince George's Community College (remote sensing, image processing, and geographic information systems). (b) Conducting a national competition to select 14 colleges to participate in activities listed below to assist them to replicate the selected NSF projects. (c) Convening two National Science Education Conferences, the first to work with mentors to learn about the curricula to be implemented and prepare a plan to integrate these into their curricula and the second to report on progress, and (d) publishing three networking newsletters and a final case study monograph documenting the work of the participating colleges.

1994 and 1995 Project Awards Continuing into 1996

Title: Preparation of Technicians for the Biotechnology Industry

Jack G. Chirikjian
Georgetown University
3900 Reservoir Road NW
Washington, DC 20007

DUE-9553661
FY 1995 ATE $150,000
(TOTAL $250,000)
Biotechnology

This project is focusing on (a) bringing together a coalition of educators, scientists, industrial partners, and curriculum developers to establish a strategy for the Tech/Prep Associate Degree technician preparation program; (b) developing a preliminary curriculum to provide hands-on enhancement opportunities for college faculty and preservice teachers in the area of biotechnology; and (c) recruiting two-year college faculty to test the curriculum materials in summer workshops. At the beginning of the project, this coalition is meeting to determine the most effective strategy to initiate and address project goals and objectives.

The program is having both a direct and an indirect effect on preservice teachers in the area of biotechnology that includes: (a) two-year and four-year college faculty who are directly incorporating the curriculum in their instruction, (b) the availability of materials that make it possible to incorporate the biotechnology curriculum into teacher education programs; and (c) participants on the Steering Committee and Advisory Board who are integrating these materials in their preservice education programs.

Title: Remote Sensing, Image Processing, and Geographic Information Systems

Patricia A. Cunniff
Prince George's
Community College
301 Largo Road
Largo, MD 20772
pc92@umail.umd.edu

DUE-9553662
FY 1995 $313,973
FY 1996 $293,427
FY 1997 $87,541
Geographical Information
Systems

Community Colleges for Innovative Technology Transfer, Inc. (CCITT), a consortium of 12 community colleges across the United States all linked with a local NASA Center, is conducting six faculty development workshops (two each) in remote sensing, image processing, and geographic information systems (GIS). An Earth Systems science course with a self-standing laboratory utilizing remote sensing, image processing, and geographic information systems is being developed as well as an interdisciplinary curriculum module
having multiple strands which utilize the technologies above. The interdisciplinary modules can be infused into science and technology courses at CCITT institutions and other community colleges throughout the United States.

Community college members of CCITT include: Brevard Community College, FL; Cuyahoga Community College, OH; Foothill-De Anza Community College District, CA; John C. Calhoun Community College, AL; Pasadena City College, CA; Pearl River Community College, MS; Prince George's Community College, MD; Thomas Nelson Community College, VA; and the Houston, TX-based Consortium for Aeronautical Technical Education composed of San Jacinto Community College, College of the Mainland, Alvin College, and Lee College.

NASA Headquarters and local NASA Centers are supporting the faculty development/curriculum work. The remote sensing workshops are being held at NASA Goddard Space Flight Center in Greenbelt, MD, with a portion of the instruction being provided by NASA scientists and engineers. Scientists from NASA/AMES are involved with the two image processing workshops to be held at Foothill College. Individuals from academe and industry with GIS experience are supporting the two GIS workshops.

Title: Associate Degree for Manufacturing Technicians

Arnold H. Packer
Johns Hopkins University
Charles and 34th Street
Baltimore, MD 21218
packer@jhunix.hcf.jhu.edu

DUE-9553664
FY 1995 $499,967
FY 1996 $400,000
FY 1997 $399,867
Manufacturing

This project is developing six instructional modules in science, mathematics, manufacturing technology, and technical communication which can be infused into four courses and thereby assist in the creation of the foundation for a broadly accepted portable associate degree in manufacturing. Modules are being created around 8 of the 22 generic standards developed by a national panel of educators and employers in 1994. The standards are based primarily on the competencies defined by the Secretary's Commission on Achieving Necessary Skills (SCANS). Multidisciplinary teams of mathematics, science, and technology faculty are designing a series of CD-ROMs and print materials for the instructional modules. The materials are being produced by the Educational Film Center. The design teams come from 5 Lead Colleges representing 5 consortia of community colleges, which include over 130 colleges. The Lead Colleges are implementing the revised curricula and disseminating the

results to consortia members. Two consortia are state systems—California and New Hampshire, two are industry-based—Boeing and the Alliance of AT&T and its union, the last is the Consortium for Manufacturing Competitiveness. Affiliate Colleges also implement the instructional modules. National boards, which include representatives of the American Association of Community Colleges, the National Association of Manufacturers, the five consortia, industry, and related community college efforts, are guiding the design and implementation of activities and helping disseminate the results to community colleges and employers across the nation. A formative and summative evaluation is being undertaken by the American Institute for Research.

Title: Introductory College Physics 2000-ICP/2

Alexander K. Dickison
Seminole Community College
Highway 1792
Sanford, FL 32771
akdc@aip.org

DUE-9553665
FY 1995 $429,521
Physics

This project is developing a new and innovative curriculum for introductory college physics to be known as Introductory College Physics 2000 (ICP/2). This algebra-based course is modular since its genesis is the Principles of Technology Modules developed in the 1970s. ICP/2 is being made available in hard copy, but IBM and MAC versions on CD-ROM are emphasized since they allow the instructor using the material to edit it before printing for classroom use. The new curriculum incorporates what is now known, through studies in cognitive science, about teaching strategies that improve student learning. The modules are being developed to introduce activities designed to enhance a student's conceptual understanding and ability to make connections to related ideas.

Introductory College Physics 2000 targets students in technology courses, although it is suitable for all college students. With the introduction of Tech-Prep and similar programs, more technology students are taking college physics. Each module in the new curriculum uses modern technological devices to introduce physics concepts. This motivates technological students and helps them see the connections between physics and their chosen fields. This college physics course maintains a rigor that makes it highly transferable to universities. It emphasizes a hands on approach and introduces all major concepts of introductory physics. However, it is the philosophy of ICP/2 that it is more important for students to fully understand fewer basic concepts and have confidence in applying them to new situations than it is for them to be exposed to more ideas that are neither understood nor remembered. Project ICP/2 involves consultants and two other community colleges in Washington and Pennsylvania. During the first year, advisory boards and other writing centers are being formed.

Title: Chemical Engineering Technology Advanced Process Operations Program

Edward R. Fisher
Michigan Technological University
Department of Chemical Engineering
1400 Townsend Drive
Houghton, MI 49931
edfisher@mtu.edu

DUE-9553671
FY 1995 $499,996
Chemical Technology

This 3-year project is developing an innovative two-year degree program in Chemical Engineering Technology: Advanced Process Operation. The project draws upon a strong partnership among Dow Corning Corporation, Dow Chemical Company, Delta Community College, and Michigan Technological University. The degree program consists of a first-year program taught at Delta Community College where high school articulation agreements and diversity outreach initiatives are well established. Due to proximity, work internships are available with industrial partners. Upon successful completion of this first-year experience based on academic performance and work related recommendations, students transfer to the second-year academic program at Michigan Tech. The second year stresses engineering technology with a strong laboratory component leading to a capstone experience in the new multipurpose pilot plant facilities of the Process Simulation and Control Center. Cooperative and apprentice experiences are available during the second year.

The Partnership enables the development and implementation of a model program to lead to highly trained process operators who are comfortable with new process technologies, regulations which shape these industries, and safety and teamwork skills which are adaptive to the changing high performance workplace of the future.

Title: A Chemical Technology Curriculum and Materials Development Project

John V. Kenkel
Southeast Community College
8800 O Street
Lincoln, NE 68520-1227
jkenkel@aol.com

DUE-9553674
FY 1995 $191,590
Chemical Technology

Southeast Community College, in partnership with the University of Nebraska at Lincoln, is directing a curriculum and materials development project for the first-year chemistry

course in two-year college chemical technology programs. The specific objectives of the project are to create: (1) a national model for the introductory chemistry portion of the curriculum; and (2) materials that can be used with the model curriculum that will be published and widely disseminated. The model and written materials are utilizing industrial examples and the new voluntary industry standards (VIS) with the goal of developing a mindset in students that prepares them for their chosen careers. With this background, students are also better prepared for their second-year courses in analytical chemistry, organic chemistry, and biochemistry which build on this base. In addition, consideration is being given to transferability to four-year colleges and universities.

Written materials are being produced as the project unfolds. These materials initially take the form of modules representing individual subject areas. The authors are using industrial process/topics to introduce and support each subject area and are deriving basic chemical principles from the processes described. Such a theme-based or "story line" approach is unique, but effective, in creating the desired mindset. The project is examining the newly developed VIS and incorporating those that are relevant to the subject matter presented. The modules when completed, are being published in the form of a textbook. Prototype CD-ROMs are being produced to accompany some of the modules with the intent of supporting and reinforcing the subject matter. Field-testing is taking place at Southeast Community College, University of Nebraska at Lincoln, and Athens State Technical Institute in Georgia. Further dissemination and voluntary field-testing is taking place via a network of colleges formed as part of an earlier grant.

The principal investigators are approaching the tasks with the thought that further reforms of the chemical technology curriculum (i.e., the second academic year) and the production of additional CD-ROM materials will take place as part of future projects.

Title: Rural Alaskan Environmental Education Program

John W. Carnegie
University of Alaska SE Juneau
Juneau, AK 99801-8625

DUE-9553680
FY 1995 $250,000
FY 1996 $250,000
FY 1997 $100,000
Environmental Technology

The University of Alaska Southeast (UAS) is developing and implementing the Rural Alaskan Environmental Education Program. The project is establishing a centralized educational center at the UAS Sitka Campus, as well as a system for dissemination of curriculum to teachers and students in remote villages throughout the state. The program is modeled on the recommendations of the Federal Field Working Group on Rural Alaska Sanitation Problems and represents a cooperative effort of secondary/postsecondary educators, native leaders, and those State and Federal agencies responsible for environmental programs in the State of Alaska. The program addresses a critical public health need, throughout Alaska and other rural settings, for environmental scientists and sanitation technicians. It is designed to establish cultural awareness of the link between the environment and public health, engaging village youth as agents of change.

The program is providing a cross-disciplinary curriculum in an articulated 2+2 tech-prep format for grades 11-14. Curriculum components encompass an academic core (math, written and oral communications, social science), laboratory science (chemistry, microbiology, geology, climate), and systems technology (hydraulics, mechanics, electronics).

Students are completing a systematic program leading from a secondary diploma to a postsecondary associate degree, along with field experience necessary to achieve technician certification under Alaska regulations for operation of water and wastewater treatment, distribution, and collection systems. An academic and career counseling program, based on professional mentoring and service learning, is assuring that students completing the program are prepared both for transfer to baccalaureate degree programs and for transition into the workforce in rural Alaska.

Title: Electronics Technology Curriculum Development

Brenda L. Bryan
Front Range Community College
3645 West 112th Avenue
Westminster, CO 80030

DUE-9553685
FY 1995 $301,783
Electronics

In this project, interdisciplinary curriculum development teams are designing, developing, and implementing a flexible and modular electronics curriculum. This curriculum integrates academic and cutting-edge technical skills with innovative instructional technology to produce job skills for industry. The curriculum focuses initially on DC Fundamentals and AC Fundamentals with beginning work in Solid State Fundamentals and Digital Fundamentals. The project is combining the resources of Front Range Community College, Colorado State University School of Occupational and Educational Studies, and local secondary institutions. Innovative, competency-based instructional modules that utilize a combination of task-oriented and student-oriented methods are being designed. Multi-media techniques are supporting both consistency and flexibility of instruction and delivery. Results, techniques, and modules are being shared through publications and conference presentations.

Title: Foundation Skills for Advanced Technology

Stephen B. Rodi
Austin Community College
1212 Rio Grande Street
Austin, TX 78701
rodi@tenet.edu

DUE-9553689
FY 1995 $318,715
Physics

This project is producing and field-testing instructional materials intended to develop foundational skills for careers in advanced technology. The course is aimed at 11th and 12th grade students but is applicable to other student populations as well. The course focuses on topics and skills in mathematics, physics, and engineering. It emphasizes understanding of ideas and the natural interplay of mathematics, physics, and engineering in solving problems. It intends to provide an alternative to the routine, rote, and worksheet-driven curriculum which sometimes characterizes beginning instruction for students interested in technological careers. The course is built around 10 problems, each problem associated with an instructional module. Students work in cohorts of four to solve problems. Each problem requires students to use instruments, collect data, understand the mathematics and physics related to the problem, and write up and present solutions in a group setting. Mathematics and physics are taught as a seamless whole related to real problems in a setting in which, it is hoped, students see group effort as the most effective route to success. The course may be an alternate or re-entry path back to the regular science curriculum or may lead to advanced degrees in science and engineering technology. Faculty and teacher development activities are an important component of the project.

Title: The Southeastern Michigan Alliance for Reinvestment in Technological Education (SMARTE) Project

Mulchand S. Rathod
Wayne State University
Department of Engineering Technology
Detroit, MI 48202
rathod@etl.eng.wayne.edu

DUE-9553692
FY 1995 $149,900
Manufacturing

Seven community colleges are part of SMARTE (Southeastern Michigan Alliance for Reinvestment in Technological Education) as well as K-12 school systems, a major state university, community-based organizations, government agencies, labor, business, and industry interests in southeastern Michigan.

The goals of the project include:

1. Development of a SCANS based model for a manufacturing program, which maps the standards in each of three disciplines: product design, industrial controls, and manufacturing. Specific tasks to be accomplished are to: identify skill standards which relate to engineering technologies, organize workshops to review skill standards, create model competencies, study professional organization certification procedures, and provide access to the information on curriculum and certification via WWW SMARTE aliases.

2. Establishment of pilot enrichment programs for students who are beginning preparation for coursework in the technologies as early as elementary school grades. This results in holding at least one 2-week intensified summer institute for local public school students, and at least two workshops at community college sites to encourage elementary and middle school students, primarily minorities and females, into technology fields.

3. Development of a curriculum in product design, which is being shared with faculty and teachers of the consortium through a hands-on workshop.

Title: Advancing Geo-Technology Education: Providing GIS Remote Skills for the Workforce of the Twenty-First Century

William A. Dando
Indiana State University
217 North 6th Street
Terre Haute, IN 47809
gedando@scifac.indstate.edu

DUE-9553694
FY 1995 $300,000
Geographical Information Systems

The Department of Geography and Geology of Indiana State University is introducing 40 community college instructors to the principles of Geographic Information Systems (GIS), one of the fastest growing employment fields in the 1990s. Designed to promote the adoption of GIS as an integral part of numerous technically oriented instructional programs in two-year colleges, this model program is taking the needed first step in supplying the workforce in the Midwest with technicians educated in the use of this rapidly growing technology. Working in teams of two or three community college instructors from the same institution, participants are acquiring the basic principles of GIS in two 3-week summer institutes and in one continuing education class. They are learning the many ways in which this technology is used today in business, government, and industry. The immediate aim of this project is to give participants sufficient familiarity with

GIS principles and knowledge of software and its utility so that they can return to their campuses with enough expertise to begin to incorporate this technology into existing courses. The long-term aim envisions participants establishing discrete GIS education programs at their institutions. To ensure realization of project goals, consultants from two-year colleges with successful GIS programs are advising in organizing all institution programs. They are also part of the summer institutes' teaching teams. A two-year college faculty member is serving as project evaluator.

Close cooperation of the Robinson, IL, campus of Illinois Eastern Community College and the Terre Haute campus of Indiana Vocational Technical Institute is assured in two ways: (1) faculty teams from these two institutions are receiving GIS instruction in the summer institutes; and (2) these institutions are being provided with hardware and software to help facilitate employment of GIS into their existing courses. Development of introductory courses in GIS and integration of GIS into existing courses at these two institutions are among the primary aims of the project.

Title: Integrating New Visions in Environmental Sciences and Technology (INVEST)

Catherine Almquist
Trident Technical College
Department of Physical Sciences
P.O. Box 10367
Charleston, SC 29411
zpalmquist@trident.tec.sc.us

DUE-9553696
FY 1995 $250,647
Environmental Technology

This 2-year project encompasses curriculum development, faculty enhancement, and instrumentation and laboratory improvement. Curriculum activities include development of: (1) a curriculum for a course in X-Ray Fluorescence Analysis of Lead Based Paint and Building Materials; (2) stand-alone laboratory experiments in analysis of lead in drinking water, GIS applications in environmental assessment and remediation, and gas chromatography/mass spectrometer sugar analysis identification of viable airborne organisms; and (3) environmental application for integration into math, science, and technology courses. Opportunities for faculty enhancement are being provided through internships with industrial partners, as well as participation in conferences and workshops. A curriculum work group, composed of project partners, is facilitating a comprehensive approach to materials development and sharing of expertise. A 1-week faculty training institute is being held in the second year of the project to disseminate course materials and train instructors in advanced technologies. A variety of activities designed to increase career awareness in secondary and post secondary minority student populations are planned for both years of the project.

Title: Interdisciplinary Courses in Electronics Manufacturing

Elaine M. Cooney
Indiana University - Bloomington
799 West Michigan Street
Bloomington, IN 47402
cooney@tech.iupui.edu

DUE-9553699
FY 1995 $297,475
Electronics

This project is leading to the development of interdisciplinary courses for electronics manufacturing education that provide highly trained technicians to U.S. industry. A wide range of activities that include all three subcategories of ATE Projects are necessary to meet this goal. Associate degree faculty expertise is being enhanced with industry fellowships, workshops, and seminars. With better understanding of industry needs, these faculty, along with a practicing engineer from the Electronic Manufacturing Productivity Facility (EMPF), are developing three new courses that are the basis for a new degree option. The laboratories which accompany these courses use facilities belonging to industry partners, the EMPF, and the schools, along with equipment purchased under the Instrumentation and Laboratory Improvement section of this grant. Additional activities, centering around the Mobile Electronics Manufacturing Line and the EMPF, link secondary teachers and students with associate degree faculty, practicing engineers, and technicians. Such activities facilitate secondary teacher enhancement and curriculum development.

Title: Regional Center of Excellence for Precision Manufacturing Technologies

Wayne Wells
Rio Grande Center for Manufacturing
Director's Office
1201 West University Drive
Edinburg, TX 78539
wwells@panam.edu

DUE-9553701
FY 1995 $100,340
Manufacturing

Precision manufacturing, particularly tool, die and precision machining and related manufacturing technologies, including plastics molding and metal stamping are an important segment of the Rio Grande Valley regional economy and the national economy. A new model educational program is being developed to create skilled workers who can participate in workplace teams in concurrent engineering. The model is based on the historical guild. Master technologists and students work side-by-side performing productive work in a learning environment. A consortium of other colleges and local industries is being created.

Title: Mathematics for Technology - Laboratory Investigations

Gary M. Simundza
Wentworth Institute of Technology
550 Huntington Avenue
Boston, MA 02115
simundza@accd.wit.edu

DUE-9553704
FY 1995 $499,951
Mathematics

Mathematics faculty at Wentworth Institute of Technology have been employing active learning strategies, characteristic of the calculus reform movement, at all levels of mathematics courses for students of engineering technology since 1989. This student population is motivated primarily by perceived relevance of subject matter to specific technical problems.

The project is developing, through joint efforts of mathematics and technical faculty, laboratory investigations using engineering laboratories and multimedia simulations that illustrate and teach mathematical concepts. The project begins at the intermediate algebra/trigonometry level and continues through precalculus. Fifty sections per year, containing 1500 students, are being affected at Wentworth. Through an existing network of Tech-Prep consortia, Wentworth is taking the lead in extending the secondary level integrated curriculum reforms of Tech-Prep to the college level. Collaboration among faculty from Wentworth and neighboring colleges and secondary schools involved in Tech-Prep, as well as selected industry personnel, is resulting in a series of workshops and minicourses to disseminate materials and methods developed at Wentworth to mathematics teachers at New England area institutions, affecting a potential 25,000 Tech-Prep students.

The Wentworth project serves as a national model for colleges of engineering technology in integrating the learning of mathematics with technical applications. Through the American Society for Engineering Education (ASEE) and the American Mathematical Association of Two-Year Colleges (AMATYC), a potential 100,000 additional students may ultimately be affected.

Title: Problem-Based Learning: A Key to Enhanced Performance in Advanced Technological Education

Buck F. Brown
Rose-Hulman Institute of Technology
Department of Electrical Engineering
5500 Wabash Avenue
Terre Haute, IN 47803
buck.brown@rose-hulman.edu

DUE-9553705
FY 1995 $475,000
Engineering Technology

Education in the United States is at a pivotal juncture. U.S. citizens must compete in a demanding global society, but our educational systems are struggling with outdated approaches and stagnant budgets. The knowledge explosion of the past 20 to 30 years has provided advanced technological education with a singularly difficult challenge. The traditional answer to this knowledge explosion has been to pack more essential facts into the curricula. Careful consideration of this issue suggests that an information-laden society requires resourceful skills, insights, and abilities; hence, educational innovation must focus less on facts and more on problem solving and inquiry-based learning. The Wabash Valley Educational Alliance is implementing an important educational vision and establishing a permanent cooperative effort within the Wabash Valley (west central Indiana). This project addresses instructional methods that impact the education of students of technology, science, mathematics, and engineering in two year, associate degree granting institutions. It is affecting educational approaches at all levels of technology; producing new curricula materials including problems and examples; providing a living video series of applications; and creating a national, refereed, electronic database for sharing problem-based materials and experiences. Problem-based instruction concentrates learning around real-world problems similar to those encountered by practitioners in the field. In problem-based learning, the teacher's role changes quite dramatically from that in a traditional learning situation. The teacher must guide the students in the problem-solving process, directing them through questioning techniques. Problem-based learning helps students become critical thinkers and problem solvers. There is significant potential for its further refinement and widespread application to advanced technological education. This potential, if fully developed, can place technological education in a leadership role and heighten its visibility among the professions.

Title: Rocky Mountain Advanced Technology Education Project

Don E. Goodwin
Colorado Community College System
9125 East 10th Drive, Building 859
Aurora, CO 80010
ca_dgoodwin@mash.colorado.edu

DUE-9553706
FY 1995 $181,170
FY 1996 $117,294
Manufacturing

In recognition of the importance of metrology in advanced manufacturing and to the future of the United State's economy, the Colorado Community College and Occupational Education System (CCCOES) is undertaking the Metrology Curriculum Development Project which involves curricula development, laboratory development, faculty in-service, and professional development for regional and national dissemination. This program is being developed at the Community College of Aurora, which is improving and modernizing its existing Associate of Applied Science Degree in Metrology/Precision Measurement program offered at the Higher Education Advanced Technology Center (HEAT Center). The project team is seeking input and direction from its Advisory Council from the National Institute of Standards and Technology (NIST) and the National Conference of Standards Laboratories (NCSL), as well as from industry.

The specific outcomes of the Metrology Curriculum Development Project include pedagogical strategies that will reconceptualize metrology education nationwide. The project provides opportunities to enrich a variety of curriculum in advanced technology education by incorporating the following elements:

1. the use and integration of distance learning in the instructional strategy;
2. an effective articulation model;
3. development of national standards for metrology education in cooperation with NIST and NCSL;
4. a model for a professional advisory council associated with metrology; and
5. development of an information CD for direct distribution, as well as dissemination on Internet.

Title: Advanced Biotechnology Education Project

Shahla Sheikholeslam
De Anza College
21250 Stevens Creek Boulevard
Cupertino, CA 95014

DUE-9553708
FY 1995 $225,306
Biotechnology

The project is developing an advanced biotechnology education program that can serve as a satellite model program for other community colleges in California and the nation. The fundamental objective is to advance and broaden students' knowledge and hands-on experience in the area of biotechnology. The new laboratory instructional materials are fostering technical education and are helping students gain marketable skills for the workforce.

Title: Collaborative Model for Technician Education Through Interactive Technology

J. Parker Chesson
North Carolina State Board of Community Colleges
200 West Jones Street
Raleigh, NC 27603
chesson@uncecs.edu

DUE-9553709
FY 1995 $120,000
Manufacturing

The North Carolina Community College System is developing a program focused at the 11th and 12th grade levels and at the community college level for engineering technology students preparing to enter the manufacturing workforce. The underlying precept of the project is that workers at all levels of manufacturing must formulate and derive solutions to problems. These workers must enter the workplace with competence in numerical methods including statistics, probability, rate of change, and conversions, as well as being able to use computers, networks, and other sophisticated mathematical tools and information technology to solve problems. Students are being taught the same powerful problem-solving strategies that are used in the manufacturing industry, and are solving these problems by developing critical thinking skills and using multimedia and interactive technology in networked collaborative learning environments. Students learn to develop solutions to real problems in a high technology virtual workplace classroom. Through partnerships with industry, universities, community colleges, and high schools, new models of faculty enhancement and instructional materials development are being used.

Colleges of education at universities, in cooperation with the manufacturing industry and non-profit technology institutions, in North Carolina are providing both in-service and pre-service professional development and technical support to high school and community college faculty. In this new model for technician education, the classroom is becoming a virtual workplace for students to gain experience and confidence in solving real problems facing engineering technicians in manufacturing, and to share experiences on problem-solving strategies used in manufacturing.

Title: Machine Tool Advanced Skills Technology Educational Resources (MASTER) Program

John D. Pierson
Texas State Technical
College - Waco
3801 Campus Drive
Waco, TX 76705
dpier@tstc.edu

DUE-9553716
FY 1995 $550,000
FY 1996 $500,000
FY 1997 $500,000
Manufacturing

This project is a multi-state effort to develop curricula and laboratory materials for student learning in advanced skills technologies for 15 occupational areas supporting the American machining and machine tool industries. The Machine Tool Advanced Skills Technology Educational Resources (MASTER) Program is designing, developing, testing and disseminating new curricula materials for AS/AAS degree options in machining and metals related technologies. Since these occupational areas generally require some form of apprenticeship or internship, these educational materials are also designed and prescribed for use with industry partners. The problems addressed by this project are: (1) the use of outdated curricula materials by schools and colleges; (2) fewer students entering programs of study in these career fields that are highly important to the nation's economy in aerospace, metals, and manufacturing; (3) the rapid evolution of new multi-task machine tools that have reached beyond the capabilities of many existing technicians; and (4) the lack of rigorous college level programs that are needed to prepare a target audience of knowledge based workers in advanced problem solving skills. Five key goals are being addressed by the MASTER Program: (1) to provide more technical graduates that are multi-skilled in new machining tools and support related technologies; (2) to upgrade curricula and laboratories in these technical fields which are critical to the success of our nation; (3) to offer college-level training to existing industry employees to become multi-skilled with new and highly advanced equipment; (4) to establish realistic opportunities for college and industrial partners to validate competency requirements, and prepare a national model for apprenticeship/internship with prescribed laboratory work experiences; and (5) to disseminate the new curricula and educational materials nationally. This collaborative effort brings together six of the nation's leading two-year colleges, geographically dispersed, in areas of high demand, with identified public school and industry partners. Significant potential national outcomes include the survival of many critical industries and technical jobs.

Title: High Quality Biotechnology Education

Kathleen Frame
National Association
of Biology Teachers
11250 Roger Bacon Drive
Reston, VA 22090
kframe@capaccess.org

DUE-9553720
FY 1995 $499,239
Biotechnology

The National Association of Biology Teachers (NABT) is conducting a project using the Life Technologies, Inc.(LTI): GIBCO BRL Training Center laboratories in Germantown, Maryland. Two-year college faculty in partnership with high school teachers from across the nation are being updated on cutting-edge biotechnological research and procedures. Teamed with scientists and technicians from industry, these teachers are developing an innovative educational model to rapidly adapt the advanced techniques and sophisticated equipment of modern biotechnology to inexpensive, hands-on, investigative classroom activities. These activities allow two-year college and secondary schools with limited budgets to provide future technicians and scientists with an excellent scientific background in the techniques and concepts of biotechnology. Additionally, strong articulation between two-year and high school programs and industry is being established to ensure that students pursuing careers in biotechnology have the ability to enter the industrial or research work environment as more than competent technicians, or to pursue higher degrees at four-year institutions. These activities seek to involve all students in learning biotechnology, including women, minorities, and persons with disabilities. Emphases are being placed on the role of biotechnology in the future of the human environment and medicine, and the effect of biotechnology on preservation of plant species and enrichment of agriculture.

Activities from this workshop are being refined, reviewed for scientific accuracy and pedagogy, and field-tested nationwide. Field-test results and review panel advice are being used to modify the activities for compilation into a monograph for nationwide distribution. Project results are being disseminated through training and in-service workshops at national, state, regional, and local levels.

Title: Advanced Technology Curriculum: Meeting AEA Standards

Andrew Woodson
North Seattle Community College
9600 College Way North
Seattle, WA 98103
awood@seaccd.sccd.ctc.edu

DUE-9553726
FY 1995 $300,000
FY 1996 $300,000
Electronics

The aim of the project is to enhance pre-vocational and electronics and engineering technologies curricula. By collaborating with industry, professional associations, institutions of higher education, and secondary schools, the project is developing model programs that raise standards and performance levels for technicians in industrial applications. To comply with the new standards developed for technicians by the American Electronics Association (AEA) designed to raise skill and knowledge levels, the project is effecting significant changes in the approach to technological education. Spanning a period of 2 years, the project focuses on three major components:

(1) Faculty Development. A faculty enhancement program is planned to prepare faculty for curricular reform. Participants in summer institutes include electronics and engineering faculty, secondary school teachers, and representatives of industry. The institutes cover a range of topics that include AEA standards, industry practices, collaborative approaches to teaching, use of interactive courseware, and competency-based instruction.

(2) Curriculum and Institution Materials. Comprehensive curricular reform includes development of pre-college level workshops in communications; computers; developmental technical mathematics and algebra for students deficient in basic skills; applied academics; integration of science and mathematics into technical programs; and new and revised curricula in electronics and engineering technology. Modules focus on basic skills and on specific, typically complex technical topics such as object-oriented design and documentation.

(3) Laboratory Improvement. Over the two-year period, faculty are integrating into the curriculum a new learning laboratory where automated work environments can be simulated and state-of-the-art systems demonstrated. The integrated systems laboratory is designed to provide students with an overview of systems involved in taking a product from design and pattern layout to a tested and finished product.

Title: The South Carolina Advanced Technological Education (SC ATE) Exemplary Faculty Project

Lynn Mack
Piedmont Technical College
Department of Mathematics
Greenwood, SC 29648
mack@ped.tec.sc.us

DUE-9553740
FY 1995 $486,930
FY 1996 $487,297
FY 1997 $482,379
Engineering Technology

The South Carolina Advanced Technological Education (SC ATE) Exemplary Faculty project is designed to restructure the learning environment to prepare two-year technical college students for the workplace. The project is creating a cadre of exemplary faculty teams for the express purpose of implementing innovative research-based advanced technological education practices across the SC Technical College System. The major objectives are to: (1) develop and implement a comprehensive faculty development program for ATE that addresses faculty development needs in advanced technology education content, effective pedagogy, and assessment of student learning outcomes; (2) develop, pilot test, and implement research-based curricular reform in advanced engineering technology programs; and (3) evaluate implementation processes and materials and disseminate successful processes and products at the local, state, and national levels. Methods include involving interdisciplinary faculty teams from the 16 SC technical colleges in intensive professional development activities. The primary audience is mathematics, physical science, engineering technology and communications faculty members. Collaborative partners include Clemson University and the National Dropout Prevention Center at Clemson, the SC State Department of Education (SSI and Tech-Prep Programs) SC ETV, the Academy for Educational Development, and the Virginia Community College System.

Title: Development of a Two-Year Associate Degree in Agricultural Technology

Terry Brase
Hawkeye Community College
1501 East Orange Road
Waterloo, IA 50704

DUE-9553751
FY 1995 $200,000
Biotechnology

Hawkeye Community College is developing and distributing the curriculum for an associate degree in Agricultural and Food Technology. In the past 2 years rapid changes have occurred in technology in the field of food systems.

Technology changes involving biotechnology, GPS/GIS satellites, and computer/telecommunication networks and other innovations will continue into the next century. For farmers to remain competitive in the food industry, they, and the food systems sales and service people supporting them, must be educated in this new technology. There are "fewer and larger farm operations, still individually owned and operated by families, but more businesslike...And to be profitable, the farmer must use technology" (KSU AG REPORT, Fall 1994). Hawkeye Community College is planning and testing an innovative 64 credit hour curriculum which links the agricultural and business experience with technology. The curriculum and all support materials are being used in expanding articulation agreements with the secondary schools and four-year institutions including a land grant university interested in updating agricultural curriculum into food systems. The materials are being disseminated through national education associations, journals, and telecommunication systems.

Title: Teacher/Faculty Enhancement, Curriculum Development and Laboratory Improvement for Fiber Optics Technology Education

Nicholas M. Massa
New England Board of Higher Education
45 Temple Place
Boston, Massachusetts 02111
massa@stcciphub.stcc.mass.edu

DUE-9553762
FY 1995 $365,100
Electronics

This project is a faculty development activity which aims to provide training for college faculty and pre-college faculty members. A series of 2-day workshops, summer workshops, and technical assistance sessions is being conducted over a period of 30 months. The project is designed to increase the number of high school teachers and two-year college faculty who have the expertise to include fiber optics and related topics in their science/technology programs. Also, the project includes faculty enhancement, curriculum development, and laboratory improvement. There is significant participation from industry.

Title: Development and Implementation of Advanced Applied Technological Mathematics

Alfred Patrick
SUNY Adirondack Community College
Bay Road
Queensbury, NY 12804

DUE-9553765
FY 1995 $184,880
FY 1997 $49,314
Mathematics

This 3-year project involves a community college, four area high schools, and local business and industry in developing and piloting an advanced mathematics course as a 4th- year offering to follow and extend a Tech-Prep applied mathematics sequence. This course is consistent with the New York State Framework and national guidelines from the National Council of Teachers of Mathematics and the American Mathematical Association of Two-Year Colleges. Specific attention is being devoted to student problem solving, critical thinking skills, concept attainment, motivation, and making connections in applied laboratory hands-on settings. The embedded use of calculators and computers is a major goal of this effort. The course materials are being disseminated in the Capitol Region Consortium and beyond. A publisher is anticipated for this course product.

Title: Defining the Emerging Role of the Technologist in a Computer-Aided-Engineering Environment

Robert W. Simoneau
Keene State College
229 Main Street
Keene, NH 03435
rsimonea@keene.edu

DUE-9553767
FY 1995 $250,000
FY 1996 $150,000
FY 1997 $148,260
Manufacturing

The Industrial Technology and Safety Program at Keene State College project is planning and implementing a revised curricula in its two-year associate degree program in Design and Manufacturing based on the emerging Computer Aided Engineering environment. Today graduates are entering an increasingly competitive job market. They need to have a readily marketable skill in order to compete for jobs or the academic proficiency to go on to obtain advanced degrees. The companies that hire graduates are facing enormous competitive

pressure from around the world. The loss of our manufacturing base continues. The resulting job loss is a significant socio-economic and political problem. United State's companies need a flexible and technologically competent workforce in order to stem this tide. The emerging role of the technologist must be one that can fully utilize computer assisted technology. This computer environment is integrating the once discrete job functions of design, manufacturing, and business. The current limitations in existing discrete curricula suggests a new seamless educational paradigm. To address this situation, three areas of study need to be examined. The first is a conceptual-based curriculum, using a projects focus, to deliver technical problem solving for meeting curriculum goals. The second aspect is to create a series of four integrated courses in the area of product design and development, utilizing a computer assisted environment. The third is to establish a collaborative working on these projects on the Internet, with other schools, government laboratories, and companies. The curriculum model the project is creating is an immersion model for students that provides both a contextual and constructivist environment for problem solving. In this environment, students solve holistic and fully integrative problems in math, science, technology, and business. This curriculum model emulates both the emerging computer assisted environment and the world of work. The goals are to create this new curriculum paradigm and study its effectiveness. The model is both pragmatic and realistic and serves as a nation model. This is one of many solutions being offered to help improve the competitive position of graduates. By breaking with traditional paradigms the project serves as a model to entice non-traditional and minority students, as well as displaced workers, to move into the exciting and challenging world of product design and development. The project also opens many new and exciting opportunity for educational research.

Title: Advanced Technological Education Project in Environmental Technology

Jeffrey Cramer
Stark Technical College
6200 Frank Avenue, NW
Canton, OH 44720
jcramer@stark.tec.om.us

DUE-9553768
FY 1995 $516,209
Environmental Technology

Stark Technical College (STC) is developing an Advanced Technological Education project in Environmental Technology which is resulting in the development of an Environmental Technology option within Civil Engineering Technology. The project is addressing northeastern Ohio's business and industry needs for technical expertise in the environmental instrumentation, regulation and compliance areas, as well as waste minimization/pollution prevention concepts. This need is critical due to the heavy concentration of manufacturing in the region, and the fact that northeastern Ohio is the most polluted quadrant of the state. The College's established ties with business and industry in the region are facilitating the design of a program that is producing uniquely qualified graduates who help the public and private sectors address growing environmental regulations and concerns. The AAS degree curriculum is tied into secondary Tech-Prep programs in the region and related bachelor's degree programs at Youngstown State University and the University of Findlay. An integral part of the curriculum is advanced communications technologies which enable students (high school, two-year college and university) to communicate with each other on collaborative projects. It also serves as the basis for an Environmental Resource Center (ERC), to be operated by students, which facilitates and enhances instruction, as well as responds to business/industry and community questions and concerns. A major component of the project is the use of summer institutes and academic year follow-ups for teacher/faculty enhancement in several key areas: pedagogy; technical expertise; and math, science and communications-related instruction.

Title: Math/Science Enhanced Manufacturing Technology Training for Females and Minorities

James Amara
Minuteman Science and
Technology High School
758 Marrett Road
Lexington, MA 02173

ESIE 9453921
FY 1994 $185,700
FY 1996(ATE) $170,370
Manufacturing

A pilot manufacturing laboratory facility has been established at Minuteman Science and Technology High School. This formal 3-year curriculum in manufacturing technology is coordinating with Middlesex Community College. This project is developing over a 4-year period, an integrated manufacturing institution model for 30 female and minority teachers grades 6-12. Participants are being introduced to the project via three seminars held in the spring. Seminars are on equity issues and manufacturing technology. Each summer over the life of the project, participants receive an intensive 3-week workshop on current trends and practices in manufacturing. Topics include: automation, electronics, mechanics, and bio-manufacturing. Emphasis is placed upon the integration of mathematics and science, the importance of communication and human relations, technology skills related to manufacturing, career awareness, and hands-on activities appropriate for junior and senior secondary school students. Each academic year, the original 30 teachers acquire more

complex integrated mathematics/science and technology skills coupled with specific workshops on women and minority issues as they begin to develop integrated projects suited to their teaching environment. The project emphasizes a realistic view of science and technology and problem-solving activities which require skill in collaboration, experimentation, writing, computing, and the pursuit of exploration.

Title: Expanding the Biotechnology Education Program in the San Francisco/Oakland Bay Area

David R. Stronck
California State University Foundation
Department of Teacher Education
Hayward, CA 94542

DUE-9454502
FY 1994 $250,000
Biotechnology

A program for training biotechnology technicians is presently operating at Contra Costa Community College with articulation to Richmond Secondary School. A Tech-Prep grant funded internships at Contra Costa College and local biotechnology firms for secondary school students. This project is assisting science educators and scientists to continue preparing technicians for local biotechnology companies. For the 48 teachers involved, a 3-week workshop and 8 follow-up meetings during the academic year are being offered. Mentors make site visits. Telecommunications is being used to implement the program. A biotechnology kit and curriculum are being developed; implementation is planned into many secondary schools with high minority enrollments.

Title: Pac-TEC: The Pacific Technological Education Center

Wade Ellis
West Valley Community College District
14000 Fruitvale Avenue
Saratoga, CA 95070
wade_ellis@msmail-gw.wvmccd.cc.ca.us

DUE-9454513
FY 1994 $300,000
Multidisciplinary

Pac-TEC is a consortium of two-year colleges, secondary schools, and businesses situated in the Silicon Valley with regional partnerships in seven western states. This project is developing and distributing state-of-the-art instructional materials and techniques to secondary schools, colleges, industry, and government. These materials focus on innovative mathematics, science, engineering, and technology, and are aimed at students who are becoming technicians. Emphasis is being placed on the development of materials which enhance students' problem solving abilities, computer literacy, effective oral and written communication skills, and ability to work in groups. The materials are being created around open-ended, design-based project work.

Title: Partnership for the Advancement of Chemical Technology (PACT)

Arlyne M. Sarquis
Miami University Middletown
4200 East University Boulevard
Middletown, OH 45052
sarquiam@muohio.edu

DUE-9454518
FY 1994 $400,000
FY 1995 $400,000
FY 1996 $400,000
Chemical Technology

Miami University Middletown, in partnership with the major chemical industries in Ohio and a regional consortium of two-year and four-year colleges and secondary schools, is establishing a regional consortium for Chemical Technology Education. By bringing academic courses into closer touch with today's industrial chemistry, the project is attracting additional students to careers in chemistry and improving the quality of education of chemical technicians.

Four categories of activities are envisioned for the project: (1) Curriculum Development; (2) Instructional Materials Development; (3) Faculty and Teacher Enhancement; and (4) Student Enhancement and Outreach. Secondary school and college faculty are eligible for a Teacher Industrial Internship Program in which participants spend a summer or part of an academic year working in partner industries. Similarly, master secondary school teachers and two-year college faculty are working in collaboration with industrial chemists in developing curriculum and instructional materials. Symposia and special topic seminars are also being organized on a regular basis.

The project is being built upon the nationally known, 8-year old Partners for Terrific Science industrial/academic partnership and programs housed in the Center for Chemical Education at Miami University Middletown, as well as upon existing collaborative efforts of other consortium members. This project is serving as a model for regional and national development of improved chemical technician education.

Title: Image Processing for Teaching: Faculty Development and Curriculum Materials

Melanie Magisos
Center for Image Processing
in Education
5343 E. Pima Street, Suite 201
Tucson, AZ 85712
ipmagisos@aol.com

DUE-9454520
FY 1994 $403,814
FY 1995 $466,493
FY 1996 $476,524
Computer and Information
Technology

Image Processing for Teaching (IPT) brings a powerful technology to schools and two-year colleges where students use this state-of-the-art tool for exploration and analysis, and for learning problem-solving skills, computer and imaging technologies, and specific image processing skills which are becoming increasingly important in the modern workplace. IPT's past success at exciting students about science and mathematics by bringing inquiry- and discovery-based learning to students of all ability levels has created considerable demand for implementation in vocational and technological education settings.

The IPT project is producing curriculum materials targeting technological education programs. Workshops are being designed and conducted to provide the faculty development necessary for successful implementation. IPT further supports implementation with follow-up services, including toll-free telephone and e-mail communication, an annual conference, and periodic video conferences. The team of expert teachers play a primary role in all planning, development, and instructional activities. The stream of interdisciplinary activities, keyed to occupational clusters, keeps instructors and their students on the cutting edge of technology while using a demonstrated powerful tool for learning.

Title: Preserving the Legacy: A Comprehensive Curriculum and Materials Development Project in Support of Advanced Environmental Technology Education

Sally V. Beaty
Intelecom Intelligent
Telecommunications
150 East Colorado Boulevard
Suite 300
Pasadena, CA 91105

DUE-9454521
FY 1994 $499,988
FY 1995 $499,989
FY 1996 $499,989
Environmental Technology

Preserving the Legacy is an educational print and video series being produced by INTELECOM Intelligent Communications in association with the Partnership for Environmental Technology Education (PETE) and Van Nostrand Reinhold Publishers. This series was designed primarily for two-year community and technical college students seeking employment in environmental technology. The series can be used in traditional classrooms, for televised distance learning programs, or in companies providing their employed environmental technicians with worksite education. *Preserving the Legacy* will be of interest to anyone desiring information about industry compliance with environmental regulations.

Preserving the Legacy textbooks and videos are based on these core curriculum topics: (1) Introduction to Environmental Technology; (2) Waste Generation, Reduction, and Treatment; (3) Site Characterization, Sampling and Analysis; (4) Basics of Toxicology; and (5) Basics of Industrial Hygiene. *Preserving the Legacy* will also include a handbook called *Communications for Environmental Technology*, a collection of practical exercises to develop on-the-job communications skills. Each of the 15 videos will be accompanied by a teacher guide suggesting multiple ways the series can be coordinated for maximum effectiveness.

Title: An Advanced Biotechnology Education Partnership Program

Joy A. McMillan
Madison Area Technical College
Dept. of Biotechnology
3550 Anderson Street
Madison, WI 53704
jam1819@madison.tec.wi.us

DUE-9454555
FY 1994 $400,000
FY 1995 $400,000
FY 1996 $200,000
Biotechnology

The goal of the project is to provide skilled employees for the biotechnology industry. To achieve this goal, a collaboration is being established between the Biotechnology Laboratory Technician Program at Madison Area Technical College, the University of Wisconsin Teacher Enhancement Program, and the industry-based BioPharmaceutical Technology Center Institute. This project is a well-coordinated, highly integrated effort to: (1) develop and disseminate curriculum materials specifically designed for technician training at the two-year associate degree level; (2) provide teacher enhancement activities in biotechnology including summer institutes and mentoring and curriculum development partnerships for associate degree and secondary level school teachers; and, (3) support the development and coordination of industry-led, statewide programs to offer work-based experiences for secondary school students. The program links together the development of instructional materials with faculty enhancement, student laboratory experiences, and school-to-work initiatives.

Title: Science Technology: Knowledge and Skills

David K. Lavallee
American Chemical Society (ACS)
1155 16th Street, NW
Washington, DC 20036

DUE-9454564
FY 1994 $500,000
FY 1995 $500,000
FY 1996 $500,000
Chemical Technology

The Science Technology: Knowledge and Skills curriculum project (SciTeKS) fills the void of science-oriented technical courses in Tech-Prep and similar school-to-work transition secondary school programs. The project is designed to develop print and multimedia student and teacher materials for large context modules involving chemistry, biology, and earth/space sciences. The development includes curriculum design recommendations and models, multimedia instructional and reference materials for students, suggestions and models for implementation, support for teachers, and guidance for assessment. The curriculum is designed to develop, in secondary school students, skills in teamwork, problem solving, communication, and other capabilities considered critical for their success in the workplace and/or in further education. The SciTeKS project provides a two-year science curriculum for a variety of school-to-work programs. Students completing SciTeKS are ideally prepared to enter immediate employment or college technician programs based on biology, chemistry, or earth/space sciences. The pedagogical strategies are being developed by a team of secondary school, college, and industrial participants.

Title: Hands-On Physics: A New Conception of Physics

Robert Tinker
Concord Consortium
37 Thoreau Street
Concord, MA 01742
bob@concord.edu

DUE-9454575
FY 1994 $432,743
Physics

Hands-On Physics represents a major reconsideration of introductory physics which takes full advantage of the powerful insights learned about how students learn and the new opportunities technologies offer. The material targets students headed for technological careers at the secondary school and two-year college level. The project is a collaboration between a small central staff and practicing teachers and faculty who are developing, testing, and revising the material in actual classrooms. The Concord Consortium is a collaboration between TERC, MIT (Massachusetts Institute of Technology), and several community colleges in Massachusetts.

Title: Kentucky Advanced Technology Education Project

Anthony Newberry
University of Kentucky
Community College System
Breckinridge Hall
Lexington, KY 40506
anewbl@service1.uky.edu

DUE-9454585
FY 1994 ATE $696,300
FY 1994 ILI $103,700
Mathematics

The Kentucky Community College System is establishing computer facilities at each of its 15 widely separated community college campuses. These new facilities are being utilized for statewide reform of the algebra level and calculus mathematics which form part of the curriculum for students in Advanced Technological Education programs. The laboratories also support development of new two-year curricula in telecommunications and computer system management. A system of formal courses (taught using satellite facilities) to train faculty and staff to maintain the network system is catalyzing Continuing Education and Community Service programs in the use and administration of network systems. Colleges are also developing the capability to offer a new associate degree program in network system administration. At the conclusion of this project, approximately 40% of the System's intermediate and college algebra level mathematics courses will be taught as integrated courses in a collaborative learning environment using technology as a learning tool. While 15,000 students across Kentucky are directly benefiting from the revised curriculum during the actual project period, the project will ultimately affect many thousands more students and ordinary citizens.

Title: Technology Instruction for the 21st Century

Bernard E. Mohr
CUNY Queensborough
Community College
56th Avenue Springfield Boulevard
Bayside, NY 11364

DUE-9454613
FY 1994 $197,013
FY 1995 $205,300
FY 1996 $110,652
Electronics

Multimedia-based curriculum materials are being developed to support technology education in data acquisition, embedded systems, and multimedia and high speed networks. These materials, which include networked laboratory manuals, text and student exercises, are available in a modular format to facilitate their incorporation into technology education courses at other institutions. A significant evaluation component is included to assess the effectiveness of the multimedia materials, especially with respect to learning outcomes for members of underrepresented groups. Six 1-week summer

workshops (two each year over a 3-year period) are being offered to disseminate products completed in the project and to assist faculty in developing the capability to author effective multimedia-based materials.

Title: Two-Year Associate of Technology Curriculum Development for GIS/GPS Technologies

James L. Keating
Kansas State University - Salina
2409 Scanlan Avenue
Salina, KS 67401
jkeatin@ksuvm.ksu.edu

DUE-9454618
FY 1994 $500,000
Geographical Information Systems

This project is developing and distributing a curriculum for an associate degree in the fields of Geographical Information Systems (GIS) and Global Positioning Systems (GPS). The projected need for trained GIS and GPS technicians is high because within the next decade, every plane, ship, and most vehicles will use GIS and GPS. Governments will rely on these technologies to track, tabulate, and map environmental, census, and tax data.

In cooperation with a network of eight community colleges, an innovative curriculum is being planned and tested which links the environmental, legal, and business experience of the partner colleges with the lead institution's experience in GIS/GPS and engineering technology. The curriculum, and all support materials, are being used as a vehicle to ease articulation between other schools (secondary, two-year and four-year) that are interested in adding GIS/GPS to their curricula. The materials are also being disseminated through national publishers, journals, and a national educational association.

Title: The Application-Based, Technology-Supported, One-Track Mathematics Curriculum Program (ATO)

Catherine Curtis
Mount Hood Community College
26000 SE Stark
Gresham, OR 97030

DUE-9454627
FY 1994 $469,923
Mathematics

The Mt. Hood Community College (MHCC) Mathematics Division is developing, implementing and disseminating a comprehensive Application-based, Technology supported, One-track Mathematics Curriculum for all students (baccalaureate preparation and technical preparation). The four levels of study incorporate the National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards and the Secretary's Commission on Achieving Necessary Skills (SCANS) recommendations. The curriculum development responds to the education reform movement in mathematics while addressing the lack of appropriate course materials targeting community college students; the lack of a framework to train adjunct mathematics instructors (on which the community college heavily relies); and the lack of articulated curriculum for the same level of mathematics taught in middle schools, secondary schools, community colleges and four-year schools.

The following are the three objectives for development and implementation of the Applications, Technology, One-Track (ATO) Program: (1) to develop and publish course materials for Levels II and III (applications oriented algebra) of ATO: a textbook for each level that fully integrates the use of technology and hands-on activities and real-world interdisciplinary applications supplement; (2) to develop a framework for the ongoing staff development of community college adjunct mathematics faculty to enable them to effectively deliver a coherent mathematics curriculum; and (3) to develop, in collaboration with middle schools and secondary schools in the community college district, an articulated coherent mathematics curriculum that addresses content-based proficiency assessment strategies and supports uniform implementation of the NCTM Standards in mathematics education.

Methods to accomplish these objectives build on previously established team efforts at MHCC; partnerships with industry; and collaborative activities with other schools including middle schools, secondary schools, and four-year colleges. The Northwest Regional Educational Laboratory is instrumental in the evaluation of the project, along with the Program Management Evaluation and Assessment Advisory Team.

Title: Environmental Technology Education Transfer to Native American Tribal Colleges

Karl F. Topper
Mesa State College
P.O. Box 2647
Grand Junction, CO 81502
topper@mesa2.mesa.colorado.edu

DUE-9454633
FY 1994 $399,778
Environmental Technology

Native American Tribal environments have often historically been neglected; tribes have had inadequate resources and expertise to deal with cleanup and prevention of further pollution. Because tribes need to know how to measure and analyze their own environmental risks, a technologically educated and trained Native American environmental workforce is needed. This project is using existing resources to create and transfer an interdisciplinary environmental

technology associate degree curriculum for tribal colleges and other community colleges with roles in educating American Indians. It is also providing faculty enhancement, institution materials, and a rotating equipment program. The curriculum focuses on those technologies used for environmental monitoring, site assessment, solid waste management, and pollution prevention because these are the prominent environmental issues facing tribal lands. From incorporation of support disciplines (mathematics, science, communications), students are developing analytical skills for situations in which they are not specifically trained. Mesa State College and Navajo Community College are the resource colleges, each with different established environmental technology programs. The pilot group of tribal and tribally related colleges consists of Navajo Community College, Northern New Mexico Community College, Crownpoint Institute of Technology, and Southwest Indian Polytechnic Institute. The project methodology is interactive, using workshops, site visits, iterative writing/review, and hands-on activities. The tribal colleges are part of the process from the beginning and will take ownership of the curriculum.

Title: Advanced Biotechnology Education Project

Barry L. Werner
Middlesex Community College
Springs Road
Bedford, MA 01730
wernerb@admin.mcc.mass.edu

DUE-9454642
FY 1994 $347,978
FY 1995 $392,307
FY 1996 $392,109
Biotechnology

This project is developing coordinated secondary school and two-year college biotechnology curricula. Supporting activities include teacher and faculty training, industry mentor education, program materials development, job shadowing, and the recruitment and retention of underrepresented groups of students. Principal collaborators include a two-year college, secondary schools, four-year colleges and universities, biotechnological industries, and government. Biotechnology programs are being articulated for different educational levels. Major developments include classroom and multimedia materials. Also, developed materials are being disseminated through various media such as publications, videos, electronic linkages, workshops, and conferences.

Title: Establishing and Transporting Science, Computer and Electronics Technology Curricula to Rural Minority Students through Simulated Labs and Telecourses

G. Robert Converse
University of Hawaii/Maui
Community College
310 Kalahumanu Avenue
Honolulu, HI 96822
converse@mccada.mauicc.hawaii.edu

DUE-9454647
FY 1994 $499,938
Computer and Information
Technology

Maui Community College (MCC) is establishing and transporting a distance education project that involves teaching science, computer, and electronics technology curricula to rural minority students through interactive teleclass lectures and simulated multimedia laboratory experiences. The first stage of the project encompasses the development of multimedia institution materials for a model Certificate and Associate in Science Degree curriculum in Electronics and Computer Engineering Technology (ECET). The program is cooperatively designed to provide technical certification and/or transfer opportunities to baccalaureate degree programs at the University of Hawaii-Manoa or distance education offerings at the Maui Research and Technology Center from the University of New Mexico. The second stage focuses on developing multimedia laboratory exercises for the ECET curriculum in a format transportable to outreach by reducing dependence on costly laboratory equipment and faculty travel. This innovative format utilizes simulated laboratory experiments by developing, purchasing, and integrating multimedia software for Computer-Aided Instruction (CAI) workstations. The ECET program is being field-tested on the main campus and then extended to the college outreach centers and is recruiting students from MCC's densely populated Pacific Island and Asian community. The third stage is the extension of the simulated methodology to other science and mathematics courses at the college. The final stage involves teacher and faculty enhancement. Effectiveness of this approach is being demonstrated through scheduled workshops for other college instructors state-wide and to secondary school teachers. The project results are being disseminated on a national level.

Title: Technical Sciences Academy Proposal

Therese A. Jones
Amarillo College
P.O. Box 447
Amarillo, TX 79178
tjones@pcad-ml.actx.edu

DUE-9454651
FY 1994 $630,000
Multidisciplinary

This project is creating a Technical Science Academy as a division within the Amarillo Scientific Arts Academy. The Academy serves secondary and postsecondary students from Amarillo and the surrounding area through state-of-the-art curricula and laboratories in mathematics, science, and technology. The project is providing hands-on curricula for majors in Electronics Engineering Technology and Hazardous Materials Technology. The project implements a seamless educational strand which removes barriers between secondary and postsecondary levels. Team teaching, proficiency based curricula, and cooperative learning are the major emphases of the project, as well as the implementation of internships, cooperatives, and interactions with industrial partners for faculty and students. The project is appealing to underrepresented groups including women and minorities. This project grew out of a committee effort which brought together educators and business/industry leaders to generate realistic ways to address national education goals.

Title: Advanced Technical Education (ATE) Alliance

James A. Jordan
Consortium for Advanced Manufacturing International (CAM-I)
1250 E. Copeland Road, Suite 500
Arlington, TX 76011
jjordan@cup.portal.com

DUE-9454655
FY 1994 $499,950
FY 1995 $499,950
FY 1996 $499,950
Manufacturing

This project is developing, delivering, and evaluating a national curricula to educate technicians who are employable in 21st century manufacturing enterprises. Instructional delivery is being assisted by distance learning technology and the National Information Infrastructure. Added funding comes from local, state, and other federal sources. CAM-I is leading an Advanced Technical Education (ATE) Alliance, including as members Lawrence Technological University; C.S. Mott Community College; Goodrich, Michigan area schools as well as affiliates from other school districts in the Flint, MI area; clusters of community colleges, school districts, and CAM-I company members in Oak Ridge, TN; Kansas City, MO and Kansas City, KS, Los Angeles, CA; the Mescalero Apache Reservation, NM; Lehigh University; and the National Technological University.

The knowledge and skill needs for a new breed of agile technicians who are able to respond knowledgeably, effectively, and quickly in highly competitive, rapidly changing global manufacturing, are being addressed. The ATE Alliance is meeting these needs by combining existing best practices modules already developed by its members and affiliates, with newly developed modules in an integrated, flexible, grade 11–14 program in mathematics, science, communications, computing, and manufacturing enterprise technologies in a pilot program centered at C.S. Mott Community College and Goodrich, MI, area schools.

The Alliance is sharing the modules using nationally scaleable distance learning techniques. The curricula are being reinforced with teacher training, job site education for teachers and students, and public information programs. The ATE Alliance is establishing a virtual school, combining a national network of educational resources to provide optimized education for employability. The pilot curriculum modules are being disseminated via distance learning techniques to the members and the affiliated associate degree granting institutions and school districts. The curriculum is being evaluated through performance based assessment. Successful modules are being further disseminated throughout the United States by CAM-I in publications, public forums, and through CAM-I's national network of industrial members. The ATE Alliance provides 21st century education in clusters with large, diverse minority populations, preparing students for employment in challenging and rewarding careers.

Title: Advanced Technological Education in Biotechnology: A Community College Partnership with Industry

Barbara Des Rochers
Peralta Community College
District Office
333 East Eighth Street
Oakland, CA 94606
bsd@nature.berkeley.edu

DUE-9454657
FY 1994 $209,073
Biotechnology

This project involves an integrated and vocational enriched program in biotechnology. The program leads to a certificate and associate degree and incorporates basic science, computer use, applied mathematics, reading skills, writing skills, and critical thinking. Committed partnerships include industry, a 2-year college, secondary schools, and government. The project also address the needs of a rapidly changing workforce by reducing barriers for entry of women and minorities into science and mathematics based occupations. New instructional methods are being incorporated into the curriculum, and cooperative learning environments are being provided through mentorships and internships with industry.

Special Projects

Title: Creating Partnerships between Urban Community College and Industry to Prepare Students to Enter and Succeed in the Technical Workforce

Nancy DeSombre
City Colleges of Chicago
Harold Washington College
Chicago, IL 60601-2420

DUE-9634670
FY 1996 $9,975
Multidisciplinary

This project is planning a national conference to create partnerships between urban community colleges and industry to prepare students in urban communities to enter and succeed in the technical workforce. With the increased use of technology by corporate America, industry can no longer accept people who lack technical skills. Urban community colleges and their high school partners are uniquely positioned to assume a lead role in preparing the workforce necessary for industry to remain productive in urban areas. Partnerships between industry, urban based public schools, and community colleges must be established that have as a central purpose the preparation of students for technical careers and access of students to other careers which depend on use of technical information. The conference is involving city major's offices, business and industry, the Superintendent of the public schools, and Chancellor or President of the community college system in nine major urban cities (Chicago, Los Angeles, Miami, Cincinnati, Cleveland, Baltimore, New York, St. Louis, and Detroit). To set an agenda for such a highly visible national workshop, a national steering committee is being established to lead in planning and coordinating the effort.

Title: Expanding the Network of Community Colleges in Advanced Science and Engineering Technology Education

James Mahoney
American Assoc. of Community Colleges
One Dupont Circle, NW, Suite 410
Washington, DC 20036
jmahoney@aacc.nche.edu

DUE-9552975
FY 1995 $237,320
Multidisciplinary

The American Association of Community Colleges is conducting a 2-year project consisting of a series of interconnected activities designed to enhance the quality of science, mathematics, engineering, and technological education in community colleges. The activities include (a) two national meetings approximately 1 year apart of representatives from groups interested in science and engineering advanced technological education including the principal investigators from many current Advanced Technological Education (ATE) projects and centers, private and public sector leaders, and professional associations; (b) a roundtable of experts on issues in science and engineering advanced technological education; and (c) a live national teleconference on such issues. The sequence of programs is designed to provide people interested in advanced technological education opportunities to network with one another; identify significant issues related to the delivery of effective science and engineering technological education; disseminate the results of these activities to a broad national audience; and, broadcast a national teleconference on these issues.

Expected outcomes include a sharper understanding of the characteristics of successful science and engineering technological education programs for all stakeholders in this area, the development of additional resource documents of use to current and future participants in these educational programs, and an increased awareness of the value of each of these activities for delivering information to a broad audience.

Title: Physics Education in the Two-Year Colleges: A Neglected Resource

Michael Neuchatz
American Institute of Physics
Education and Employment
Statistic Division
One Physics Ellipse
College Park, MD 20740

DUE-9453180
FY 1995 ATE $199,988
FY 1996 ATE $43,000
(TOTAL $193,000)
FY 1997 ATE $42,692
(TOTAL $92,692)
Physics

Two-year colleges have the potential to provide education programs which produce a technically sophisticated workforce able to respond to the changing needs of the U.S. economy. In addition, there have been calls to reform and update the science and technology programs at these institutions. Yet, surprisingly little is known about existing programs or the faculty who lead them. In order to assess the success of the reforms that are being proposed, it is essential to have an understanding of current conditions in these programs. There are several reasons to examine physics in detail at the two-year college level: (1) the existence of detailed information about physics education at both the high school and four-year college level allows physics education at the two-year college level to be placed in a broader context; (2) physics courses are among the core requirements for most technology-based programs at two-year colleges, and thus help define the overall quality of these programs; and (3) since physics is

relatively well-defined as a discipline and its two-year college faculty small in number, the study serves as a model that can be applied to other disciplines. The primary vehicle for studying physics education at two-year colleges is a survey of all full-time and part-time faculty who teach physics. A two-stage approach is being employed to define this population. Academic deans and directors of vocational programming at each two-year college are being asked to identify relevant department chairs, who will then be asked to indicate all full- and part-time faculty who teach physics. The project design anticipates a high response rate from both groups.

All faculty identified by the chairs are receiving a detailed questionnaire seeking information about their workloads, education and employment backgrounds, the facilities and resources available to them, opportunities for professional development, teaching methods and institution materials used, the nature of articulation agreements with nearby high schools and four-year colleges, and other key indicators of their work environment. In addition to the survey, face-to-face interviews with chairs and faculty (both full- and part-time) are being conducted at 12 two-year colleges, chosen to reflect the variation in institutional size and control, academic orientation, and geographic region. The interviews provide an opportunity to probe issues which are not easily captured in a self-administered format. In addition, six to eight students at each institution are participating in a student focus group. The students' perspectives on the quality and difficulty of their physics courses, their interactions with the physics faculty, their reasons for taking physics, and their educational goals are enhancing the information gained through the faculty survey and interviews. The results of this research are coordinated with other higher education studies and disseminated to representatives of local industries; department chairs and faculty at two-year colleges, high schools, and four-year colleges; and other professional organizations active at the two-year college level. The investigators are actively collaborating with two-year college groups to provide relevant and timely information to current and proposed regional two-year college development programs.

Title: The Two-Year College in the Twenty-First Century: Breaking Down Barriers

Mary Beth Monroe
American Association of Physics Teachers
5110 Roanoke Place, Suite 101
College Park, MD 20740
mbm3@pinet.aip.org

DUE-9450160
FY 1995 $208,348
FY 1996 $358,975
FY 1997 $360,125
FY 1998 $257,957
Physics

The project is improving learning opportunities for students at two-year colleges—those that transfer, those that become technicians in the high-technology workplace, and all students for whom physics serves as a part of their college education. The project is establishing a network of physics faculty in two-year colleges. The network consists of 15 regional organizations, coordinated and linked by a national steering committee. The development of the network of colleagues allows two-year college faculty to share their successes as teachers and scholars with each other and with the broader physics community; it increases their awareness of current developments in physics education research and innovative teaching strategies; and it decreases the sense of isolation felt by many two-year college faculty members.

During the 4-year project, 15 Regional Coordinators and their Regional Teams, selected and mentored by a Steering Committee, are organizing and hosting small local meetings and are leading participants as they develop projects and programs within their regions relating to critical and topical issues that may be particularly important in the region. Many of these issues are being developed from the work begun at the 1989 topical conference entitled "Critical Issues in Two-Year College Physics and Astronomy—1990 and Beyond" supported by the American Association of Physics Teachers (AAPT) and the NSF, and at the 1992 NSF Workshop on the "Role of Professional Societies in Science, Technology, Engineering, and Mathematics Education in Two-Year Colleges." To enlarge the network and provide a national forum, the Regional Coordinators and three elected delegates from each region are participating in a national meeting, convened as an AAPT Topical Conference, where various speakers and consultants are engaging participants in a more global discussion of critical issues and issues of particular and timely pedagogical significance. Conference participants are making recommendations for national reform.

In the project, the Steering Committee is producing three proceedings from annual meetings, compiling and publishing demographic data better describing the two-year college physics education communities, and writing a major report characterizing the two-year college faculty and their impact on the physics education community of our country. In addition, 15 regional structures are being established, under the auspices of AAPT, which allow for the continued collaboration on issues of importance to the physics education communities.

ATE Contributions to Other Projects and Projects Funded Through Other Programs that Benefit Technician Education

The ATE program is contributing funds to projects submitted to several other programs to help ensure that these projects make the education of technicians a project priority. The ATE contribution is given here, and the total award from all other sources is listed in parentheses. A few awards are listed here that did not receive ATE funds, but are directly benefiting technician education.

Title: The Capstone Project: An Integrated Approach to Learning

Benjamin R. White
Wake Technical Community College
9101 Fayetteville Road
Raleigh, NC 27603-5655

DUE-9652146
FY 1996 $199,949
Institution-Wide Reform
Engineering Technology

Wake Technical Community College is expanding the capstone project currently required in three engineering technology departments. A capstone project demonstrating student skills helps resolve the problems of students graduating who are unable to integrate curriculum components into the high-tech workplace. Today employers hire those capable of assimilating their technical and general education to perform with competence in the workplace. Expanding the project from three A.A.S. curricula to 27 A.A.S. curricula demands revision and development of required courses to emphasize an integrated, practical approach to learning, one in which students are active participants in the educational process. The objective of the reform initiative include: (a) requiring a team of students to complete an applications-oriented capstone project, (b) integrating mathematics, engineering technology, science, and communications skills early in their education, (c) creating a partnership with workforce representatives to assure validity of the projects, (d) establishing an annual Presentation Day, (e) and collaborating with other community colleges to spread the initiative using the college's project as a model. The reform effort is being evaluated at each stage including: instructor evaluation of classroom performance, evaluation of each student team's written reports, evaluation of the team presentation, assessment of the program by graduates, and an evaluation of their training by employers.

The special features of the reform initiative include integrated, participatory approach to education culminating in the team presentation of the capstone project to an evaluation panel and to invited guests. Additionally, integrating curricula early in a student's curriculum provide a broad-based practical education. Finally, requiring the capstone project as a culmination to the students' education showcases their knowledge to their peers, instructors, administration, and prospective employers. It also showcases the programs offered at the college.

Title: Addressing National Needs for Skilled Technical Degree Graduates

Jeanne K. Deisen
Indian River Community College
3209 Virginia Avenue
Fort Pierce, FL 34981-5541

REC-9628036
FY 1996 $364,021
FY 1997 $363,080
FY 1998 $217,528
Multidisciplinary

The overall objective of the project is to identify sets of core competencies and skills in mathematics, science, engineering and technology that are required by industries that hire two-year college graduates with technical degrees. The project is investigating 5 technology based industries, interviewing technicians and supervisors in five companies in each of these industries, and interviewing a sample of graduates of community colleges. The project is producing research papers on the measurement of the integration of community college curriculum with industrial needs and is providing a basis for future study of technical education. It provides some of the first detailed workplace ethnography's of the use of mathematics and science in industrial jobs of technicians. No other study of colleges has developed a similar curriculum study of community colleges and a match with industrial uses of those graduates.

Title: REU-Site for Biotechnology

Bruce Jackson
Massachusetts Bay
Community College
50 Oakland Street
Wellesley, MA 02181

BIR-9424103
FY 1995 ATE $15,000
(Total $55,796)
FY 1996 ATE $15,000
(Total $60,296)
FY 1997 ATE $15,000
(TOTAL $60,296)
Biotechnology

Through this award, the Directorate for Biological Sciences and the ATE program of the Directorate for Education and

Human Resources are providing support for an innovative summer program that targets students from two-year colleges, a student population that typically does not participate in REU-site programs. During the first 2 summers, participants are being extensively trained in various techniques used commonly in molecular biology and biotechnology research at the Massachusetts Bay Community College in Wellesley Hills, MA. During the third summer, participants will use this technical knowledge to pursue independent research at the Marine Biological Laboratory in Woods Hole, MA, or the Science Park biotechnology center in New Haven, CT. The aim of the program is to equip students with the confidence and experience necessary to enter and complete training in science.

Title: Middle Atlantic Consortium for Mathematics and Its Applications Throughout the Curriculum

Dennis DeTurck
University of Pennsylvania
Department of Mathematics
Rittenhouse Laboratory
Philadelphia, PA 19104

DUE-9552464
FY 1995 ATE $75,000
(TOTAL $598,206)
FY 1996 ATE $50,000
(FY 1997 $499,653)
FY 1998 $499,653
Mathematics Initiative

This project is designed to promote a climate in which faculty from all disciplines view themselves as being jointly responsible for the scientific, mathematical, and technical education of undergraduates, rather than clients and servers. To help accomplish this, a consortium comprised of the University of Pennsylvania, Villanova University, Polytechnic University, Community College of Philadelphia, two Philadelphia public schools, and the Society for Industrial and Applied Mathematics (SIAM) is undertaking this major initiative to integrate research and real-world applications from various disciplines into the mathematics curriculum, and to achieve more effective integration of advanced mathematics and computing into the curricula of disciplines that use mathematics.

To begin a process to achieve this overall goal, this project consists of four parts:

1. Creation of application modules for mathematics courses and mathematics modules for other-discipline courses
2. Development of basic and advanced interdisciplinary courses that integrate mathematics with specific application areas.
3. Development of applications and laboratory-oriented courses for mathematics majors.
4. Development of materials for students in courses such as business, economics, psychology, and liberal arts and humanities courses that focus on mathematical literacy issues.

Topics are chosen from a broad range of discipline areas, including biological and social sciences, as well as engineering, business, and physics modules. These modules involve many different important mathematical topics and techniques. The two different types of modules which are planned allow for multiple levels of student backgrounds. They impact multiple points of the curriculum ranging from courses for majors in fields which have traditionally used little or no mathematics, to those for lower division students in mathematics and mathematically oriented disciplines, to those for upper division mathematics majors. Several interdisciplinary courses are being created, including one incorporating mathematics, physics, and chemistry, as well as one in geographiometry. A team of faculty are also developing a 2-semester course for mathematics majors that surveys industrial uses of mathematics via applications. SIAM is providing expertise both in the development of the interdisciplinary modules and courses and in broad dissemination of materials through conferences, workshops, and products. Distribution of materials is through World Wide Web sites at the University of Pennsylvania and SIAM, as well as by commercial publication. Two particular areas of emphasis in the program are the use of application and technology for students pursuing careers as technicians in the industrial/scientific workplace and the preparation of future secondary teachers.

Title: Mathematics and its Applications in Engineering and Sciences: Building the Links

William E. Boyce
Rensselaer Polytechnic Institute (RPI)
Department of Mathematics
110 8th Street
Troy, NY 12180

DUE-9552465
FY 1995 ATE $125,000
(TOTAL $1,311,000)
FY 1996 ATE $125,000
(TOTAL $700,000)
FY 1997 ATE $125,000
(TOTAL $700,000)
FY 1998 ATE $125,000
(TOTAL $700,000)
FY 1999 $600,000
Mathematics Initiative

The division of courses into many different departments often makes it difficult for students to grasp the intimate connections that exist between mathematics and its applications in engineering and science. To make these connections clearer RPI is developing a library of hypertext documents which link important mathematical topics with

contemporary interesting applications in various fields of engineering and science. This library covers the mathematical areas normally studied by undergraduate students in engineering and science, including calculus, differential equations, mechanics and linear systems, advanced mathematical methods, and probability and statistics. The library that is created initially constitutes the basis for a constantly expanding resource that is supporting a growing movement, at Rensselaer and elsewhere, to move away from a lecture-dominated mode of instruction to a workshop or studio mode. The development of these materials involves a collaboration among faculty at Rensselaer and at a number of other institutions, including the University of Delaware, Siena College, Virginia Polytechnic Institute, Central State University, Hudson Valley Community College, and the University of Maryland. By means of Visiting Professorships, faculty at several other institutions are also becoming involved as the project develops. After careful testing and evaluation, the library of hypertext documents is being made available on the World Wide Web, on CDs, and in printed form. Among the added benefits to Rensselaer and the other institutions directly participating in the project is a much enhanced level of cooperation among faculty who teach related courses in many different academic departments. The project is developing and testing materials that enhance the use of applications and technology.

Title: West Hawaii Explorations Academy: A Center for Integrative Secondary Curriculum Development

Bill Woerner
Hawaii Department of Education
P.O. Box 2360
Honolulu, HI 96804

ESIE-9452790
FY 1995 ATE $75,000
(TOTAL $119,958)
FY 1996 ATE $75,000
(TOTAL $131,654)
FY 1997 ATE $75,000
(TOTAL $98,728)
Instructional Materials Development

This project is establishing a secondary educational facility which differs fundamentally from traditional classroom education. The West Hawaii Explorations Academy is an operational project and work experience laboratory for secondary students. It also serves as a center for integrative curriculum development and teacher training. The project is headquartered at the Natural Energy Laboratory of Hawaii, a state funded incubation facility for scientific research and commercial operations in aquaculture and energy development. Approximately 133 10th through 12th grade students from many different backgrounds, including high-risk students, work and study full time throughout the school year. Students team with peers, staff, University of Hawaii faculty and students, graduate students, mentors, community members, and employers. Rather than attend classes, students receive credit for all of their core courses by managing and staffing a wide variety of projects. These include aquaculture and cold water agriculture research and production, alternatively-fueled vehicle research, environmental projects, aquarium site development, desalination, alternative energy development, sustainable research, and marine environments. While engaged in project work, they take modules in Records/Business/Finance, Media/Publications, Research Support, Facilities, Leadership, and Reading/Writing. The vision is partnering with a research laboratory, a university and the community to develop a new model for education with the following goals: (a) enhance the prospect that students, including high risk youth, go to college or are employed; (b) encourage inservice teachers to adopt an integrative teaching style; (c) develop preservice teachers who can implement an integrative program and modify the curriculum for high risk students; (d) increase the science, math, and engineering expertise available to students; (e) serve as a national model program in expanding education beyond the walls of the classroom and attract community and university resources; and (f) prepare and distribute a collection of exemplary materials with national scope which promote and facilitate integrative education at the secondary level. An external evaluator carefully documents project activities and student outcomes so the results can be disseminated to the profession.

Title: Sweeping Change in Manageable Units: A Modular Approach for Chemistry Curriculum Reform

C. Bradley Moore
University of California -Berkeley
School of Chemistry
Berkeley, CA 94720

DUE-9455924
FY 1995 ATE $100,000
(TOTAL $755,000)
FY 1996 ATE $50,000
(TOTAL $795,000)
FY 1997 ATE $50,000
(TOTAL $795,000)
(FY 1998 $350,000)
(FY 1999 $350,000)
Chemistry Initiative

The purpose of this project is to develop new curricula, materials, and methods which are enhancing the appreciation and learning of science, especially chemistry, for every undergraduate student so that all college graduates command the knowledge and skills necessary to permit continued learning, lead productive lives, and make informed decisions. To accomplish this mission, a modular approach to teaching chemistry in the first 2 years of the undergraduate curriculum

is being developed and evaluated. Modules of 1 to 4 weeks present fundamental chemistry to students in the context of a real-world problem or application and emphasize the links between chemistry and other disciplines. In collaboration with the ChemLinks Coalition, modules are being developed, tested and refined at the two- and four-year colleges and research universities comprising the two consortia. Curriculum materials, including text, lab, and multimedia components that are suitable for students from diverse cultural and ethnic backgrounds and are usable at a wide variety of undergraduate institutions are being produced and distributed by an established publisher. Teaching methods which utilize current understanding of learning processes and emphasize active learning and the full spectrum of modern technologies are being supported, tested, and promulgated. A model support infrastructure for development and assessment of new materials and methods is being provided. A framework for continuous improvement of curricula is resulting from the work and will be institutionalized within the consortium. Faculty workshops and sessions at national and regional meetings are being conducted to guarantee dissemination. The consortium institutions now participate significantly in preservice teacher training and education of technology specialists, and are developing new programs in these areas. Thus, the program is strongly impacting the ATE and Teacher Preparation Programs by developing modular materials appropriate to the task of educating future teachers and technology specialists.

Title: Establishing New Traditions: Revitalizing the Curriculum

John W. Moore
University of
Wisconsin-Madison
Department of Chemistry
Madison, WI 53706

DUE-9455928
FY 1995 ATE $100,000
(TOTAL $849,968)
FY 1996 ATE $50,000
(TOTAL $849,999)
FY 1997 ATE $50,000
(TOTAL $849,941)
(FY 1998 $499,941)
(FY 1999 $499,742)
Chemistry Initiative

This project is establishing new traditions in the chemistry curriculum that optimize opportunities for all students to learn chemical facts and concepts, develop and pursue interests in chemistry and chemistry-related disciplines, and appreciate how an understanding of chemistry is important to life and living. The project is fundamentally changing the ways students, faculty, and administrators view their roles, creating a student-centered, active-learning emphasis. There are a broad range of reforms, each of which is developed, tested, modified, thoroughly evaluated, and widely disseminated. There are five main areas that apply to all levels of the curriculum: student-focused active learning; inquiry-based/open-ended laboratories; interdisciplinary course clusters to create learning communities; a topic-oriented curriculum; and information technology/computer tools. Each development in each area is carefully evaluated, and only the best survive. Evaluation provides important information about the process of transfer of innovations among institutions of different types. To insure that the reforms are useful for all students, the consortium includes industry, public and private four-year institutions, minority institutions, and two-year colleges. The project gives special emphasis to students who choose teaching as a career option by mainstreaming these students in courses which benefit them in both content and pedagogy. Students, including those in science education, are fully integrated in the development and implementation of the project, working on both research topics and evaluation. The project also gives special emphasis to community college students in Advanced Technological Education programs to ensure that they are provided the newly developed curriculum. The students in the ATE program clearly benefit from the five main areas of thrust that this coalition is developing. All students emerge with greater comprehension and better retention of chemical knowledge, improved ability to apply chemical concepts to new problems, enhanced appreciation of the relation between chemistry and other disciplines, and the skills that enable them to work effectively in multidisciplinary teams.

Title: ChemLinks Coalition: Making Chemical Connections

Brock Spencer
Beloit College
Chemistry Department
700 College Street
Beloit, WI 53511

DUE-9455918
FY 1995 ATE $100,000
(TOTAL $705,000)
FY 1996 ATE $50,000
(TOTAL $705,000)
FY 1997 ATE $50,000
(TOTAL $705,000)
(FY 1998 $350,000)
(FY 1999 $350,000)
Chemistry Initiative

The ChemLinks Coalition is undertaking a 5-year project to change the way students learn chemistry; increase scientific literacy for all students taking chemistry; and promote the process of educational reform. In collaboration with the ModularChem Consortium, faculty are developing, testing, and disseminating modular course materials that use active and collaborative approaches to learning. These materials, focused on the first 2 years of the chemistry curriculum, start

with interdisciplinary questions important to students and to society (the molecular basis of life, the environment, technology). In answering them, students develop an appreciation of how science is actually done. This approach is designed to reach a broader student audience more effectively than do traditional courses, an audience that includes students who are members of groups traditionally underrepresented in science, non-science majors, and those taking chemistry as a supporting course, as well as chemistry majors. By providing a model for students preparing for careers in teaching, this approach has an impact on Teacher Preparation Programs. Collaboration among faculty from different disciplines and a number of institutions supports and reinforces those who want to make changes. These leading liberal arts colleges (Beloit, Carleton, Colorado, Grinnell, Hope, Kalamazoo, Knox, Lawrence, Macalester, Rhodes, Spelman, St. Olaf, Wooster) and research universities (Chicago, Washington - St. Louis) already have experience working together on chemistry curricular reform. An alliance with the Advanced Technology Environmental Education Center's coalition of 2-year institutions assures an impact on Advanced Technology Education Programs. By using the extensive Project Kaleidoscope network to promote reform, the ChemLinks Coalition involves a much larger and more diverse group of institutions in making systemic and sustainable changes in undergraduate chemistry education.

Title: A Workshop Chemistry Curriculum

David K. Gosser
CUNY City College
Department of Chemistry
Convent Avenue and 138th Street
New York, NY 10031

DUE-9455920
FY 1995 ATE $50,000
(TOTAL $425,000)
FY 1996 ATE $25,000
(TOTAL $400,000)
FY 1997 ATE $25,000
(TOTAL $400,000)
(FY 1998 $150,000)
(FY 1999 $150,000)
Chemistry Initiative

The City College Consortium, which includes 10 senior and community colleges at the City University of New York, and the Universities of Pittsburgh, Pennsylvania, and Rochester, is developing and widely applying a new model of teaching. This model, called Workshop Chemistry, introduces participation and mentoring by students who have recently completed the course. Small group, student-led workshops are integral to the course structure. Each week, two workshops of an hour each complement the lecture and laboratory components. The workshop model provides a collaborative learning experience that increases student involvement and provides a new role for students as mentors. In Workshop Chemistry, students learn the problem solving, communication, and teamwork skills crucial for success in the workplace while learning chemistry more effectively. Working together with the faculty, students become an active part of the community of the department. A prototype workshop model has been developed at City College in a general chemistry course for science and engineering majors, and is being expanded and refined for a broad range of courses including preparatory chemistry, chemistry for allied health sciences, organic chemistry, instrumental, and analytical chemistry. The experience of students as workshop leaders provides a natural introduction to teaching that is being formalized through a Teacher Preparation component of the project. The workshop method is also being exploited and applied in curricula for technician training, an initiative relevant to Advanced Technological Education. The project evaluates Workshop Chemistry and disseminates it beyond the bounds of the consortium. Student Workshop Manuals that include the problem solving, model building, and simulation activities of the workshops are being produced for each course. New project partners are being invited to view workshops, to participate in faculty developments, and to implement pilot workshop courses at their own institutions.

Title: Introductory Biology at Community Colleges: A New Model

Lynda B. Micikas
Biological Sciences Curriculum Study (BSCS)
Department of Biological Sciences
Pikes Peak Research Park
5415 Mark Dabling Boulevard
Colorado Springs, CO 80903

DUE-9455725
FY 1995 ATE $100,000
(TOTAL $450,000)
FY 1996 ATE $50,000
(TOTAL $435,000)
FY 1997 ATE $50,000
(TOTAL $435,000)
Course and Curriculum
Life Sciences

In recognition of the importance of introductory biology courses at community colleges to the education of the future workforce and the development of scientific literacy, BSCS is conceptualizing, writing, testing, and evaluating a set of innovative curriculum materials for biology students at the college level. Collaborating in the 36-month project are 15 partners, including biology faculty at 8 community colleges (involving several that offer programs in biotechnology and environmental technology that include strong components of basic science), the American Association of Community Colleges (AACC), the two-year college section of the National Association of Biology Teachers (NABT), the Society for College Science Teaching (SCST), the American Mathematical Association of Two-Year Colleges (AMATYC), the American Institute of Biological Sciences (AIBS), Ward's

Natural Science Establishment, Inc., and Kendall/Hunt Publishing Company (college division). The completed program is offering an integrated and coherent approach to helping students achieve three major goals of biological literacy: (1) to understand the basic unifying principles of biology; (2) to develop the fundamental skills of critical thinking and scientific reasoning; and (3) to recognize the applications of science, especially relationships among science, technology, and society. The materials that are being developed are of use to future teachers of science at the elementary and secondary levels because strategies are incorporated that encourage students to reflect on the overall design of the program, the strategies that help them learn, various teaching techniques, and assessment strategies. The products of the project include student materials (readings, activities, and laboratory exercises) that support both semester- and year-long introductory biology courses and that emphasize hands-on, open-ended inquiry, collaborative learning, and the relationships among science, technology, and society; an instructor's guide that provides faculty with extensive background reading and specific implementation support; and a model for a faculty development workshop that is being designed and tested by the partner faculty and is being supported after the end of the project by revenues realized from sales of the program.

Title: Activity-Based Physics: Curricula, Computer Tools, and Apparatus for Introductory Physics Courses

Priscilla W. Laws
Dickinson College
Department of Physics
and Astronomy
Box 1773
Carlisle, PA 17013

DUE-9455561
FY 1995 ATE $100,000
(TOTAL $725,000)
FY 1996 ATE $100,000
(TOTAL $525,000)
FY 1997 ATE $100,000
(TOTAL $525,000)
Course and Curriculum
Physics

Three related activity-based introductory physics curricula have been developed with major support from the U.S. Department of Education and the National Science Foundation. These are Workshop Physics, Tools for Scientific Thinking, and RealTime Physics. All three curricula use the findings of physics education research; are activity-based; and involve the design of computer hardware and software for investigation, data analysis, and dynamic modeling. This 3-year collaboration between principal investigators at Dickinson College, University of Maryland, University of Oregon, Tufts University, and Millersville State University is extending, enhancing, evaluating, and disseminating activity-based curricular materials, apparatus, and computer tools for teaching introductory physics based on this previous work. The ultimate goals of this program are to continue full scale efforts to improve the scientific literacy of introductory physics students through the mastery of physics concepts, investigative skills, and mathematical modeling techniques and to motivate students to learn more science. Throughout the 3-year period, a comprehensive dissemination program is being conducted to reach introductory physics instructors at high school and college levels through workshops, public talks, on-site visits to institutions, and journal publications. These dissemination efforts are being supported by the commercial distribution of products through J.C. Wiley & Sons, PASCO Scientific, Vernier Software, and Physics Academic Software. Particular attention is being given to developing physics activities suitable for courses designed for future technicians at two-year colleges and preservice teachers.

Title: Implementing the Standards for Introductory College Mathematics Before Calculus

Marilyn E. Mays
American Mathematical
Association of Two-Year Colleges
Memphis, TN 38134

DUE-9555059
FY 1996 ATE $5,014
(TOTAL $120,014)
Course and Curriculum
Mathematics

Standards for Introductory College Mathematics Before Calculus was developed with funding from the National Science and the Exxon Education Foundations to address the special needs of, establish standards for, and make recommendations about introductory college mathematics below the level of calculus. The standards provide goals for introductory college mathematics and guidelines for selecting content and instructional strategies for accomplishing these goals. The goal of this project is to facilitate the implementation of the Standards. This is being accomplished by holding four regional workshops. The purposes of these workshops include the following: (a) to inform a wider audience of the reform issues and proposed patterns and models for improving curriculum and instruction, (b) to encourage the formation of consortia of two- and four-year colleges and universities in each of several regions which will continue to work on implementation projects, (c) to review current exemplary programs, materials, and activities at the introductory college mathematics level as well as relevant secondary programs based on the NCTM Standards, (d) to provide workshop participants information on relevant research in mathematics education, effective approaches to change, and suggestions for working with their administrations to provide a meaningful mathematics

education for their students, (e) to prepare a compilation of reports on the implementation projects begun as a result of the regional workshops, and (f) to make this available to all members of the mathematics community. Introductory college mathematics is the mathematics that most of our students study. It is mathematics for the workforce, for future teachers and for those who plan to major in mathematics or a mathematics-dependent field but who enter college unprepared to study calculus. It is also the gate-keeper or critical filter for the majority. Greater numbers of students are entering the mathematics "pipeline" at some point in introductory college mathematics but no more are continuing to calculus and higher level courses. Mathematics education at this level must change. Providing faculty with development opportunities is essential for change to occur. The workshops enable faculty and administrators to learn about successful programs that embody the Standards, to have an opportunity to observe or experience the process of learning through working in groups, in a laboratory setting, or using technology, or to engage in any of the active learning processes recommended by the Standards.

Title: Long Island Consortium for Mathematical Sciences Throughout the Curriculum

Alan Tucker
SUNY at Stony Brook
Stony Brook, NY 11794-0001

DUE-9555401
FY 1996 ATE $50,000
(TOTAL $699,850)
FY 1997 ATE $25,000
(TOTAL $715,810)
FY 1998 ATE $25,000
(TOTAL $692,080)
Course and Curriculum
Mathematics

A consortium of faculty at ten colleges and universities on Long Island, in conjunction with the State University of New York (SUNY) system, is designing a comprehensive, multi-faceted project to develop an environment for interconnected learning in mathematics courses and in mathematically based disciplines. The consortium is headquartered at the State University of New York at Stony Brook. The other consortium institutions are: C. W. Post College, Dowling College, Nassau Community College, New York Institute of Technology, St. Joseph's College, Suffolk Community College, SUNY Agricultural and Technology College at Farmingdale, SUNY College at Old Westbury, and CUNY-York College. The model for interconnected learning developed on Long Island is being extended to SUNY-wide implementation (64 institutions), and actively disseminated to other institutions inside and outside New York state. The enhanced learning environment has three components: (i) systemic change in instructional practices, (ii) creation of new courses and curricular materials, and (iii) development of human resources. The interconnections in this project involve: (a) collaboration and cooperation in instruction among faculty across quantitative disciplines; (b) regional interconnectivity of energized faculty at different types of institutions; and (c) the enhanced effect of combining change in modes of instruction with curricular reform, educational technology, and coordination of instruction among departments. Major project activities include: (a) changing modes of faculty instruction and student learning; (b) day-to-day and general coordination of instruction across the curriculum; (c) extensive use of educational technology across the curriculum; (d) completing reform throughout the calculus sequence and undertaking reform before calculus; (e) reworking all aspects of the curriculum for future mathematics teachers to reflect the needs of the NCTM Standards; (f) developing new multidisciplinary courses; (g) addressing student needs in Advanced Technological Education programs such as engineering and science technology through the development of appropriate mathematics courses and other mathematically oriented materials; (h) Assisting groups that are underrepresented in quantitative disciplines; (i) developing unified courses in statistics and other mathematical sciences topics now taught in multiple departments. This project for systemic change involves an extensive organizational structure with (i) departmental teams at each institution, (ii) institutional coordinating committees; (iii) consortium-wide disciplinary committees; and (iv) task forces for specific projects such as development of new courses.

Title: Molecular Science

Orville L. Chapman
University of California
Los Angeles, CA 90024-1301

DUE-9555605
FY 1996 ATE $50,000
(TOTAL $725,000)
FY 1997 ATE $25,000
(TOTAL $575,000)
FY 1998 ATE $25,000
(TOTAL $575,000)
FY 1999 TOTAL $275,000
FY 2000 TOTAL $275,000
Course and Curriculum
Chemistry

The UCLA-CSUF-Community College Alliance (24 area community colleges that have worked together for more than 15 years) is developing a sweeping restructuring of the lower division chemistry curriculum and the auxiliary learning and assessment processes. In forming the new curriculum, the project rejects the positivist approach to science education in favor of a constructivist approach that emphasizes problem

solving and exploratory learning. They make this change in order to focus on the developing key skills, traits, and abilities of students. The new curriculum, the Molecular Science Curriculum, cuts across departmental and disciplines to embrace all activities that involve the study of atoms and molecules. In particular, environmental science, materials science, and molecular life science, have important positions in the lower-division chemistry curriculum. The new curriculum reflects accurately current practice in research and the chemical industry where growth in occurring in these new fields. Today information-technology-based learning enables a practical approach to discovery learning, which educational theorists have long favored. Students can learn science by doing science. In particular, the project is producing problem-based modular learning units that define the molecular science curriculum; data sets organized for exploratory learning; prepackaged molecular, mathematical, and schematic models illustrating important principles and phenomena; and a client/server system that manages education. Client/server technology enables individualized courses and frees students from rigid time constraints. The learning units are being used by several of the community colleges in technology programs, such as those for science technicians and hazardous materials technicians at Mount San Antonio Community College. New assessment vehicles including cumulative electronic portfolios of group and individual work provide new insight into student development and potential.

The project also addresses the preparation of primary and secondary science teachers by involving them as active participants in the lower division courses of molecular science curriculum. At both UCLA and CSUF, these students gain experience with the modules, associated learning methods, and electronic delivery system. These experiences result in teachers with a practical perspective on science teaching as well as the ability to utilize current technology to direct learning activities. The electronic delivery system allows students at UCLA to work with the science education faculty at CSUF to obtain certification. Since 1990 two high schools (Aliso Niguel and Crossroads) have become members of the Alliance. These schools have the facilities to expose students, experienced teachers, and future teachers to both the content and learning methods of the molecular science curriculum.

Title: Transition to the Workplace Through Manufacturing Experiences

Sandra H. Harpole
Mississippi State University
Physics and Astronomy
Department
PO Box 6156
Mississippi, MS 39762

ESI-9555646
FY 1996 TOTAL $567,456
FY 1998 ATE $157,000
(TOTAL $347,306)
FY 1999 ATE $125,000
(TOTAL $358,722)
Manufacturing

This national project includes 14 physics and Tech-Prep teachers in the first year and 52 in each of the succeeding 3-years. In Phase I, Leadership Teams (one physics teacher and one Tech-Prep teacher) and project staff develop workshop materials for a 3-week workshop entitled, “Learning Through Manufacturing Experiences”. This happens during a five-week program which includes a 3-week internship with Peavey Electronics Corporation and two weeks of materials adaptation and content reinforcement at Mississippi State University. During the second, third and fourth years of the project two cohorts of 24 physics and Tech-Prep teachers participate in these workshops designed to equip them with knowledge and experience of the skills necessary for students to enter the world of manufacturing and the content knowledge to develop those skills. Academic year follow-up includes site visits to schools of participants, Internet communication and one-day workshops in association with professional teachers' conferences.

Title: Technology for All Americans

William E. Dugger
International Technology
Education Association
Reston, VA 22090-1539

ESI-9355826
FY 1994 ATE $75,000
(TOTAL $500,000)
ESI-9641641
FY 1996 ATE $50,000 (TOTAL $99,955)
ESI-9626809
FY 1997 ATE $250,000 (TOTAL $501,905)
FY1998 ATE $200,000 (TOTAL $419,755)
FY 1999 ATE $250,000) (TOTAL $539,060)
Instructional Materials
Technology Education

Standards for technology education are needed to complement the national standards in mathematics and science. The first phase of the project is to articulate a rationale and structure for technology education - a vision for the intellectual domain for

technology education and its interface with science and mathematics. The International Technology Education Association (ITEA) is developing the document and the processes for evaluating it to gain consensus and acceptance by the technology education community and other constituencies. An advisory board of people with national reputations in various fields oversees the process.

The document, *Rationale and Structure for the Study of Technology*, produced by the International Technology Education Association, identifies components that are the basis of technological literacy for all students. They are (a) designing and developing, (b) determining and controlling behavior, and (c) utilizing and assessing contextual relationships, nature and evolution of technology, and technological concepts and principles. Using this as a basis, this project develops standards for what technological concepts and processes students should understand and be able to apply in grades K-12 with benchmarks at grades 2, 5, 8 and 12. The standards are compiled by a small central staff. Three teams, consisting of representatives from technology education, both teachers and technologists, as well as representatives from science, mathematics, and engineering some of whom were involved in developing other standards, provide the content. Input and consensus is developed by presentations to diverse groups interested in education, newsletters, and the WWW. Third party evaluation is used to monitor the content and the process to assure that the standards are useful in a variety of contexts.

Instrumentation and Laboratory Improvement - FY 1996 Awards For Two- Year Colleges that Benefit Technician Education

In 1996, many projects were supported through the Instrumentation and Laboratory Improvement (ILI) program with an emphasis on advanced technological education. They are included in this book to show the breadth of support for technical education. Instrumentation only projects for technician education are supported primarily through ILI, not ATE. ILI awards that benefit strictly transfer program are not listed here.

Title: Instrumentation for Undergraduate Biology and Biotechnology Training

William J. Thieman
Ventura County Community College
Ventura, CA 93003-2037

DUE-9650005
FY 1996 $25,000
Instrumentation and Laboratory Improvement
Biotechnology

The project is designed to increase the learning, retention, and lab skills of students in biology and biotechnology programs. This is being achieved through major revisions and changes in the lab experiences of students who enroll in biology labs and completion of the biotechnology specialization program, permitting many hands-on explorations into molecular biology in the laboratory. This project involves a 2-year college, a 4-year university, and a biotech industry, through a consortium effort to identify and teach appropriate lab exercises that give students hands-on experience with the problem-solving methods used in biotechnology. These exercises are initially being integrated into the biotechnology lab course and the biology majors lab course. The biotechnology lab is part of a Tech-Prep program linked to local high schools and to a transfer program. In addition, the equipment can be integrated into a training course for high school science teachers. The individuals primarily affected are biology majors and those preparing for careers in biotechnology, research, medicine, and teaching. The new equipment is fundamental to the training of the 35,000 to 100,000 biotechnicians and scientists who will be needed in the next decade. This instrumentation funding provides students with a comprehensive biotechnology lab program; improved instrumentation in majors and nonmajors biology lab courses; increased hands-on learning in a collaborative-learning atmosphere; state-of-the-art training (for teachers) in biotechnology lab skills; and expanded independent student

Title: Atomic Absorption Spectroscopy as a Unifying Curricular Element

Leverett R. Smith
Contra Costa Community College
San Pablo, CA 94806-3166

DUE-9650043
FY 1996 $18,627
Instrumentation and Laboratory Improvement
Chemical Technology

The project is using atomic absorption spectroscopy (AA) to enhance the chemistry curriculum, via relevant issues in chemistry, environmental science, and other areas. Both science and non-science majors are being introduced to the use of the instrument. The instrument is used for hands-on student laboratory exercises in the introductory, general, and analytical chemistry courses. The project makes use of standard protocols for student exercises, but is also committed to developing lab exercises for lower-division undergraduate courses. Anticipated exercises include water analysis, environmental analysis, food and forensic analyses, and data handling exercises. For introductory chemistry, as a follow-up to electronic spectra, application of AA is brought into a laboratory exercise, for example by analyzing water samples for sodium or paint samples for lead. In general chemistry, AA is to be used in a more rigorous way, including at least one AA exercise each semester. The first semester compares metal analysis results from AA and home water test kits, or a comparable exercise. In the second semester, the AA is used for environmental applications, by incorporating a mini-site assessment in the laboratory. Exercises in field sampling and sample preparation are incorporated. In quantitative analysis, the AA instrument is used to educate students in the rigorous standards routinely required to meet regulatory agency standards for metals analysis in water, soil and other analyses, using both flame and graphite furnace methods in suitable "real-world" analysis situations. The instrument is also used for student independent study projects, to examine aspects of local water quality and soil pollution. The project intends also to develop short exercises that can be used by the administration of justice and biotechnology programs at Contra Costa College.

Title: Robotic Welding Technology

Martha J. Vann
Trident Technical Colleges
Charleston, SC 29411

DUE-9650053
FY 1996 $78,840
Instrumentation and
Laboratory Improvement
Engineering Technology

This project uses an innovative approach to upgrade the welding curriculum by offering a new course teaching the principles and application of robotic welding and by introducing the latest welding technology through a multidisciplinary team approach, simulating an industrial automated production environment. Students, using a robotic system, synthesize conventional welding theory and skills training with automated application. The robot, indexing fixture, and power sources, when integrated are capable of replicating the automated production welding processes found in industry. The final project exposes students from welding, machine tool, computer-assisted design, automated manufacturing, computer-integrated manufacturing, and mechanical engineering technology programs to a realistic manufacturing exercise. Students use knowledge gained from their curricula as they work together in teams (manufacturing units) to develop and manufacture a product (project). A project of this magnitude, involving teamwork, electronic communication, planning, and problem-solving is invaluable to students entering an industrial/manufacturing environment.

Title: Panola College Physics Laboratory Improvement

Norma S. Evers
Panola College
Carthage, TX 75633-2341

DUE-9650100
FY 1996 $19,226
Instrumentation and
Laboratory Improvement
Physics

The goal of this project is to improve the physics laboratory experience for students, making it a better aid to learning the concepts of motion and energy. The acquisition of computers and interactive computer equipment also provides much needed exposure to a rapidly changing technological workplace for a very nontraditional student body, especially a large force of older female students. The improvement in equipment is being accompanied by the development of a set of experiments and related activities keyed to the interests of the students and stressing the development of critical reading and thinking skills. Equipment used in the project include MBL interface probes and software, interactive digital video equipment, and additional computer software programs. The curricula targeted for the project include the motion and energy units in the first semester of introductory physics at all levels. Early development versions of experiments in kinematics, dynamics, and mechanics being performed by students who then provide feedback and refinements. Tested and critiqued by the participants, a final set of experiments with assessments ready for use in successive classes is produced. Materials developed can be provided to other introductory physics teachers through professional organizations and publications, along with evaluation information on the impact of the activities on student learning and motivation.

Title: Implementation of a Computer Networking Laboratory

Matthew D. Mills
Northeast State Technical
Community College
Blountville, TN 37617-0246

DUE-9650210
FY 1996 $55,000
Instrumentation and
Laboratory Improvement
Computer Engineering Technology

Industry in the Appalachia Region of Northeast Tennessee has nowhere to turn to hire qualified college graduates with networking experience and cannot locally find unbiased assistance in planning and implementing local area networks (LANs). While the Computer Engineering Technology department should be a natural focus for this type of training, it has not been able to provide these skills because it has been severely lacking in the requisite equipment. Students have been exposed to LANs in a single limited-availability course that deals with a single network operating system (NOS). However, efforts are being made to correct this deficiency in order to increase the region's industrial success. The Computer Networking Laboratory seeks to eliminate these problems by providing students with a variety of network architectures and a large capacity network (up to 50 simultaneous users). At the same time, data gathered from laboratory experiences can be compiled into a document that makes available to companies and educational institutions the information necessary to emulate or adapt the exercises or put the results to work in a business environment. Several NOSs are being implemented in a hands-on laboratory environment, and the students are being given the opportunity to experiment with the LANs. A communications server is being included to enable users to call from remote sites and log on to use the facilities, which provides a new dimension in distance education. The new laboratory also allows industry workshops to be conducted to educate persons requiring specialized training. The program has the potential to reach at least four academic program areas in the current catalog (over 100 students per year) and potentially that many from industry. The impact on local institutions can be amplified by the production of the self-help documentation.

Title: Incorporation of Cell and Tissue Culture Techniques and Environmental Physiology into the Undergraduate Curriculum

Wendy McCullen
Columbus State Community College
Columbus, OH 43215-1722

DUE-9650526
FY 1996 $32,924
Instrumentation and Laboratory Improvement
Environmental Technology

The purpose of this project is to continually enhance the educational opportunities available in biological sciences and to improve efficiency of instruction in the classrooms and laboratories. The project has a far-reaching impact on the campus which has extended beyond the Biological and Physical Science Department. As a direct result of the project, two new courses, Environmental Science and Ecology have been added to the curriculum. This enhancement also involves the purchase of two lab line environmental chambers, three ecology study chambers, and two plant growth racks, which are all housed in the lab classrooms in Nestor Hall. Upon development of the environmental science course, the Environmental Technology Department made a decision to require it for all of their technical students as a basic related course. All equipment has been integrated into the biology curriculum across the board and is being utilized to its fullest capacity. The videomicroscopy system is being used to teach dissection techniques, to teach microscopy techniques, and to study specific specimens as a group for discussion. Especially significant is the dimension that this equipment adds to the two introductory-level, nonlaboratory courses. Videomicroscopy is such a successful teaching technique that the college has purchased additional systems so that the technique can be made available to any faculty member. The department has recently purchased photoprinters to capture images from the monitors. These images may then be used on quizzes, exams, hand-outs, etc. Interactive computer/video applications are continually being developed using the Media Argus Master Authoring software and hardware purchased. In anatomy, these applications are being used as supplements to lecture material and also, more recently, to provide alternative teaching methods to those students opposed to the dissection of animals. Applications in invertebrate biology are also in use. The results of this project have been disseminated in workshops presented at both the departmental and divisional levels. The authoring software has been widely viewed and interest in developing interactive software applications has grown across campus.

Title: An Undergraduate Photonics Laboratory

David H. Lieberman
CUNY Queensborough Community College
New York, NY 11364

DUE-9650617
FY 1996 $41,780
Instrumentation and Laboratory Improvement
Engineering Technology

This college has over 1,200 students in the engineering technologies and about 200 in engineering science. This department is upgrading the modern optics component of the appropriate courses by introducing current instrumentation for the study of lasers. Through laboratory experiments, students gain an understanding of the principles and measurement techniques involved in the study and use of lasers. The pedagogical format is that of a traditional laboratory, with careful prototyping leading to write-ups that ensure maximum learning by the students. The laboratory centers around the principles of lasers and signal transmission. The use of Ti:Sapphire and Diode lasers affords the students the unique opportunity to study these principles while working with state-of-the-art technology. Laboratory exercises on the modulation and demodulation of signals for fiber-optic communication, and on the acousto-optic and electro-optic modulation, are combined with existing laboratories to complete the set of photonics laboratories applicable to both engineering and technology students. The particular laboratories developed under this program provide a model for other laboratories on the principles of lasers and their applications.

Title: Biotechnology Laboratory Instrumentation Improvement

Martha Brosz
Cincinnati Technical College
Cincinnati, OH 45223-2612

DUE-9650655
FY 1996 $60,000
Instrumentation and Laboratory Improvement
Biotechnology

This college's Biotechnology Program, launched in 1994, is the only 2-year biotechnology degree program in the state of Ohio. Biotechnology prepares majors for employment in this rapidly expanding leading-edge technology. In addition to intensive lecture/lab courses, majors are required to conduct a capstone research project and to participate in the college's nationally recognized co-op program. Graduates earn an Associate of

Applied Science degree that transfers to 4-year degree programs. For nonmajors in the Associate of Science (AS) transfer program, the Biotechnology sequence fulfills the sophomore-level science component. The program is advised by a partnership committee of industry and research laboratory scientists. This project improves undergraduate instruction by enabling students in all five Biotechnology courses to work extensively with eukaryotic systems (yeast and insect cells), as well as with the traditional prokaryotic systems, across the range of biotechnology techniques. In addition, the project significantly expands student biotechnology lab experience with growth, maintenance, and storage of prokaryotic and eukaryotic cells; centrifugation; column chromatography (gel filtration, ion-exchange, affinity); and antibody-antigen interactions (ELISA). The Biotechnology improvements annually affects 40 majors, 50 A.S. students, and 250 Health Sciences students (Microbiology and Immunology courses). The project also generates SEM pipeline workshops for 11-12 graders (100/year) and teachers (50/year) and awareness for 7-12 graders (160/year).

Title: A Mathematics Learning Laboratory

Jorge Perez
CUNY Laguardia Community College
Long Island City, NY 11101-3071

DUE-9650658
FY 1996 $70,000
Instrumentation and Laboratory Improvement
Mathematics

This project is reforming the mathematics program by dividing the curriculum of the second level developmental mathematics course into two courses. The decision to restructure the curriculum is based on an analysis of students' difficulties in successfully completing the extensive content to be covered in this course in a semester of only 12 weeks and the fact that the success rate in upper-level courses indicates that even technical transfer students who pass may be in jeopardy in precalculus and calculus. In addition, in the present structure, neither technical nor transfer students receive college-level algebra instruction prior to precalculus. While the department has had significant success in infusing new teaching methodologies in precalculus and calculus resulting in significantly higher pass rates, hundreds of students never make it to these upper-level courses because of their poor preparation. The department is using this project to do a better job of preparing the vast majority of students who start out in developmental mathematics for upper-level precalculus and calculus courses. Central to this project is the transformation of sections of these developmental courses along with sections of precalculus and calculus into multimedia laboratory courses where students work individually and in small groups on state-of-the-art, interactive, CD-ROM-based instruction, supported with accompanying texts that contain exploratory environments, video clips, simulations, explanations, and exercises. Using this new technology, students work on modules at their own pace, taking proficiency exams when they are ready. The self-paced nature of the new CD-ROM technology makes better use of the additional time students have in this course.

Title: Digital Video Computer Editing Laboratory

Kirk T. Smallman
Springfield Technical Community College
Springfield, MA 01105

DUE-9650693
FY 1996 $13,539
Instrumentation and Laboratory Improvement
Telecommunications

The Telecommunications Technology Department is enhancing its curriculum by acquiring a digital video computer editing lab. Over the past 5 years, the use of high-speed computers in specialized configurations for manipulating video, print, and sound has rapidly come into its own. In combination with sophisticated software packages, these computer systems have moved into increasing use in the teleproduction industry where they can be made to perform a variety of tasks, including the creation of educational multimedia CD-ROMs for interactive training. Acquiring a digital video computer editing lab makes it possible to assign students digital video experiments in four current courses: Video Techniques, Video Production, Electronic Media Systems, and Informational Video Design. Through these courses, students are learning the technical and methodological processes by which video images are conceived, captured, and edited temporally using analog tape processes. With the digital lab in place for experiments, students are able to experience for themselves how transforming analog video to digital form makes possible highly complex manipulations performed rapidly and with perfectly controllable precision, control of variations of almost any image parameter through software, layering of images and sounds in multiple generations without quality degradation, and design of variations without destruction of prior versions.

Title: Improving Undergraduate Instruction Through the Inauguration of a Multi-Disciplinary Computer Simulation Laboratory

Gerhard Laule
Seminole Junior College
Seminole, OK 74818-0351

DUE-9650726
FY 1996 $55,000
Instrumentation and Laboratory Improvement
Multi-Disciplinary

In the Division of Math, Science, and Engineering, faculty have been working with an outdated Mathematics and Science Computer Assisted Learning Center (MSCALC) still equipped with original Apple II/e computers. The limited capabilities of the MSCALC has severely hindered the faculty' s goal of going beyond the currently used drill and practice exercises to add an interactive laboratory simulation component to the mathematics and science curriculum. The project aims to remedy this situation by redesigning the MSCALC, equipping it with Power Macintosh computers that can run Macintosh or IBM PC software. This new instructional technology enables science faculty members to offer laboratory exercises that can reinforce `wet lab` experiments and familiarize students with modern analytical techniques using computer simulations. The computers can be used for prelab orientation exercises, for simulations in areas where expensive instrumentation or materials are required, for visualization of complex lecture concepts, and for postlab exercises to reinforce and assess student learning. Mathematics students can use software packages to strengthen mathematical intuition and insight by representing mathematical ideas and objects (such as functions, matrices, differential equations, and infinite series) in a variety of forms that permit them to be experimented with and manipulated. The project also specifically helps the majority over 60 percent of the college's students who are women, a great number of whom are returning to school after years at home or work. The project is helping these students gain further knowledge, help in their retention, and increase their competency and familiarity with modern computer systems.

Title: Reforming Mathematics Curriculum Through Computerized Laboratories and Cooperative Learning

Jacquelyn Wozniak
Brevard Community College
Cocoa, FL 32922-6503

DUE-9650737
FY 1996 $70,000
Instrumentation and Laboratory Improvement
Mathematics

Brevard Community College, a multi-campus, co-educational community college located on the east coast of Florida, is establishing three computerized mathematics laboratories at the Melbourne Campus and one at the College's Institute for Space Technology. The laboratories are part of a comprehensive effort to reform the entire mathematics curriculum that addresses improving teaching techniques and focuses on increasing students' understanding of and success in mathematics at all levels. The target student audience includes all students requiring an introductory college level mathematics course or greater to complete degree requirements, and student employees of the Kennedy Space Center requiring mathematics as a component of space technology related training programs. Cooperative learning techniques are implemented as small student groups use the computer to simulate mathematical equations, explore related mathematical concepts, and test possible solutions. As they perform computer-based activities in their groups, students organize their own mathematical concepts, enabling them to learn more effectively and improve their mathematical problem solving skills. Evaluation of the project consists of comparing student success rates, satisfaction, and retention in classes using the reformed pedagogy to traditional lecture-based classes. Assessing project impact will also take into consideration how improving mathematical competency contributes to enhanced job skills of Kennedy Space Center employees. The proposed reforms can serve as a model for other institutions wishing to initiate similar changes to their own curricula.

Title: Laser Materials Processing Laboratory

Peter D. Vangel
Springfield Technical Community College
Springfield, MA 01105

DUE-9650745
FY 1996 $72,750
Instrumentation and Laboratory Improvement
Engineering Technology

The Laser Electro-Optics Technology Department and the Mechanical Engineering Technology Department are jointly enhancing their curricula by developing a Laser Materials Processing Lab. According to the Department of Defense and the Department of Commerce, the field of photonics, which includes laser materials processing, has been included in the list of critical technologies to be supported by the Federal Government as an enabling technology that will significantly enhance global competitiveness. By integrating specific components from both the Mechanical Engineering Technology program and the Laser Electro-Optics Technology program, this project can develop a working laboratory that addresses the need for advanced training in state-of-the-art manufacturing technology with specific emphasis on laser applications. Over the past decade, the use of laser technology in the manufacturing sector has increased dramatically, especially in the areas of materials processing (precision cutting, welding, drilling, and heat treating), submicron marking and etching,

automated laser-based inspection systems for quality assurance, and laser-based micropositioning and measurement systems. Access to such equipment by students enriches the already diverse laser and mechanical engineering technology curricula. With the opportunity to engage in hands-on applications employing real-world laser processing equipment in a laboratory setting, students can be significantly better prepared to pursue technical careers in the industrial and manufacturing sectors or to continue their studies at the university level.

Title: Enhancement of Undergraduate Chemistry Curriculum Through the Incorporation of FTIR

Hal E. Wright
Trident Technical College
Charleston, SC 29411

DUE-9650828
FY 1996 $9,672
Instrumentation and
Laboratory Improvement
Chemistry

The focus of this project is the enhancement of the laboratory experience in introductory, organic, and analytical chemistry through the acquisition of an FTIR spectrophotometer. This instrument allows rapid acquisition of spectra and helps students relate practical experiences to theory. The project provides students with FTIR instrumentation which allows them to assimilate theory and concepts, resulting in improved learning; provides students with experience in applying qualitative methods to the analysis of data, resulting in increased critical thinking and problem solving skills; better prepares students for transfer into 4-year science and engineering curricula or for entry into technical careers by providing a practical laboratory experience using spectroscopy; and provides underprepared students exposure to advanced analytical tools and an appreciation for "real world" chemistry by developing laboratory exercises that incorporate FTIR applications. The addition of FTIR to the laboratory, integrated with assignments in the classroom, reinforces concepts and provide students a more comprehensive understanding of entry-level and college-transfer chemistry. The approach in integrating theory and application encourages further exploration and practice on the part of the students.

Title: High Vacuum Systems Laboratory

David M. Hata
Portland Community College
Portland, OR 97219-7197

DUE-9650916
FY 1996 $50,384
Instrumentation and
Laboratory Improvement
Microelectronics Technology

This project develops a high vacuum systems laboratory for a 2-year, associate of applied science degree program in Microelectronics Technology. This unique, advanced-level technical program prepares technicians for jobs in the wafer fab in our nation's expanding semiconductor industry. Wafer fab technicians need a working knowledge of high vacuum systems because high vacuum techniques are so pervasive in the manufacture of integrated circuits. Unfortunately, few colleges are prepared to offer high vacuum systems courses because of a lack of suitable training systems and a lack of appropriate instructional materials. To address this need, this project is purchasing six miniturbomolecular (high vacuum) pumping stations and three helium leak detectors to equip a technician-level, high vacuum systems laboratory, adapt them for educational use, and design laboratory experiments for these systems. Experiments can be compiled and published as a laboratory manual for use at other community colleges and technical institutes. Laboratory experiments include demonstrations of vacuum fundamentals, operation of the pumping station, gauging and pressure measurement techniques, and leak detection.

Title: Improved Undergraduate Analytical Chemistry Through Use of Atomic Absorption Spectrometry and UV-Visible Spectroscopy

Connie M. Hendrickson
Dallas County Community
College System Office
Dallas, TX 75202-3201

DUE-9650948
FY 1996 $12,425
Instrumentation and
Laboratory Improvement
Environmental Technology

The equipment requested is being used to support revision in quantitative and instrumental analysis for chemistry courses leading to certificates and associate degrees in Environmental Technology and also for students transferring to four-year institutions. The addition of atomic absorption spectrometry and UV-visible spectrometry close the gap between Brookhaven College's current instrumentation and instruments found in modern industrial laboratories. The new instruments better prepare students for typical, work-related tasks in environmental sampling and measurements. The instrumentation is being used in both analytical and general chemistry courses.

Title: Using the TI-92 to Enhance the Learning of Precalculus and Calculus

Sharon Griggs
St. Petersburg Junior College
Saint Petersburg, FL 33733-3489

DUE-9650960
FY 1996 $31,388
Instrumentation and Laboratory Improvement
Mathematics

Expectations set forth by the mathematics professionals in the AMATYC standards, and by business and industry leaders in the SCANS Report, recommend that students entering the workforce be prepared to (1) gather, display, and analyze real-world data and then communicate their findings; (2) understand how to integrate concepts in math with science or engineering or liberal arts through data gathering and problem-solving experiences; and (3) be able to use new technologies and recognize them as valuable instructional tools. This project uses TI-92 calculators in conjunction with the Calculator-Based Laboratories (CBLs) for its three comprehensive instructional sites in order to address workforce expectations and help students become active learners in mathematics. With this equipment, students can engage in class or small group projects that solve realistic problems. CAS software has not been available for classroom use in precalculus or calculus, science, or engineering technology courses. Faculty who have used graphing calculators can attend a CAS Short Course. Faculty, upon return, train their colleagues in developing classroom activities using the TI-92 in combination with the CBL in mathematics and science classes. The faculty training and development of classroom activities are being shared via a World Wide Web site on the Internet and at state and national professional meetings.

Title: A Dual Site Chemistry Laboratory

Carolina Handy
Portland Community College
Portland, OR 97219-7197

DUE-9650968
FY 1996 $17,323
Instrumentation and Laboratory Improvement
Chemistry

This Portland Community College (PCC) project creates an opportunity for science and non-science majors to increase their understanding of physical laws of nature as they apply to chemistry by using computer-interfaced instrumentation. PCC is receiving support from the National Science Foundation to acquire a modern Fourier Transform Infrared spectrophotometer (FTIR) for the chemistry department at PCC, Sylvania Campus, and critical pieces of molecular biology equipment to be housed at the Center for Research on Occupational and Environmental Toxicology (CROET). The acquisition of this equipment creates a dual-site instructional laboratory that provides opportunities for introductory and advanced learning and training for the workforce for PCC students. The dual-site also provides opportunities for faculty enhancement. The link between a community college such as PCC and a research institution such as CROET is innovative and is a national model for the improvement of undergraduate laboratory instruction.

Title: Metamorphosing Organic Chemistry Laboratory into a Mini-Collaborative Work Place. Phase 1 - Enhancement of Learning by FT-IR Spectroscopy

Girija Subramaniam
Pennsylvania State University
University Park, PA 16802-1503

DUE-9650991
FY 1996 $10,306
Instrumentation and Laboratory Improvement
Chemistry

The aim of the project is to give a complete, better and real learning experience for the undergraduate students in the organic chemistry curriculum by added instrumentation and computer modeling. Recipe approach to organic synthesis is being transformed into a discovery approach by the addition of FT-IR spectrometer, requested through this proposal. The project integrates theory, computer modeling and FT-IR spectroscopy to give the students a collaborative, mini-corporate world experience. Students use FT-IR spectroscopy to follow chemical reactions, identify isomeric mixtures and for structural elucidation of products of chemical reaction. The theory of IR spectroscopy they learn comes alive by their personal handling of the IR spectrometer in the organic laboratory. Students as a team use SIPDE-SPARC approach to design and carry out their own synthesis; they use FT-IR spectroscopy to learn about quality control and product development in collaboration with a local industry. The collaborative, autonomous nature of these projects aided by FT-IR spectrometer and computer modeling gives the students a glimpse of the real professional world and prepares them adequately with all the requites of the cyberspace/virtual reality age.

Title: Applying Instrumental Analysis to a Computerized Process

Gary Hicks
Brazosport College
Lake Jackson, TX 77566-3136

DUE-9650996
FY 1996 $35,684
Instrumentation and Laboratory Improvement
Chemical Technology

This project seeks to improve the instructional methodology by which analytical instruments are taught. Students have been receiving training in the Chemical Technology program with regard to performing analysis of a sample, but they also need the ability to evaluate the analytical results in terms of what they indicate about a given chemical process. The objectives of the project are to (a) set up a complete computerized process in glassware, (b) provide a lab environment for teaching instrumental analysis in which the student learns not only to operate the analytical instruments but also to interpret the analytical results in the context of a multistep process; (c) enhance computer skills through a computerized, controlled lab process, data collection, calculation, and analytical instrument control; (d) provide students with an overview of an entire multistep process on a small scale, and of how these operations are linked together and how one operation affects succeeding operations;(e) provide students with a representative sample of the analytical instruments used in the local chemical industry; and (f) provide the organic lab students with instruments with which to do product analysis, giving them feedback on the purity of the products they are synthesizing. This project also provides students with hands-on experience at interpreting spectra. To accomplish these objectives, the department is using Fourier-transform -infrared and ultra-violet spectrophotometers to provide a representative sample of the instruments used in the chemical industry. Assembly of a computerized, small-scale, glassware, multistep process is used to illustrate the interrelation of processes and how the analysis is tied to a particular operation. As a result of the project, other colleges can design a lab facility that better meets the need of the chemical industry. Information on the project is being be disseminated through journal articles, conference presentations, and lab tours. The project is evaluated based on enrollment and input from instructors, students, and industry.

Title: A Interdisciplinary Automated Manufacturing Laboratory for the Electro-Mechanical Engineering Technology Program

James Rehg
Pennsylvania State Univ., University Park
University Park, PA 16802-1503

DUE-9651001
FY 1996 $50,318
Instrumentation and Laboratory Improvement
Electro-Mechanical Engineering Technology

There is a need in industry for technology graduates who can use a combination of electrical and mechanical concepts in the design, installation, and servicing of products and production systems. Preparing associate degree graduates for this role is difficult because 4 semesters is too short for extensive education in both disciplines. The Engineering Technology Department has addressed this problem by modifying three courses offered at the associate degree level to include basic concepts that bridge the two technologies and introducing a new 4-year degree program, Bachelor of Science in Electro-Mechanical Engineering Technology. The solution to the training problem created two major pedagogical problems. The first problem was the method used to deliver the content in the three courses. While the courses covered both product design and production system design and had a mix of electrical and mechanical concepts, there was no effort to use the same product examples in the courses. The second problem had two components: (1) the department did not have an automated manufacturing system on which students could learn to solve the electromechanical integration problems associated with these systems and (2) if a system was built for training, it was difficult to teach standard 16-student laboratory sections with single production machines and one-of-a-kind manufacturing systems. This project includes two initiatives that overcome the instructional delivery problems associated with cross training in electromechanical concepts and the use of large automated manufacturing systems in traditional laboratory sections. The project focuses on the integration of a product design problem into manufacturing courses and the development of a laboratory system that permits standard laboratory class sizes of 16 students to effectively use single production machines and a one-of-a-kind manufacturing system. The second problem is significant because many colleges add manufacturing systems to laboratories, but few address the training issues associated with the one-of-a-kind hardware in standard laboratory sections.

Title: Development of Curricular Tools for Quantitative Estimation in Physics

Bruce Emerson
Central Oregon Community College
Bend, OR 97701-5933

DUE-9651038
FY 1996 $19,872
Instrumentation and Laboratory Improvement
Physics

This project uses equipment to address a curricular need that exists in this department and in physics programs nationwide. One of the express goals of introductory physics courses is to prepare students to apply physics to the world around them. Students should be capable of thoughtfully performing back-of-the-envelope calculations to reach valid conclusions about physics as it is observed. Rarely, if ever, do teachers validate this skill by testing students. The outcomes of those tests that have been employed are disappointing. Therefore, this department is developing methods to ensure greater student skill in these estimation processes. If students are going to learn to make valid estimations, they need to practice. It is crucial that they have quick feedback about the accuracy of their estimates. To this end, eight computer-based data acquisition systems are being used along with suitable probes and modeling software. Together with structured learning activities, this hardware provides the immediate feedback that is needed to develop student skills in estimation. Simple modeling exercises enable the students to discover which aspects of the problem are most critical. Because of the growing numbers of physics classes with access to microcomputer based labs (MBL), the tools and resources developed are easily transportable to schools nationwide.

Title: Palomar College Integrated General Education Science Curriculum Project

Patricia Schmidt
Palomar College
San Marcos, CA 92069-1415

DUE-9651115
FY 1996 $77,449
Instrumentation and Laboratory Improvement
Multidisciplinary

This project is developing an integrated computer laboratory for general science education at Palomar College. The project involves design, implementation, and evaluation of an integrative curriculum for three cohorts of students enrolled in the designated general education biology, chemistry, physics, astronomy, geography, geology, and oceanography classes. Organized around the theme of oceanography, collaborative research projects and daily assignments are integrating industry-related curricula into introductory science courses and addressing career awareness and student interactions with the professional scientific community. The computer lab is bridging scientific theory with industry applications. The project is facilitating student learning in an open computer lab environment. It also provides a model for a four-part faculty enhancement program. Faculty have the opportunity to develop relationships with scientists and others in industry, integrate curriculum, and develop learning communities. A Teacher's Resource Guide and a train-the-trainer program are ensuring local and national project information dissemination.

Title: Portable Computer Algebra System Laboratories

Anthony L. Newberry
University of Kentucky
Research Foundation
Lexington, KY 40506-0057

DUE-9651142
FY 1996 $61,218
Instrumentation and Laboratory Improvement
Mathematics

A Kentucky consortium composed of six colleges in the University of Kentucky Community College System, Northern Kentucky University and Morehead State University are joined by two colleges in Florida and Georgia to adapt ongoing graphics calculator and computer algebra system projects for use with the new TI-92 and CBL (Calculator Based Laboratory). The project kicks off with an already-funded workshop at Northern Kentucky University and adapts already existing CBL/TI-82/CAS activities to the new hand-held system. The project focuses on calculus instruction, with extensions to individual precalculus, physics, engineering technology, and teacher training courses at various colleges. The project gives consortium members a `jump start` on exploring appropriate use of the hand-held CAS capabilities in the curriculum.

Title: Improving Science Education through GIS/GPS Technology

Gary Beluzo
Holyoke Community College
Holyoke, MA 01040-1091

DUE-9651211
FY 1996 $30,000
Instrumentation and Laboratory Improvement
Geographical Information Systems

Vastly improved Geographic Information Systems (GIS) and Global Positioning Systems (GPS) and low cost of Pentium processors are revolutionizing methods of research and analysis of data that are geographically distributed. New GIS/GPS technology and software products are ideally suited for the study of environmental science and related disciplines, yet most two- and four-year colleges are ill-prepared to adapt their current curriculum to use this valuable tool. Holyoke

Community College (HCC) believes that a strategic investment in this keystone technology will have a long-term payoff in a broad range applications in many disciplines and will result in better prepared transfer and career graduates. This project has two major foci: 1) enhancement of the Environmental Science curriculum through the use of GIS/GPS, including the creation of a new major devoted solely to GIS/GPS; and 2) enrichment of teaching and learning of science in area secondary schools through the use of HCC as a GIS/GPS technology transfer station via collaborative relationships with Salem State College. This project is creating a 10 station Pentium GIS/GPS lab. Classroom and laboratory learning at the college and area high schools are being enhanced by hands-on, discovery-based learning, especially important for nontraditional learners, particularly students for whom English is a second language. A formative and summative evaluation process is being used over the two-year life of the project. Modifications are being made based upon feedback from pilot testing of new GIS/GPS classroom and lab modules and ongoing input and evaluation from a project advisory committee comprised of local and national experts from two- and four-year institutions and private industry. Final products developed and experience gained are being shared with other educational institutions through HCC's home page on Internet and published in appropriate GIS journals.

Title: NetCo/CoNet Lab Project

Michael P. Seymour
Minnesota Riverland Technical College (Austin Campus)
Austin, MN 55912-1473

DUE-9651242
FY 1996 $58,000
Instrumentation and Laboratory Improvement
Networking Communication

The converging technologies of telecommunications, computers, and media are creating new businesses, new jobs, and new courses of study at technical and community colleges. Students need access to digital TV, multimedia, wireless, community server, public kiosk, and audience feedback technologies in order to become builders of future information infrastructure, a new national priority with local and regional economic development and community building potential. This project, which equips students in this area of advanced technological education, has been organized within the framework of a new networking communication (NetCo) curriculum that both draws upon and contributes to building rural community networks (CoNets). Some of the equipment for this project goes into college electronic labs, computer labs, and video production studios for NetCo students pursuing three study options: communication technology, multimedia software, and interactive television. Equipment can also be shared through links into and among rural communities, which make up a CoNet model. This model involves spread spectrum transceivers on antenna towers and public kiosks in various local sites. This CoNet model impacting handicapped, elderly, young, and especially rurally remote families includes new RAN (rural area network) wireless links among LANs, WANs and MANs. Mayors, school superintendents, teachers, librarians, county agents, and business people attended week-long summer workshops to learn how to initiate CoNets locally and regionally in 1995. In 1996-97, 60 faculty statewide are learning to use this equipment in support of NetCo curriculum.

Title: Computer Assisted Interdisciplinary Problem Solving in Mathematics and Science

Carol L. Freeman
Community College Finger Lakes
Canandaigua, NY 14424

DUE-9651271
FY 1996 $31,830
Instrumentation and Laboratory Improvement
Mathematics

This project integrates real-world interdisciplinary activities into targeted mathematics and science courses: Introductory Statistics, Algebra/Precalculus, General Chemistry, and General Physics. Two computer-equipped classrooms, one for mathematics and one for science, are essential for the success of the project. Each classroom provides an environment where students work in teams on activities designed to develop problem-solving skills and an understanding of course concepts. Three types of activity are used to meet the objectives of the project. TYPE I activities are designed to introduce students to problem-solving methodologies using a real-life scenario and an innovative problem-solving model called the WHEEL. TYPE II activities involve students from one discipline in a direct interaction with students from another discipline. TYPE III activities use technology for instruction within a specific course. They are designed to guide students in their construction of knowledge. The software required for the computer equipped classrooms (10 computers each) are Minitab, a statistics package; Derive, a computer algebra system; Quattro-Pro, a spreadsheet program; and PCSOLVE, a general problem-solving software package. This project can serve as a model for 2-year colleges to integrate a real-world problem-solving learning environment into their curriculum.

Title: Improving Physics Instruction for Technical Students Using a Microcomputer-Based Laboratory (MBL)

Alfred Amatangelo
Central Maine Technical College
Auburn, ME 04210-6436

DUE-9651318
FY 1996 $15,852
Instrumentation and Laboratory Improvement
Physics

This project provides assistance in improving laboratory instruction in introductory physics courses. Faculty believe that many students in these courses fail to develop adequate understanding of the basic concepts presented. Therefore, this project addresses the identified reasons for this failure: students are not (l) actively involved in the design of experiments; (2) sufficiently engaged in small group, collaborative learning; (3) receiving feedback on the results of many experiments; or (4) using their laboratory time efficiently and for laboratory-dependent activities. This project is making improvements in laboratory instruction by revising the curricula of two introductory physics courses and integrating the use of microcomputer-based laboratory tools into the laboratory component of those courses. Students taking the physics courses improved by this project are in majors that prepare them for work as technicians in manufacturing, engineering, or technical service environments. This project can serve as a model for the instruction of physics to college students in technical programs. Evaluation of both program improvements and student outcomes will be conducted as part of the project.

Title: Developing Mobile and Industrial Electrohydraulic and Electropneumatic Technical Education

Robert W. Vogt
Oklahoma State University-Olmulgee and Research Foundation Inc.
Stillwater, OK 74078

DUE-9651347
FY 1996 $71,454
Instrumentation and Laboratory Improvement
Electronics

Competencies in the areas of fluid power, electrical, and electronic systems and controls are essential for technicians' understanding of manufacturing processes and other dynamic industries including transportation, construction, agriculture, power generation, and petrochemical. The artificial separation of electrical/electronic and fluid power systems curricula does not adequately prepare students to design, troubleshoot, repair, and service electrohydraulic and electropneumatic systems. This project integrates the electrical/electronics and fluid power technical curricula to foster synthesis of the knowledge and produce graduates with necessary skills and competencies. The goal of this project is to develop mobile and industrial electrohydraulic and electropneumatic technical education to produce more broadly-trained and competent technicians, as well as increase the knowledge of the incumbent workforce and technology teachers with an emphasis on experiential learning using state-of-the-art technology. The curricula is being redesigned to integrate these disciplines into four courses with a team teaching approach for students majoring in electrical and electronics technology, heavy equipment and vehicles, air conditioning and refrigeration technology, engineering graphics technology, and manufacturing technology at OSU-Okmulgee. The key to teaching this interdisciplinary technical curriculum is a unique hydraulic and electronic trainer which permits experiential learning opportunities in laboratory exercises. This project serves many non-traditional students: the campus' average student age is 26.9 years and the racial distribution is more diverse than the state population. Curriculum developed for this project is being produced on multimedia and packaged for distance learning applications for the incumbent workforce. Results of this project are being disseminated to academic and fluid power professional associations, through the Internet, and on an electronic bulletin board.

Title: Restructured Physics Learning Environment

David S. Mills
College of the Redwoods
Eureka, CA 95501-9302

DUE-9651375
FY 1996 $9,068
Instrumentation and Laboratory Improvement
Physics

The purpose of this project is to change the teaching and learning of physics through the utilization of microcomputers and Calculator-Based Laboratory units as data acquisition, storage, and analysis tools. The acquisition of this technology supports the introduction of Workshop Physics, Tools for Scientific Thinking, Real-Time Physics, and Conceptual Exercises: Overview Case Studies curricular materials and the transformation of instruction from a lecture-oriented delivery system to one that is more collaborative, constructivist, and laboratory oriented. This new technology-rich learning environment also encourages the mastery of new measurement and analysis skills and better prepares the college's physics students for the learning and work environments in which they will eventually find themselves.

Title: Sage Junior College of Albany Chemistry Laboratory Enhancement

Daniel Lewicki
Russell Sage Junior College of Albany
Troy, NY 12180-4115

DUE-9651446
FY 1996 $14,871
Instrumentation and Laboratory Improvement
Chemistry

The purpose of this project is to reform the chemistry laboratory curriculum at Sage JCA in Albany, NY by incorporating hands-on student use of microcomputers. To accomplish this goal, the project supports eight Power Mac computers, eight set-ups of computer interface plus probes/sensors, a variety of software packages, and cable for networking. The networked computer workstations along with existing instruments allow for (1) an increase of student awareness of the capabilities of the microcomputer as an instrument of chemistry; (2) an enhancement of traditional teaching techniques currently used; (3) an increase in the diversity of experiments and simulations which may be performed by students; (4) an increase in student interest and understanding of the nature of measurements and of the principles of chemistry; (5) an increase in student appreciation of the role of technology in acquiring useful information; and (6). an increase in student's computer literacy skills. Acquisition of the proposed equipment impact all of the chemistry course offerings at Sage Junior College of Albany. Computer-assisted experiments and simulations enable students to acquire, analyze and display data in a variety of different and exciting ways. These activities help students to investigate phenomena and perform calculations rapidly and transparently to look for trends and inconsistencies in experimental data. This experience provides students with relevant skills and improved abilities as they enter an increasingly technological world where knowledge-intensive job skills are necessary to compete for careers.

Title: Data Acquisition, Manipulation and Presentation in Physics and Physical Science

Bryan H. Long
Columbia State Community College
Columbia, TN 38402-1315

DUE-9651477
FY 1996 $15,227
Instrumentation and Laboratory Improvement
Physics

The goals of this project are to improve the quality of physics instruction at this institution by enhancing and updating the laboratory equipment and curricula; to increase enrollment and retention of students in mathematics- and science-related programs of study; and to increase the enrollment of women, minorities, and undeclared majors in careers in science by providing resources to aid in the instruction and application of knowledge. The department is using microcomputer-based laboratory experiments in data acquisition, analysis, and presentation in undergraduate physics and physical science laboratories in the areas of mechanics, heat and thermodynamics, electricity and magnetism, and optics. Microcomputer-based laboratory experiments are being designed to enable students to gain hands-on experience with new technology while reinforcing traditional instructional methods. These enhanced laboratory experiences provide students with effective learning to support lecture theory. In addition to increasing learning, exposure to current laboratory instrumentation and technology makes students more competitive upon transfer to a senior institution or entrance into the workforce. Previously, there had been no classes in the curricula of elementary education, pre-professional engineering, or science in which students experience this type of computer utilization. The project supports seven microcomputer workstations equipped with seven computers, appropriate software, and supplementary laboratory equipment. This configuration supports all of the redesigned and newly developed laboratory experiments. Up to 102 students enrolled in physics and physical science courses may benefit and be better prepared for the technologies of the 21st century.

Instrumentation and Laboratory Improvement - FY 1996 Awards For Four - Year Colleges

For a more complete document NSF awards made in the ILI program to four-year institutions that focus on technician education are shown here.

Title: Air Process Control Trainer for Engineering Technology

Maurice Bluestein
Indiana University Bloomington
Bloomington, IN 47402-1847

DUE-9650223
FY 1996 $10,760
Instrumentation and Laboratory Improvement
Engineering Technology

The aim of this project is to add capability to an existing undergraduate laboratory course in instrumentation an Air Process Control Trainer. The present laboratory, partially funded through a previous ILI grant, includes equipment that demonstrates some of the fundamentals of Proportional-Integral-Derivative control, the basis for modern feedback control theory, programmable logic controllers, and computer control. Using a water tank as a test bed, the student becomes familiar with the concepts involved in controlling water level, and flow. Student learning is limited, however, by the low inertia of a water level detection system which limits the degree to which Derivative control is understood. Working with a local engineering firm, a prototype device has been built and tested that uses air temperature as the control parameter, thus overcoming the limitations of the water tank unit. This Air Process Control Trainer permits control of air temperature and air flow, permits demonstration of Derivative control, and adds the capability of experiments in heat transfer and fluid mechanics. This award is supporting the purchase of eight devices from the manufacturer for the existing Instrumentation lab stations. This gives students a stronger background in process control equipment; many of the graduates are employed in industries such as chemical plants, refineries, power plants, HVAC, food technology and pharmaceuticals that utilize this equipment. The course is currently offered as an elective to both mechanical engineering technology and electrical engineering technology students; it has become a requirement for the B.S. degree in MET in 1996. The project is thus interdisciplinary, affects many students including women and minorities, and benefits other institutions through dissemination of experiments and availability of a new product.

Title: Optoelectronic Device Inspection and Test Station

Bahram Nabet
Drexel University
Philadelphia, PA 19104

DUE-9650350
FY 1996 $21,965
Instrumentation and Laboratory Improvement
Microelectronics

Despite the strategic role of semiconductor manufacturing in American industry, teaching of courses related to optoelectronic devices is not popular in undergraduate curricula. These courses often appear either too theoretical and abstract or too skill oriented, with students receiving only vocational training. Most laboratory courses at best reiterate some theoretical concepts, but mostly test rather than fabricate devices. This scenario is particularly troublesome for nontraditional students, including those in community colleges and midcareer or experienced workers intending to update their skills. For both groups, these courses appear theoretical, with little relevance to the manufacturing process. In response to these needs, a course has been developed that has two unique major features: it proposes an integrated approach to the teaching of optoelectronic devices whereby students design, fabricate, and tests a device of their choice and it enables nonhomogeneous groups of students consisting of nontraditional, associate degree, undergraduate, and graduate students to work in teams responsible for all aspects of design and fabrication. The scenario played out in this course is a replica of concurrent engineering in the work place. What holds the team together is the product, the device, and what separates them is their responsibilities and backgrounds. All the equipment and supplies necessary for the fabrication of the devices are provided to the students in the microfabrication clean-room facility. Through this project, the department is acquiring equipment for testing the devices that students fabricate. These instruments enable the students to probe and test the electronic and optical response of their products.

Title: Laboratory for Interdisciplinary and Cooperative Education in Geographic Information Technologies

Zong-Guo Xia
University of Massachusetts Boston
Boston, MA 02125

DUE-9650395
FY 1996 $40,000
Instrumentation and Laboratory Improvement
Geographical Information Systems

This project focuses on improving the laboratory for Geographic Information Technologies, enabling the department to create a more comprehensive curriculum in geographic information science for undergraduates, implement an information technology literacy project in the Department of Geography, promote interdisciplinary group learning and research in the areas of geographic information technologies, and develop a cooperative education program in geographic information technologies involving the university, governmental agencies, and private industries.

Title: A Web-Based Introduction to Computer Networks for Non-Majors

Mark A. Holliday
Western Carolina University
Cullowhee, NC 28723

DUE-9650458
FY 1996 $60,352
Instrumentation and Laboratory Improvement
Computer and Information Technology

Insight into the functioning of computer networks is of increasing importance for many students. As an illustration of computer science, a relatively in-depth treatment of the topic of computer networks is also an excellent alternative to the more traditional, breadth-first approach. In this project, the department is developing courseware that provides an introduction to computer networks to be used in an introductory computer science course for students who are not planning on majoring in computer science. The courseware uses the World Wide Web and consists of Hypertext mark-up language documents and a set of `executable content` applications using the Java programming language. The Java applications use interactive algorithm animation to illustrate key concepts. Highlighted areas include CSMA/CD, Internet protocol routing, TCP error and flow control, cryptography and secure sockets, domain name resolution, and Hypertext telecommunications protocol. The role of each concept in the design of the Web serves as an organizing theme. With a focus on the key concepts and animated applications, a significant understanding of this material is possible in a course for nonmajors. The courseware is a major component of the primary course for nonmajors. The audience of the course includes a broad range of students, primarily undergraduates, but with some in-service teachers. Preservice teachers and technology majors form a large fraction of the students. The importance of understanding computer networks for our preservice and in-service teachers and technology majors is a primary factor in the project design. The courseware is being used in a computer classroom of networked PCs. One situation in which Java applications may be used is in closed student laboratories.

Title: A Physics Computing Laboratory With an Interactive Digitized Video Component

Purna C. Das
Purdue University
West Lafayette, IN 47907

DUE-9650594
FY 1996 $23,330
Instrumentation and Laboratory Improvement
Physics

This project is primarily one of laboratory curriculum development. The project is developing digitized video experiments for the general physics curriculum at Purdue. New experiments in mechanics and wave motion are being developed for the general physics courses offered to science, engineering, and technology students. The mechanics data are captured and digitized at the start of each laboratory by the students under the supervision of the laboratory instructor. The digitized movie is played frame by frame by the students in a scripted Multimedia ToolBook Application which allows the use of mouse and cursor for data collection and subsequent analysis by comparison to numerically modeled data or by curve fitting procedures. In addition, multimedia lessons involving real world situations are being developed using the Multimedia ToolBook authoring software. These lessons help explore the connection of physics principles to real life situations and aid in classroom instruction of students majoring in elementary education as well as those in science, engineering, and technology programs. The project, is also studying the student's learning behavior and understanding of the concepts related to the proposed experiments. A survey questionnaire is being devised to obtain feedback from the students regarding the usage of the new laboratory equipment. The results obtained from this project is being disseminated through articles and/or laboratory manuals and through the Purdue Home Page on the World Wide Web.

Title: SUNY Farmingdale CAD Laboratory Improvement to Include Rapid Prototyping

Dimitrios Maltezos
SUNY College of Technology Farmingdale
Farmingdale, NY 11735

DUE-9650653
FY 1996 $47,040
Instrumentation and Laboratory Improvement
Engineering Technology

In today's industry, rapid prototyping is an integrated part of most engineering design and development processes because of its cost effectiveness and quick production capability of complex three-dimensional physical parts from computer models. Currently, the Computer Aided Design (CAD) Laboratory hosts more than 24 486-66 PCs, 2 RISC 6000 IBMs, and 1 SUN-SPARC model 41. Workstations are all computer networked and fitted with solid modeling and finite element analysis software. This project adds a rapid prototyping system that is necessary to enrich students' experience with such new technology. In order to manufacture competitive products, engineering and engineering technology students must have the technical skills and appropriate methodology to design products and develop applications suited for today's modern and competitive industrial environment. Therefore, the main objective of this project is to develop a rapid prototyping capability at the CAD Laboratory. The incorporation of such modern techniques supported by actual industrial applications in the CAD Laboratory greatly enhance both the teaching and training activities in the Mechanical Engineering Technology Department. It is estimated that 700 students annually benefit from the training and exposure to this new technology. In addition, the equipment is part of the center for technical education and distance learning that was realized through an ARPA-TRP Manufacturing Engineering Grant to disseminate interactive educational courses to local universities, community colleges, and nationwide audiences. This campus is also the main hub of an educational computer network called `Exel-Link,` which connects most of New York state industrial firms and educational institutions.

Title: An Advanced Communications Curriculum for Undergraduate Technology Students Integrated Around a Fully Functional Cellular Base System

Michael Munoz
Purdue University
West Lafayette, IN 47907

DUE-9650891
FY 1996 $100,000
Instrumentation and Laboratory Improvement
Engineering Technology

The current and future growth in telecommunications (National Information Infrastructure) requires technical expertise at all levels to develop, install, and operate the equipment. There are no schools in the midwest that offer a telecommunications program for undergraduate engineering technology students. Educators have recognized the need and have created a specialization in telecommunications. From discussions with GTE Mobilnet, Exxon, Motorola, and EDS, it has become clear that telecommunications and networking professionals are needed. This project expands the communications curriculum and provides a new and innovative advanced communications laboratory. The project provides for an advanced telecommunications lab consisting of a cellular base station and supporting lab equipment. This equipment is being integrated into the advanced communications curriculum. The project plan has been laid out over several years by the department communications team with the active participation of GTE Mobilnet. Project goals and objectives include: developing an advanced communications course sequence for engineering technology students; developing an integrated wireless/cellular telecommunications laboratory; providing industry standard communications equipment for student research and projects; providing hands-on lab experience with high-technology test equipment and simulation software used in the telecommunications industry; promoting new and continued industry involvement in the ongoing development of the communications curriculum; and providing a plan for the continued improvement of the communications curriculum.

Title: An Undergraduate Laboratory for Digital Design

Rhonda Hockelberg,
Alabama A&M University
Normal, AL 35762-0285

DUE-9650946
FY 1996 $18,000
Instrumentation and
Laboratory Improvement
Engineering Technology

The goal of this project is to develop an undergraduate digital microprocessor laboratory for electrical engineering technology students. Until now, electronics courses have not offered practical laboratory experience in digital design. A series of experiments has been developed that effectively accomplishes this goal. Twelve workstations are being acquired. Each station consists of a Pentium-class personal computer equipped with a 68HC11 EVB microprocessor development board, a Universal Design Lab Platform experiment board, and ORCADTM software for logic verification and printed circuit layout. Students now receive hands-on experiences in basic digital electronics and microprocessor hardware design. Students are able to conceive, design, and simulate digital circuits. The new laboratory experiences serve as part of a revised and updated digital electronics and microprocessor courses and consolidate, add, reinforce, and update the skills taught in the old sequence of design courses.

Title: Instrumentation for a Biotechnology Center to Enhance Undergraduate Education

Gary N. Fritz
Eastern Illinois University
Charleston, IL 61920

DUE-9650953
FY 1996 $55,248
Instrumentation and
Laboratory Improvement
Biotechnology

This project is establishing a Center to address pressing needs in the undergraduate program at different curricular levels. As a result, General Biology for majors now addresses entry-level molecular biology concepts in their laboratory. Molecular biology technologies are also being added to core courses such as cell biology, genetics, and immunology. The Biotechnology Center provides a well-equipped and centralized laboratory that is shared by students in several courses. The Biotechnology Center is also a valuable resource for undergraduate students pursuing independent research projects. Finally, the Center enhances the department's teacher training program by providing a nucleus for summer courses in biotechnology for pre-service and high school teachers.

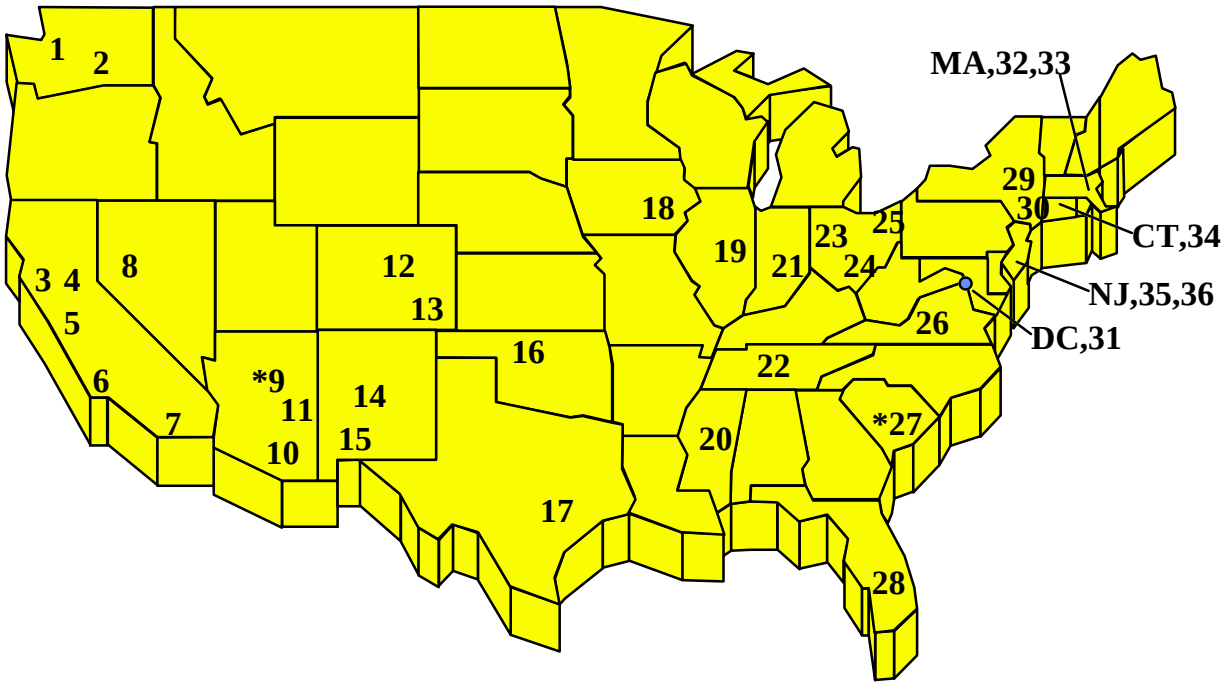
Title: Ultrafast Laser Laboratory for Photonics Undergraduates

Dean Richardson
SUNY Institute of Technology Utica-Rome
Utica, NY 13502-4013

DUE-9651324
FY 1996 $34,360
Instrumentation and
Laboratory Improvement
Engineering Technology

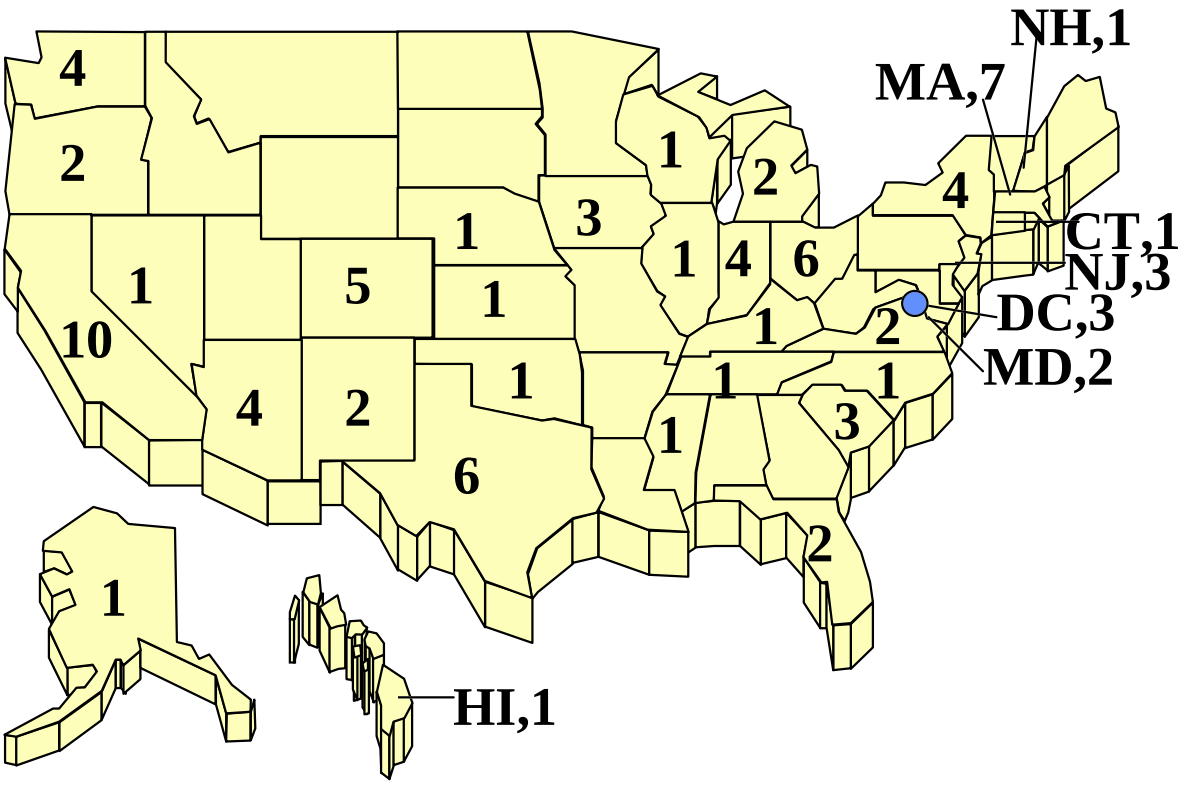
The project incorporates an Ultrafast Laser Laboratory (ULL) into the existing Photonics B.S. degree program. The ULL adds a strong ultrafast laser component to the program's Laser Physics and Applications core course and allows the establishment of an elective entitled *Advanced Photonics Lab Techniques*, providing undergraduate photonics technologists with the experience necessary to help them confidently design, construct, operate, maintain, and characterize ultrafast solid-state laser systems. Within the past 5 years, lasers have been developed based on titanium-doped sapphire crystals that allow the generation of extremely short pulses of light; these pulses be used to study the time evolution of microscopic processes, including chemical reaction kinetics and charge-carrier propagation in semiconductor quantum well materials. The ability to create and detect light pulses as short as a few femtoseconds (femto = one-quadrillionth) is rapidly transforming scientific understanding of the microscopic world. Accordingly, photonics technologists and engineers who understand ultrafast laser systems and assist in their implementation are needed by the research and academic communities. This Photonics program aims to prepare its graduates to fill that need. Until now, the school has lacked the state-of-the-art resources necessary to provide critical experimental learning experiences with ultrafast laser systems to its students. Now, rather than purchase an expensive commercial ultrafast laser for students to operate, faculty teach students how to construct one themselves from off-the-shelf components. In the laboratory, students build a crucial characterization tool (an `autocorrelator`) needed to measure the duration of the pulses output by the laser they've set up and aligned. The experience gained in developing this laboratory and its accompanying documentation assist other universities seeking to strengthen their undergraduate physics and optics programs.

FY 1996 ATE Awarded Institutions
120 Proposals Received, 36 Awarded
34 Projects, *2 Centers

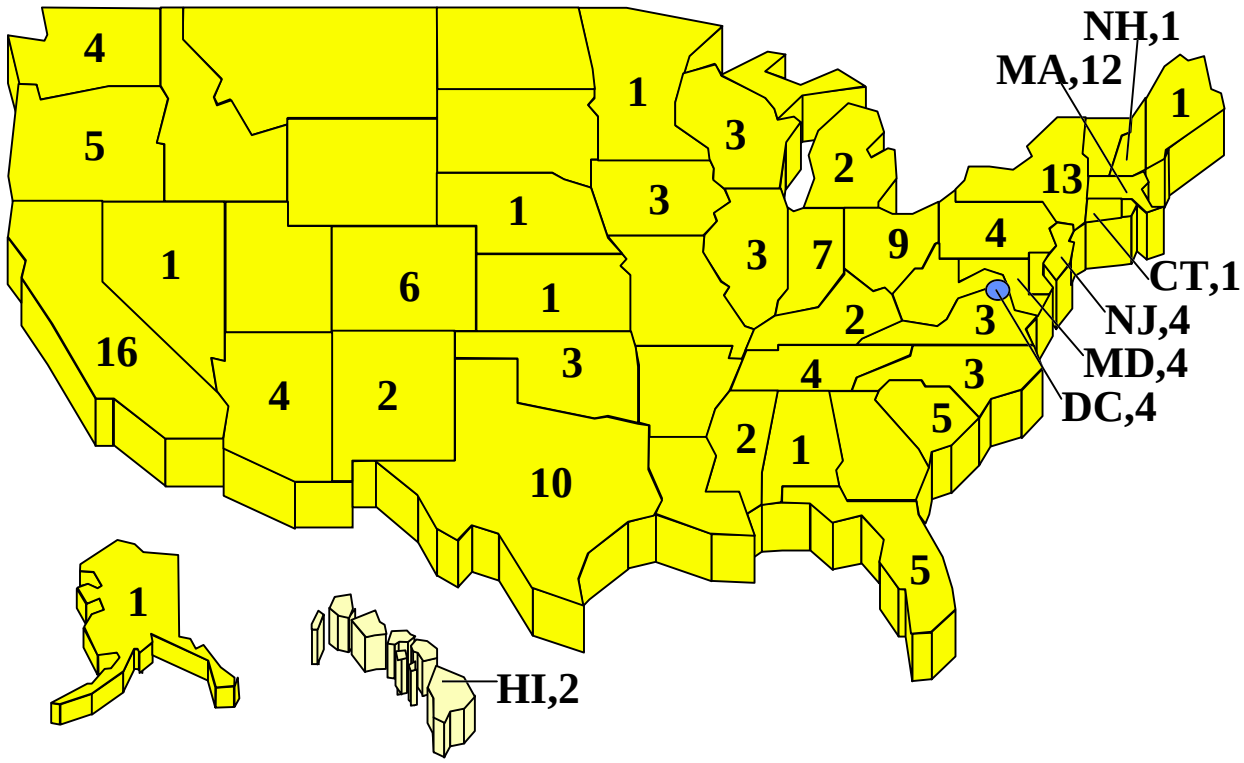


1. Edmonds Community College, WA
2. University of Washington, WA
3. West Valley Community College District, CA
4. Partnership for Environment Technical Ed, CA
5. Monterey Peninsula College, CA
6. University of California Santa Barbara, CA
7. College of the Desert, CA
8. University of Nevada Desert Research Ins, NV
9. * Maricopa County Community College District, AZ
10. Pima County Community College, AZ
11. Maricopa County Community College District, AZ
12. Colorado State University, CO
13. Geological Society of America, CO
14. Albuquerque Technical Vocational, NM
15. New Mexico State University, NM
16. Oklahoma State University-Okmulgee, OK
17. Center Occupational Research & Development, TX
18. Iowa State University, IA
19. City College of Chicago, IL
20. Phi Theta Kappa Headquarters, MS
21. Purdue University, IN
22. Nashville State Technical Institute, TN
23. Edison Industrial System Center, OH
24. University of Cincinnati, OH
25. Cleveland State University, OH
26. Wytheville Community College, VA
27. * SC State Board Techn. & Comprehensive Educ., SC
28. Broward Community College, FL
29. CUNY Queensborough Community College, NY
30. SUNY Stony Brook, NY
31. National Alliance of Business, DC
32. Harvard University, MA
33. Springfield Technical Community College, MA
34. Capital Community Technical College, CT
35. Rutgers, The State University, NJ
36. Middlesex County College, NJ

FY96 ATE Supported Projects: New and Continuing Projects by State



FY 1996 Advanced Technological Education Projects and Other Funded Projects with an Emphasis in Advanced Technological Education Shown in this Book



Index of Awards By State
FY 1996 Standard and Continuing ATE Awards, Plus ILI Awards Supporting Advanced Technological Education

DIVISION OF UNDERGRADUATE EDUCATION
and
The DIVISION OF ELEMENTARY, SECONDARY, and INFORMAL EDUCATION

Key: **ATE** = Advanced Technological Education, **ILI** = Instrumentation and Laboratory Improvement, **CCD** = Course and Curriculum Development, **IMD** = Instructional Materials Development, **IR** = Institution-Wide Reform of Undergraduate Education, **REU** = Research Experiences for Undergraduates **DUE-**= Division of Undergraduate Education, **BIR** = Biological Instrumentation and Resources, **ESI** = Division of Elementary, Secondary, and Informal Education, and **REC** = Research, Evaluation and Communication

ALABAMA

Title: An Undergraduate Laboratory for Digital Design
Rhonda Hockelberg
Alabama A&M University
Normal, AL 35762-0285

ILI Project
DUE-9650946
FY 1996 $18,000
Engineering Technology

ALASKA

Title: Rural Alaskan Environmental Education Program
John W. Carnegie
University of Alaska SE Juneau
Juneau, AK 99801-8625

ATE Project
DUE-9553680
FY 1995 $250,000
FY 1996 $250,000
FY 1997 $100,000
Environmental Technology

ARIZONA

Title: MMATE 2000 Project - Maricopa Mathematics Advanced Technology Education 2000 Project (MMATE 2000)
Alan Jacobs
Maricopa County CC District
Department of Education Development
2411 W 14th Street
Tempe, AZ 85281-6941

ATE Project
DUE-9602386
FY 1996 $161,440
FY 1997 $160,891
FY 1998 $30,904
Mathematics

Title: Teamed Internships: Innovative Education Program for Environmental Technicians and Engineers
Gregory Ogden
Pima County Community College
Department of Environmental Sciences
8181 East Irvington R.
Tucson, AZ 85709-4000

ATE Project
DUE-9602368
FY 1996 $330,000
Biotechnology

Title: Maricopa Advanced Technology Education Center — ATE Center
Alfredo de los Santos — DUE-9602373
Maricopa County CC District — FY 1996 ATE $873,878(TOTAL $892,878)
Department of Education & Student Development — FY 1997 ATE $872,940(TOTAL $892,940)
2411 W 14th Street — FY 1998 ATE $898,228(TOTAL $918,228)
Tempe, AZ 85281-6941 — Electronics

Title: Image Processing for Teaching: Faculty Development and Curriculum Materials — ATE Project
Melanie Magisos — DUE-9454520
Center for Image Processing in Education — FY 1994 $403,814
5343 E. Pima Street, Suite 201 — FY 1995 $466,493
Tucson, AZ 85712 — FY 1996 $476,524
Computer and Information Technology

CALIFORNIA

Title: Restructured Physics Learning Environment — ILI Project
David S. Mills — DUE-9651375
College of the Redwoods — FY 1996 $9,068
Eureka, CA 95501-9302 — Physics

Title: Palomar College Integrated General Education Science Curriculum Project — ILI Project
Patricia Schmidt — DUE-9651115
Palomar College — FY 1996 $77,449
San Marcos, CA 92069-1415 — Multidisciplinary

Title: Atomic Absorption Spectroscopy as a Unifying Curricular Element — ILI Project
Leverett R. Smith — DUE-9650043
Contra Costa Community College — FY 1996 $18,627
San Pablo, CA 94806-3166 — Chemical Technology

Title: Instrumentation for Undergraduate Biology and Biotechnology Training — ILI Project
William J. Thieman — DUE-9650005
Ventura County Cmty. College District System Office — FY 1996 $25,000
Ventura, CA 93003-2037 — Biotechnology

Title: Molecular Science — CCD Project
Orville L. Chapman — DUE-9555605
University of California — FY 1996 ATE $50,000(TOTAL $725,000)
Los Angeles, CA 90024-1301 — FY 1997 ATE $25,000(TOTAL $575,000)
FY 1998 ATE $25,000(TOTAL $575,000)
FY 1999 TOTAL $275,000
FY 2000 TOTAL $275,000
Chemistry

Title: MATE - Marine Advanced Technology Education — ATE Project
Nicole Crane — DUE-9602384
Monterey Peninsula College — FY 1996 $74,841
Life Sciences Division — Environmental Technology
980 Fremont Street
Monterey, CA 09394-04704

Title: The Faculty Associates in Science and Technology Leadership Corps Project for Enhancing Environmental Technology Education
Paul Dickinson
Partnership for Environmental Technology Education
Suite 235
6601 Owens Drive
Pleasanton, CA 94588

ATE Project
DUE-9602365
FY 1996 $300,000
FY 1997 $300,000
Environmental Technology

Title: Environmental Transportation Technology
Dan Baxley
College of the Desert
Department of Science & Technology
43-500 Monterey Street
Palm Desert, CA 92260-9305

ATE Project
DUE-9602448
FY 1996 $299,980
Engineering Technology

Title: Pac-Tec II: Pacific Technological Education Project
Charlotte Behm
West Valley Community College District
Department of Engineering
14000 Fruitvale Avenue
Saratoga, CA 95070

ATE Project
DUE-9602345
FY 1996 $250,753
FY 1997 $249,247
Manufacturing

Title: A GIS Core Curriculum for the 2-Year College
Michael Goodchild
University of California-Santa Barbara
Department of Geography
Santa Barbara, CA 93106

ATE Project
DUE-9602348
FY 1996 $188,469
Geographical Information Systems

Title: Sweeping Change in Manageable Units: A Modular Approach for Chemistry Curriculum Reform
C. Bradley Moore
University of California-Berkeley
School of Chemistry
Berkeley, CA 94720

CCD Project
DUE-9455924
FY 1995 ATE $100,000 (TOTAL$755,000)
FY 1996 ATE $50,000 (TOTAL $795,000)
FY 1997 ATE $50,000 (TOTAL $795,000)
FY 1998 TOTAL $350,000
FY 1999 TOTAL $350,000
Chemistry

Title: Advanced Biotechnology Education Project
Shahla Sheikholeslam
De Anza College
21250 Stevens Creek Boulevard
Cupertino, CA 95014

ATE Project
DUE-9553708
FY 1995 $225,306
Biotechnology

Title: Expanding the Biotechnology Education Program in the San Francisco/Oakland Bay Area
David R. Stronck
California State University Foundation
Department of Teacher Education
Hayward, CA 94542

ATE Project
DUE-9454502
FY 1994 $250,000
Biotechnology

Title: Preserving the Legacy: A Comprehensive Curriculum and Materials Development Project in Support of Advanced Environmental Technology Education
Sally V. Beaty
Intelecom Intelligent Telecommunications
150 East Colorado Boulevard, Suite 300
Pasadena, CA 91105

ATE Project
DUE-9454521
FY 1994 $499,988
FY 1995 $499,989
FY 1996 $499,989
Environmental Technology

Title: Advanced Technological Education in Biotechnology: A *Community College Partnership with Industry*
Barbara Des Rochers
Peralta Community College District Office
333 East Eighth Street
Oakland, CA 94606

ATE Project
DUE-9454657
FY 1994 $209,073
Biotechnology

Title: Pac-TEC: The Pacific Technological Education Center
Wade Ellis
West Valley Community College District
14000 Fruitvale Avenue
Saratoga, CA 95070

ATE Project
DUE-9454513
FY 1994 $300,000
Multidisciplinary

COLORADO

Title: Advancing Scientific and Technological Education in American Indian Communities
Keith James
Colorado State University
Department of Psychology
Fort Collins, CO 80523

ATE Project
DUE-9602376
FY 1996 $75,000
Multidisciplinary

Title: The Earth and Space Science Technological Education Project (ESSTEP)
Edward Geary
Geological Society of America
Department of Educational Programs
Boulder, CO 80302

ATE Project
DUE-9602408
FY 1996 $149,944
FY 1997 $179,975
FY 1998 $264,950
Geographical Information Systems

Title: Rocky Mountain Advanced Technology Education Project
Don E. Goodwin
Colorado Community College System
9125 East 10th Drive, Building 859
Aurora, CO 80010

ATE Project
DUE-9553706
FY 1995 $181,170
FY 1996 $117,294
Manufacturing

Title: Introductory Biology at Community Colleges: A New Model
Lynda B. Micikas
Biological Sciences Curriculum Study
Department of Biological Sciences
Pikes Peak Research Park
5415 Mark Dabling Boulevard
Colorado Springs, CO 80903

CCD Project
DUE-9455725
FY 1995 ATE $100,000 (TOTAL $450,000)
FY 1996 ATE $50,000 (TOTAL $435,000)
FY 1997 ATE $50,000 (TOTAL $435,000)
Life Sciences

Title: Electronics Technology Curriculum Development
Brenda L. Bryan
Front Range Community College
3645 West 112th Avenue
Westminster, CO 80030

ATE Project
DUE-9553685
FY 1995 $301,783
Electronics

Title: Environmental Technology Education Transfer to Native American Tribal Colleges
Karl F. Topper
Mesa State College
P.O. Box 2647
Grand Junction, CO 81502

ATE Project
DUE-9454633
FY 1994 $399,778
Environmental Technology

CONNECTICUT

Title: Reformed Mathematics Pedagogy and Laboratory/Technical Activities in Support of Aeronautics and Space Technical Education for Community and Technical College Students
ATE Project
DUE-9602456
FY 1996 $259,914
Mathematics

John Pazdar
Capital Community-Technical College
Department of Science & Mathematics
401 Flatbush Avenue
Hartford, CT 61063-757

FLORIDA

Title: Addressing National Needs for Skilled Technical Degree Graduates
Studies and Indicators Project
REC-9628036
FY 1996 $364,021
FY 1997 $363,080
FY 1998 $217,528
Multidisciplinary

Jeanne K. Deisen
Indian River Community College
3209 Virginia Avenue
Fort Pierce, FL 34981-5541

Title: Using the TI-92 to Enhance the Learning of Precalculus and Calculus
ILI Project
DUE-9650960
FY 1996 $31,388
Mathematics

Sharon Griggs
St. Petersburg Junior College
Saint Petersburg, FL 33733-3489

Title: Reforming Mathematics Curriculum Through Computerized Laboratories and Cooperative Learning
ILI Project
DUE-9650737
FY 1996 $70,000
Mathematics

Jacquelyn Wozniak
Brevard Community College
Cocoa, FL 32922-6503

Title: Biomedical Engineering Technology Program Development
ATE Project
DUE-9602383
FY 1996 $250,000
Biotechnology

Sandra Sanders
Broward Community College
Department of Engineering/Technology
225 East Las Olas Boulevard
Fort Lauderdale, FL 33301-2208

Title: Introductory College Physics 2000 - ICP/2
ATE Project
DUE-9553665
FY 1995 $429,521
Physics

Alexander K. Dickison
Seminole Community College
Highway 1792
Sanford, FL 32771

HAWAII

Title: Establishing and Transporting Science, Computer and Electronics Technology Curricula to Rural Minority Students through Simulated Labs and Telecourses
ATE Project
DUE-9454647
FY 1994 $499,938
Computer and Information Technology

G. Robert Converse
University of Hawaii/Maui Community College
310 Kalahumanu Avenue
Honolulu, HI 96822

Title: West Hawaii Explorations Academy: A Center for Integrative Secondary Curriculum Development
Bill Woerner
Hawaii Department of Education
P.O. Box 2360
Honolulu, HI 96804

IMD Project
ESIE-9452790
FY 1995 ATE $75,000 (TOTAL $119,958)
FY 1996 ATE $75,000 (TOTAL $131,654)
FY 1997 ATE $75,000 (TOTAL $98,728)
Instructional Materials Development

ILLINOIS

Title: Instrumentation for a Biotechnology Center to Enhance Undergraduate Education
Gary N. Fritz
Eastern Illinois University
Charleston, IL 61920

ILI Project
DUE-9650953
FY 1996 $55,248
Biotechnology

Title: Creating Partnerships between Urban Community College and Industry to Prepare Students to Enter and Succeed in the Technical Workforce
Nancy DeSombre
City Colleges of Chicago
Harold Washington College
Chicago, IL 60601-2420

ATE Special Project
DUE-9634670
FY 1996 $9,975
Multidisciplinary

Title: Chicago Chemical Laboratory Technology Education Partnership
Donald A. Soucek
Department of Physical Science and Engineering
City College of Chicago Truman
1145 West Wilson
Chicago, IL 60640-5616

ATE Project
DUE-9602443
FY 1996 $139,918
FY 1998 $70,163
Chemical Technology

INDIANA

Title: An Advanced Communications Curriculum for Undergraduate Technology Students Integrated Around a Fully Functional Cellular Base System
Michael Munoz
Purdue University
West Lafayette, IN 47907

ILI Project
DUE-9650891
FY 1996 $100,000
Engineering Technology

Title: A Physics Computing Laboratory With an Interactive Digitized Video Component
Purna C. Das
Purdue University
West Lafayette, IN 47907

ILI Project
DUE-9650594
FY 1996 $23,330
Physics

Title: Air Process Control Trainer for Engineering Technology
Maurice Bluestein
Indiana University Bloomington
Bloomington, IN 474021847

ILI Project
DUE-9650223
FY 1996 $10,760
Engineering Technology

Title: The Midwest Consortium for Advanced Technology Education
Dennis Depew
Purdue University
Department of Technology
West Lafayette, IN 47907

ATE Project
DUE-9602355
FY 1996 $426,570
FY 1997 $452,189
FY 1998 $469,632
Engineering Technology

Title: Interdisciplinary Courses in Electronics Manufacturing
Elaine M. Cooney
Indiana University - Bloomington
799 West Michigan Street
Bloomington, IN 47402

ATE Project
DUE-9553699
FY 1995 $297,475
Electronics

Title: Advancing Geo-Technology Education: Providing GIS Remote Skills for the Workforce of the Twenty-First Century
William A. Dando
Indiana State University
217 North 6th Street
Terre Haute, IN 47809

ATE Project
DUE-9553694
FY 1995 $300,000
Geographical Information Systems

Title: Problem-Based Learning: A Key to Enhanced Performance in Advanced Technological Education
Buck F. Brown
Rose-Hulman Institute of Technology
Department of Electrical Engineering
5500 Wabash Avenue
Terre Haute, IN 47803

ATE Project
DUE-9553705
FY 1995 $475,000
Engineering Technology

IOWA

Title: North Central Collaboration for Advanced Engineering Technology Education in NDE/NDT
David Holger
Iowa State University
Department of Engineering Administration
104 Marston Hall
Ames, IA 50011

ATE Project
DUE-9602370
FY 1996 $224,208
FY 1997 $224,647
FY 1998 $224,850
Engineering Technology

Title: Development of a Two-year Associate Degree in Agricultural Technology
Terry Brase
Hawkeye Community College
1501 East Orange Road
Waterloo, IA 50704

ATE Project
DUE-9553751
FY 1995 $200,000
Biotechnology

Title: ATEEC - Advanced Technological Environmental Education Center
Ellen Kabat
Eastern Iowa Community College District
500 Belmont Road
Betterdorf, IA 52722

ATE Center
DUE-9454638
ATE $999,961 (TOTAL $2,999,866)
FY 1994 $999,961
FY 1995 $999,907
FY 1996 $999,998

Env

KANSAS

Title: Two-Year Associate of Technology Curriculum Development for GIS/GPS Technologies
James L. Keating
Kansas State University - Salina
2409 Scanlan Avenue
Salina, KS 67401

ATE Project
DUE-9454618
FY 1994 $500,000
Geographical Information Systems

KENTUCKY

Title: Portable Computer Algebra System Laboratories
Anthony L. Newberry
University of Kentucky
Research Foundation
Lexington, KY 40506-0057

ILI Project
DUE-9651142
FY 1996 $61,218
Mathematics

Title: Kentucky Advanced Technology Education Project
Anthony Newberry
University of Kentucky Community College System
Breckinridge Hall
Lexington, KY 40506

ATE Project
DUE-9454585
FY 1994 ATE $696,300
(TOTAL $800,000)
Mathematics

MAINE

Title: Improving Physics Instruction for Technical Students Using a Microcomputer -Based Laboratory (MBL)
Alfred Amatangelo
Central Maine Technical College
Auburn, ME 04210-6436

ILI Project
DUE-9651318
FY 1996 $15,852
Physics

MARYLAND

Title: The Two-Year College in the Twenty-First Century: Breaking Down Barriers
Mary Beth Monroe
American Association of Physics Teachers
5110 Roanoke Place, Suite 101
College Park, MD 20740

ATE Special Project
DUE-9450160
FY 1995$208,348
FY 1996 $358,975
FY 1997 $360,125
FY 1998 $257,957
Physics

Title: Physics Education in the Two-Year Colleges: A Neglected Resource
Michael Neuchatz
American Institute of Physics
Education and Employment Statistic Division
One Physics Ellipse
College Park, MD 20740

ATE Special Project
DUE-9453180
FY 1995 $99,988
FY 1996 ATE $93,000 (TOTAL $193,000)
FY 1997 $92,692
Physics

Title: Remote Sensing, Image Processing, and Geographic Information Systems
Patricia A. Cunniff
Prince George's Community College
301 Largo Road
Largo, MD 20772

ATE Project
DUE-9553662
FY 1995 $313,973
FY 1996 $293,427
FY 1997 $87,541
Geographical Information Systems

Title: Associate Degree for Manufacturing Technicians
Arnold H. Packer
Johns Hopkins University
Charles and 34th Street
Baltimore, MD 21218

ATE Project
DUE-9553664
FY 1995 $499,967
FY 1996 $400,000
FY 1997 $399,867
Manufacturing

MASSACHUSETTS

Title: Laboratory for Interdisciplinary and Cooperative Education in Geographic Information Technologies
Zong-Guo Xia
University of Massachusetts Boston
Boston, MA 02125

ILI Project
DUE-9650395
FY 1996 $40,000
Geographical Information Systems

Title: Improving Science Education through GIS/GPS Technology
Gary Beluzo
Holyoke Community College
Holyoke, MA 01040-1091

ILI Project
DUE-9651211
FY 1996 $30,000
Geographical Information Systems

Title: Laser Materials Processing Laboratory
Peter D. Vangel
Springfield Technical Community College
Springfield, MA 01105

ILI Project
DUE-9650745
FY 1996 $72,750
Engineering Technology

Title: Digital Video Computer Editing Laboratory
Kirk T. Smallman
Springfield Technical Community College
Springfield, MA 01105

ILI Project
DUE-9650693
FY 1996 $13,539
Telecommunications

Title: Telecommunications and Networking Engineering Technology Education Project
Gary Mullett
Springfield Technical Community College
Department of Electronics Technology
Armory Square
Springfield, MA 01105

ATE Project
DUE-9602433
FY 1996 $200,000
FY 1997 $200,000
Telecommunications

Title: Project ComTech: A Curriculum in Technology and Science
Philip Sadler
Harvard University
Department of Science Education
Holyoke Center 458
Cambridge, MA 21383-826

ATE Project
DUE-9602404
FY 1996 $373,927
Multidisciplinary

Title: Teacher/Faculty Enhancement, Curriculum Development and Laboratory Improvement for Fiber Optics Technology Education
Nicholas M. Massa
New England Board of Higher Education
45 Temple Place
Boston, MA 02111

ATE Project
DUE-9553762
FY 1995 $365,100
Electronics

Title: Mathematics for Technology - Laboratory Investigations
Gary M. Simundza
Wentworth Institute of Technology
550 Huntington Avenue
Boston, MA 02115

ATE Project
DUE-9553704
FY 1995 $499,951
Mathematics

Title: Hands-On Physics: A New Conception of Physics
Robert Tinker
Concord Consortium
37 Thoreau Street
Concord, MA 01742

ATE Project
DUE-9454575
FY 1994 $432,743
Physics

Title: Advanced Biotechnology Education Project
Barry L. Werner
Middlesex Community College
Springs Road
Bedford, MA 01730

ATE Project
DUE-9454642
FY 1994 $347,978
FY 1995 $392,307
FY 1996 $392,109
Biotechnology

Title: Math/Science Enhanced Manufacturing Technology Training for Females and Minorities
James Amara
Minuteman Science and Technology High School
758 Marrett Road
Lexington, MA 02173

ATE Project
ESIE 9453921
ATE FY94 $185,700(ATE FY96 $170,370)
Manufacturing

Title: REU-Site for Biotechnology
Bruce Jackson
Massachusetts Bay Community College
50 Oakland Street
Wellesley, MA 02181

REU Project
BIR 9424103
FY 1995 ATE $15,000 (TOTAL $55,796)
FY 1996 ATE $15,000 (TOTAL $60,296)
FY 1997 ATE $15,000 (TOTAL $60,296)
Biotechnology

MICHIGAN

Title: The Southeastern Michigan Alliance for Reinvestment in Technological Education (SMARTE) Project
Mulchand S. Rathod
Wayne State University
Department of Engineering Technology
Detroit, MI 48202

ATE Project
DUE-9553692
FY 1995 $149,900
Manufacturing

Title: Chemical Engineering Technology Advanced Process Operations Program
Edward R. Fisher
Michigan Technological University
Department of Chemical Engineering
1400 Townsend Drive
Houghton, MI 49931

ATE Project
DUE-9553671
FY 1995 $499,996
Chemical Technology

MINNESOTA

Title: NetCo/CoNet Lab Project
Michael P. Seymour
Minnesota Riverland Technical College (Austin Campus)
Austin, MN 55912-1473

ILI Project
DUE-9651242
FY 1996 $58,000
Telecommunications

MISSISSIPPI

Title: Transition to the Workplace Through Manufacturing Experiences
Sandra H. Harpole
Mississippi State University
Physics and Astronomy Department
PO Box 6156
Mississippi, MS 39762

IMD Project
ESI-9555646
FY 1996 TOTAL $567,456
FY 1998 ATE $157,000(TOTAL $347,306)
FY 1999 ATE $125,000(TOTAL $358,722)
Manufacturing

Title: Improving Science and Engineering Technology Education at Community Colleges — ATE Project
Rod Risley — DUE-9602459
Phi Theta Kappa Headquarters — FY 1996 $211,982
Office of the Executive Director — Multidisciplinary
460 Briarwood Drive Suite 415
Jackson, MS 39206

NEBRASKA

Title: A Chemical Technology Curriculum and Materials Development Project — ATE Project
John V. Kenkel — DUE-9553674
Southeast Community College — FY 1995 $191,590
8800 O Street — Chemical Technology
Lincoln, NE 68520

NEVADA

Title: A Partnership for Computer-Based Curriculum Development in Atmospheric Technology — ATE Project
Melanie Wetzel — DUE-9602351
University of Nevada - Desert Research Institute — FY 1996 $150,000
Department of Atmospheric Sciences — FY 1997 $150,000
P.O. Box 60220 — FY 1998 $150,000
Reno, NV 89506-0220 — Environmental Technology

NEW HAMPSHIRE

Title: Defining the Emerging Role of the Technologist in a Computer-Aided-Engineering Environment — ATE Project
DUE-9553767
Robert W. Simoneau — FY 1995 $250,000
Keene State College — FY 1996 $150,000
229 Main Street — FY 1997 $148,260
Keene, NH 03435 — Manufacturing

NEW JERSEY

Title: Multimedia Communications Technology — ATE Project
David Beyer — DUE-9602375
Middlesex County College — FY 1996 $309,983
Department of Physics/Electrical Engineering Technology — Computer and Information
Edison, NJ 08818 — Technology

Title: Modular Approach to Biotechnology Laboratory Instruction Based on a Novel Green-Fluorescent Protein — ATE Project
DUE-9602356
William Ward — FY 1996 $350,000
Rutgers the State University of New Jersey — Biotechnology
Department of Biochemistry & Microbiology
New Brunswick, NJ 08903

Title: New Jersey Center for Advanced Technological Education — ATE Center
Jack Waintraub — DUE-9553749
Middlesex County College — FY 1995 ATE $785,997(TOTAL $985,997)
155 Mill Road — FY 1996 $982,931
Edison, NJ 08818 — FY 1997 $997,544
Engineering Technology

NEW MEXICO

Title: Project TIE: Training for Industry Education — ATE Project
Mary Jane Willis — DUE-9602349
Albuquerque Technical Vocational — FY 1996 $218,227
Department of Technologies — FY 1997 $203,091
525 Buena Vista SE — Electronics
Albuquerque, NM 87106-4023

Title: Development of User-Friendly Microcomputer-Based Instructional Aids for Introductory Courses in Electrical Engineering Technology — ATE Project
Howard Smolleck — DUE-9602430
New Mexico State University — FY 1996 $169,177
Department of Electrical & Computer Engineering — Engineering Technology
Box 3699
Las Cruces, NM 88003-3699

NEW YORK

Title: Ultrafast Laser Laboratory for Photonics Undergraduates — ILI Project
Dean Richardson — DUE-9651324
SUNY Institute of Technology Utica-Rome — FY 1996 $34,360
Utica, NY 13502-4013 — Engineering Technology

Title: SUNY Farmingdale CAD Laboratory Improvement to Include Rapid Prototyping — ILI Project
Dimitrios Maltezos — DUE-9650653
SUNY College of Technology Farmingdale — FY 1996 $47,040
Farmingdale, NY 11735 — Engineering Technology

Title: Sage Junior College of Albany Chemistry Laboratory Enhancement — ILI Project
Daniel Lewicki — DUE-9651446
Russell Sage Junior College of Albany — FY 1996 $14,871
Troy, NY 12180-4115 — Chemistry

Title: Computer Assisted Interdisciplinary Problem Solving in Mathematics and Science — ILI Project
Carol L. Freeman — DUE-9651271
Community College Finger Lakes — FY 1996 $31,830
Canandaigua, NY 14424 — Mathematics

Title: A Mathematics Learning Laboratory — ILI Project
Jorge Perez — DUE-9650658
CUNY Laguardia Community College — FY 1996 $70,000
Long Island City, NY 11101-3071 — Mathematics

Title: An Undergraduate Photonics Laboratory — ILI Project
David H. Lieberman — DUE-9650617
CUNY Queensborough Community College — FY 1996 $41,780
New York, NY 11364 — Engineering Technology

Title: Long Island Consortium for Mathematical Sciences Throughout the Curriculum — CCD Project
Alan Tucker — DUE-9555401
SUNY at Stony Brook — FY 1996 ATE $50,000(TOTAL $699,850)
Stony Brook, NY 11794-0001 — FY 1997 ATE $25,000(TOTAL $715,810)
FY 1998 ATE $25,000(TOTAL $692,080)
Mathematics

Title: Technology Instruction for the 21st Century - Phase II — ATE Project
Bernard Mohr — DUE-9602369
CUNY Queensborough Community College — FY 1996 $193,010
Department of Electrical & Computer Engineering Technology — FY 1997 $203,502
56th Ave., Springfield Blvd — FY 1998 $203,488
New York, NY 11364 — Engineering Technology

Title: LIGASE: Long Island Group About Science Education — ATE Project
R. David Bynum — DUE-9602450
SUNY Stony Brook — FY 1996 $225,000
Department of Biochemistry — FY 1997 $225,000
Stony Brook, NY 117940001 — Biotechnology

Title: Development and Implementation of Advanced Applied Technological Mathematics — ATE Project
Alfred Patrick — DUE-9553765
SUNY Adirondack Community College — FY 1995 $184,880
Bay Road — FY 1997 $49,314
Glens Falls, NY 12804 — Mathematics

Title: A Workshop Chemistry Curriculum — Chemistry Initiative
David K. Gosser — DUE-455920
CUNY City College — FY 1995 ATE $50,000 (TOTAL $425,000)
Department of Chemistry — FY 1996 ATE $25,000 (TOTAL $400,000)
Convent Avenue and 138th Street — FY 1997 ATE $25,000 (TOTAL $400,000)
New York, NY 10031 — (FY 1998 TOTAL $150,000)
(FY 1999 TOTAL $150,000)
Chemistry

Title: Mathematics and its Applications in Engineering and Sciences: Building the Links — CCD Project
William E. Boyce — DUE-9552465
Rensselaer Polytechnic Institute — FY 1995 ATE $125,000 (TOTAL $1,311,000)
Department of Mathematics — FY 1996 ATE $125,000 (TOTAL $700,000)
110 8th Street — FY 1997 ATE $125,000 (TOTAL $700,000)
Troy, NY 12180 — FY 1998 ATE $125,000 (TOTAL $700,000)
(FY 1999 TOTAL $600,000)
Mathematics

Title: *Technology Instruction for the 21st Century* — ATE Project
Bernard E. Mohr — DUE-9454613
CUNY Queensborough Community College — FY 1994 $197,013
56th Avenue Springfield Boulevard — FY 1995 $205,300
Bayside, NY 11364 — FY 1996 $110,652
Electronics

NORTH CAROLINA

Title: The Capstone Project: An Integrated Approach to Learning — IR Project
Benjamin R. White — DUE-9652146
Wake Technical Community College — FY 1996 $199,949
9101 Fayetteville Road — Engineering Technology
Raleigh, NC 27603-5655

Title: A Web-Based Introduction to Computer Networks for Non-Majors — ILI Project
Mark A. Holliday — DUE-9650458
Western Carolina University — FY 1996 $60,352
Cullowhee, NC 28723 — Computer and Information Technology

Title: Collaborative Model for Technician Education Through Interactive Technology — ATE Project
J. Parker Chesson — DUE-9553709
North Carolina State Board of Community Colleges — FY 1995 $120,000
200 West Jones Street — Manufacturing
Raleigh, NC 27603

OHIO

Title: Biotechnology Laboratory Instrumentation Improvement — ILI Project
Martha Brosz — DUE-9650655
Cincinnati Technical College — FY 1996 $60,000
Cincinnati, OH 45223-2612 — Biotechnology

Title: Incorporation of Cell and Tissue Culture Techniques and Environmental Physiology into the Undergraduate Curriculum — ILI Project
DUE-9650526
Wendy McCullen — FY 1996 $32,924
Columbus State Community College — Environmental Technology
Columbus, OH 43215-1722

Title: Advanced Technological Education in Chemical Technology — ATE Project
Fritz Kryman — DUE-9602437
University of Cincinnati — FY 1996 $340,129
College of Applied Science — FY 1997 $378,283
Mail Location 627 — FY 1998 $379,864
Cincinnati, OH 45221 — Chemical Technology

Title: Toledo Technology Academy — ATE Project
Lionel Sully — DUE-9602431
Edison Industrial Systems Center — FY 1996 $500,000
Department of Technology — FY 1997 $400,000
1700 N Westwood Ave.-Suite 2286 — FY 1998 $300,000
Toledo, OH 43607-1241 — Manufacturing

Title: Technological Education for Advanced Manufacturing — ATE Project
Frederick Schoenig — DUE-9602457
Cleveland State University — FY 1996 $299,880
Advanced Manufacturing Center — FY 1997 $308,876
East 24th and Euclid Ave. — Manufacturing
Cleveland, OH 44115

Title: Partnership for the Advancement of Chemical Technology (PACT) — ATE Project
Arlyne M. Sarquis — DUE-9454518
Miami University Middletown — FY 1994 $400,000
4200 East University Boulevard — FY 1995 $400,000
Middletown, OH 45052 — FY 1996 $400,000
Chemical Technology

Title: National Center of Excellence for Advanced Manufacturing Education (NCE/AME) — ATE Center
DUE-9454571
David T. Harrison — FY 1994 $1,000,000
Sinclair Community College — FY 1995 $1,000,000
444 West Third Street — FY 1996 $1,000,000
Dayton, OH 45402 — Manufacturing

Title: Advanced Technological Education Project in Environmental Technology — ATE Project
Jeffrey Cramer — DUE-9553768
Stark Technical College — FY 1995 $516,209
6200 Frank Avenue, NW — Environmental Technology
Canton, OH 44720

OKLAHOMA

Title: Developing Mobile and Industrial Electrohydraulic and Electropneumatic Technical Education — ILI Project
Robert W. Vogt — DUE-9651347
Oklahoma State University-Okmulgee — FY 1996 $71,454
Okmulgee, OK 74447 — Electronics

Title: Improving Undergraduate Instruction Through the Inauguration of a Multi-Disciplinary Computer Simulation Laboratory — ILI Project
Gerhard Laule — DUE-9650726
Seminole Junior College — FY 1996 $55,000
Seminole, OK 74818-0351 — Multidisciplinary

Title: An Innovative Approach for Advanced Technological Learning in Distinctive Manufacturing — ATE Project
Rick Allison — DUE-9602390
Oklahoma State University-Okmulgee — FY 1996 $300,000
Department of Manufacturing Technology — FY 1997 $300,000
1801 East 4th Street — Manufacturing
Okmulgee, OK 74447-3901

OREGON

Title: Development of Curricular Tools for Quantitative Estimation in Physics — ILI Project
Bruce Emerson — DUE-9651038
Central Oregon Community College — FY 1996 $19,872
Bend, OR 97701-5933 — Physics

Title: A Dual Site Chemistry Laboratory — ILI Project
Carolina Handy — DUE-9650968
Portland Community College — FY 1996 $17,323
Portland, OR 97219-7197 — Chemistry

Title: High Vacuum Systems Laboratory — ILI Project
David M. Hata — DUE-9650916
Portland Community College — FY 1996 $50,384
Portland, OR 97219-7197 — Microelectronics Technology

Title: Northwest Center for Sustainable Resources (A National Center for Advanced Technology) — ATE Center
Wynn W. Cudmore — DUE-9553760
Chemeketa Community College — FY 1995 ATE $996,663 (TOTAL $999,663)
4000 Lancaster Drive, NE, P.O. Box 14007 — FY 1996 TOTAL $999,553
Salem, OR 97309 — FY 1997 TOTAL $999,227
Environmental Technology

Title: The Application-Based, Technology-Supported, One-Track Mathematics Curriculum Program (ATO) — ATE Project
Catherine Curtis — DUE-9454627
Mount Hood Community College — FY 1994 $469,923
26000 SE Stark — Mathematics
Gresham, OR 97030

PENNSYLVANIA

Title: A Interdisciplinary Automated Manufacturing Laboratory for the Electro-Mechanical Engineering Technology Program — ILI Project
James Rehg — DUE-9651001
Pennsylvania State Univ., University Park — FY 1996 $50,318
University Park, PA 16802-1503 — Electro-Mechanical Engineering Technology

Title: Optoelectronic Device Inspection and Test Station — ILI Project
Bahram Nabet — DUE-9650350
Drexel University — FY 1996 $21,965
Philadelphia, PA 19104 — Electrical Engineering

Title: Metamorphosing Organic Chemistry Laboratory into a Mini-Collaborative Work Place. Phase 1 - Enhancement of Learning by FT-IR Spectroscopy — ILI Project
Girija Subramaniam — DUE-9650991
Pennsylvania State University — FY 1996 $10,306
University Park, PA 16802-1503 — Chemistry

Title: Middle Atlantic Consortium for Mathematics and Its Applications Throughout the Curriculum
CCD Project
DUE-9552464
Dennis DeTurck
University of Pennsylvania
Department of Mathematics
Rittenhouse Laboratory
Philadelphia, Pennsylvania 19104
FY 1995 ATE $75,000 (TOTAL $598,206)
FY 1996 ATE $50,000 (TOTAL $499,653)
FY 1998 TOTAL $499,653
Mathematics

Title: Activity Based Physics: Curricula, Computer Tools, and Apparatus for Introductory Physics Courses
CCD Project
DUE-9455561
Priscilla W. Laws
Dickinson College
Department of Physics and Astronomy
Box 1773
Carlisle, PA 17013
FY 1995 ATE $100,000 (TOTAL $725,000)
FY 1996 ATE $100,000 (TOTAL $525,000)
FY 1997 TOTAL $525,000
Physics

SOUTH CAROLINA

Title: Enhancement of Undergraduate Chemistry Curriculum Through the Incorporation of FTIR
ILI Project
DUE-9650828
Hal E. Wright
Trident Technical Colleges
Charleston, SC 29411
FY 1996 $9,672
Chemistry

Title: Robotic Welding Technology
Martha J. Vann
Trident Technical Colleges
Charleston, SC 29411
ILI Project
DUE-9650053
FY 1996 $78,840
Engineering Technology

Title: South Carolina Advanced Technological Education (SC ATE) Center of Excellence
ATE Center
DUE-9602440
Elaine Craft
South Carolina State Board of Technical & Comprehensive Education
111 Executive Center Drive
Columbia, SC 29201
FY 1996 ATE $500,000(TOTAL $550,000)
FY 1997 ATE $500,000(TOTAL $550,000)
FY 1998 ATE $950,000(TOTAL $1,000,000)
Engineering Technology

Title: The South Carolina Advanced Technological Education (SC ATE) Exemplary Faculty Project
ATE Project
DUE-9553740
Lynn Mack
Piedmont Technical College
Department of Mathematics
Greenwood, SC 29648
FY 1995 $486,930
FY 1996 $487,297
FY 1997 $482,379
Engineering Technology

Title: Integrating New Visions in Environmental Sciences Technology (INVEST)
ATE Project
DUE-9553696
Catherine Almquist
Trident Technical College
Department of Physical Sciences
P.O. Box 10367
Charleston, SC 29411
FY 1995 $250,647
Environmental Technology

TENNESSEE

Title: Data Acquisition, Manipulation and Presentation in Physics and Physical Science — ILI Project
Bryan H. Long — DUE-9651477
Columbia State Community College — FY 1996 $15,227
Columbia, TN 38402-1315 — Physics

Title: Implementation of a Computer Networking Laboratory — ILI Project
Matthew D. Mills — DUE-9650210
Northeast State Technical Community College — FY 1996 $55,000
Blountville, TN 37617-0246 — Computer Engineering

Title: Implementing the Standards for Introductory College Mathematics Before Calculus — CCD Project
Marilyn E. Mays — DUE-9555059
American Mathematical — FY 1996 ATE $5,014
Association of Two-Year Colleges — (TOTAL $120,014)
Memphis, TN 38134 — Mathematics

Title: Tennessee Exemplary Faculty for Telecommunications Technology — ATE Project
Sydney Rogers — DUE-9602401
Nashville State Technical Institute — FY 1996 $216,622
Department of Technologies — FY 1997 $229,972
120 White Bridge Road — Telecommunications
Nashville, TN 37209

TEXAS

Title: Applying Instrumental Analysis to a Computerized Process — ILI Project
Gary Hicks — DUE-9650996
Brazosport College — FY 1996 $35,684
Lake Jackson, TX 77566-3136 — Chemical Technology

Title: Improved Undergraduate Analytical Chemistry Through Use of Atomic Absorption Spectrometry and UV-Visible Spectroscopy — ILI Project
Connie M. Hendrickson — DUE-9650948
Dallas County Community College System Office — FY 1996 $12,425
Dallas, TX 75202-3201 — Environmental Technology

Title: Panola College Physics Laboratory Improvement — ILI Project
Norma S. Evers — DUE-9650100
Panola College — FY 1996 $19,226
Carthage, TX 75633-2341 — Physics

Title: Building on the Crossroads in Mathematics Standards: A Project to Develop Introductory Mathematics Curriculum Materials — ATE Project
John Souders — DUE-9602361
Center for Occupational Research & Development — FY 1996 $107,817
Department of Curriculum Material Development — Mathematics
601 Lake Air Drive
Waco, TX 76710-5878

Title: Foundation Skills for Advanced Technology
Stephen B. Rodi
Austin Community College
1212 Rio Grande Street
Austin, TX 78701

ATE Project
DUE-9553689
FY 1995 $318,715
Physics

Title: Regional Center of Excellence for Precision Manufacturing Technologies
Wayne Wells
Rio Grande Center for Manufacturing
Director's Office
1201 West University Drive
Edinburg, TX 78539

ATE Project
DUE-9553701
FY 1995 $100,340
Manufacturing

Title: Machine Tool Advanced Skills Technology Educational Resources (MASTER) Program
John D. Pierson
Texas State Technical College - Waco
3801 Campus Drive
Waco, TX 76705

ATE Project
DUE-9553716
FY 1995 $550,000
FY 1996 $500,000
FY 1997 $500,000
Manufacturing

Title: Technical Sciences Academy Proposal
Therese A. Jones
Amarillo College
P.O. Box 447
Amarillo, TX 79178

ATE Project
DUE-9454651
FY 1994 $630,000
Multidisciplinary

Title: Advanced Technical Education (ATE) Alliance
James A. Jordan
Consortium for Advanced Manufacturing International (CAM-I)
1250 E. Copeland Road, Suite 500
Arlington, TX 76011

ATE Project
DUE-9454655
FY 1994 $499,950
FY 1995 $499,950
FY 1996 $499,950
Manufacturing

Title: Southwest Regional Center for Advanced Technological Education
Robert L. Musgrove
Texas State Technical College - Sweetwater
300 College Drive
Sweetwater, TX 79556

ATE Center
DUE-9454643
FY 1994ATE $465,872(TOTAL $565,872)
FY 1995 $585,290
FY 1996 $560,475
Multidisciplinary

VIRGINIA

Title: Technology for All Americans
William E. Dugger
International Technology Education Association
Reston, VA 22090-1539

IMD Project
ESI-9355826
FY 1994 ATE $75,000 (TOTAL $500,000)
ESI-9641641
FY 1996 ATE $50,000 (TOTAL $99,955)
ESI-9626809
FY 1997 ATE $250,000 (TOTAL $501,905)
FY1998 ATE $200,000 (TOTAL $419,755)
FY 1999 ATE $250,000) (TOTAL $539,060)
Technology Education

Title: Faculty Enhancement and Curriculum Development Activities to Improve Advanced Technology Education — ATE Project
DUE-9602397
John Tice
Wytheville Community College
Southwestern Virginia Advanced Manufacturing Technology Center
1000 East Main Street
Wytheville, VA 24382-3308
FY 1996 $136,820
FY 1997 $162,874
Manufacturing

Title: High Quality Biotechnology Education — ATE Project
DUE-9553720
Kathleen Frame
National Association of Biology Teachers
11250 Roger Bacon Drive
Reston, VA 22090
FY 1995 $499,239
Biotechnology

WASHINGTON

Title: Materials Aspects of Manufacturing Technology Institute — ATE Project
DUE-9602360
Thomas Stoebe
University of Washington
Department of Materials
PO Box 2120
Seattle, WA 98195-2120
FY 1996 $218,154
Manufacturing

Title: ChemCore: An Interdisciplinary Approach to Real-World Laboratory Chemistry — ATE Project
DUE-9602403
Mary O'Brien
Edmonds Community College
Department of Chemistry
20000 68th Avenue West
Lynnwood, WA 98036-5912
FY 1996 $399,470
Chemical Technology

Title: Northwest Center for Emerging Technologies: New Designs for Advanced Information Technology Education — ATE Center
DUE-9553727
Neil Evans
Bellevue Community College
3000 Landerholm Circle, SE
Bellevue, WA 98009
FY 1995 $999,737
FY 1996 $992,386
FY 1997 $999,931
Computer and Information Technology

Title: Advanced Technology Curriculum: Meeting AEA Standards — ATE Project
DUE-9553726
Andrew Woodson
North Seattle Community College
9600 College Way North
Seattle, WA 98103
FY 1995 $300,000
FY 1996 $300,000
Electronics

WASHINGTON, DC

Title: Business Alliance for Advanced Technological Education — ATE Project
DUE-9602352
Peter Joyce
National Alliance of Business
1201 New York Avenue, NW
Washington, DC 20005-3917
FY 1996 $199,986
FY 1997 $199,986
Multidisciplinary

Title: Preparation of Technicians for the Biotechnology Industry
Jack G. Chirikjian
Georgetown University
3900 Reservoir Road, NW
Washington, DC 20007

ATE Project
DUE-9553661
FY 1995 ATE $150,000 (TOTAL $250,000)
Biotechnology

Title: Expanding the Network of Community Colleges in Advanced Science and Engineering Technology Education
James Mahoney
American Association of Community Colleges
One Dupont Circle, NW, Suite 410
Washington, DC 20036

ATE Project
DUE-9552975
FY 1995 $237,320
Multidisciplinary

Title: Science Technology: Knowledge and Skills
David K. Lavallee
American Chemical Society (ACS)
1155 16th Street, NW
Washington, DC 20036

ATE Project
DUE-9454564
FY 1994 $500,000
FY 1995 $500,000
FY 1996 $500,000
Chemical Technology

WISCONSIN

Title: ChemLinks Coalition: Making Chemical Connections
Brock Spencer
Beloit College
Chemistry Department
700 College Street
Beloit, WI 53511

CCD Project
DUE-9455918
FY 1995 ATE $100,000 (TOTAL $705,000)
FY 1996 ATE $50,000 (TOTAL $705,000)
FY 1997 ATE $50,000 (TOTAL $705,000)
FY 1998 TOTAL $350,000
FY 1999 TOTAL $350,000
Chemistry

Title: An Advanced Biotechnology Education Partnership Program
Joy A. McMillan
Madison Area Technical College
Department of Biotechnology
3550 Anderson Street
Madison, WI 53704

ATE Project
DUE-9454555
FY 1994 $400,000
FY 1995 $400,000
FY 1996 $200,000
Biotechnology

Title: Establishing New Traditions: Revitalizing the Curriculum
John W. Moore
University of Wisconsin-Madison
Department of Chemistry
Madison, WI 53706

CCD Project
DUE-9455928
FY 1995 ATE $100,000 (TOTAL $849,968)
FY 1996 ATE $50,000 (TOTAL $849,999)
FY 1997 ATE $50,000 (TOTAL $849,941)
FY 1998 TOTAL$499,941
FY 1999 TOTAL $499,742
Chemistry

Index by Type of Technology

Key: **ATE** = Advanced Technological Education, **ILI** = Instrumentation and Laboratory Improvement, **CCD** = Course and Curriculum Development, **IMD** = Instructional Materials Development, **IR** = Institution-Wide Reform of Undergraduate Education, **REU** = Research Experiences for Undergraduates **DUE-**= Division of Undergraduate Education, **BIR** = Biological Instrumentation and Resources, **ESI** = Division of Elementary, Secondary, and Informal Education, and **REC** = Research, Evaluation and Communication

Computer and Information Technology

Western Carolina University	Mark A. Holliday	DUE-9650458	ILI	86
Middlesex County College	David Beyer	DUE-9602375	ATE	33
Bellevue Community College	Neil Evans	DUE-9553727	ATE	23
University of Hawaii-Maui Cmty, College	G. Robert Converse	DUE-9454647	ATE	58
Center for Image Processing in Education	Melanie Magisos	DUE-9454520	ATE	55

Electronics

Oklahoma State Univ.-Okmulgee.	Robert W. Vogt	DUE-9651347	ILI	83
Portland Community College	David M. Hata	DUE-9650916	ILI	78
Maricopa County CC District	Alfredo de los Santos	DUE-9602373	ATE	21
Albuquerque Technical Vocational	Mary Jane Willis	DUE-9602349	ATE	27
New England Board of Higher Education	Nicholas M. Massa	DUE-9553762	ATE	52
North Seattle Community College	Andrew Woodson	DUE-9553726	ATE	51
Indiana University - Bloomington	Elaine M. Cooney	DUE-9553699	ATE	47
Front Range Community College	Brenda L. Bryan	DUE-9553685	ATE	45
CUNY Queensborough Community College	Bernard E. Mohr	DUE-9454613	ATE	56
Drexel University	Bahram Nabet	DUE-9650350	ILI	85

Other Engineering Technology

Wake Technical Community College	Benjamin R. White	DUE-9652146	IR	63
SUNY Institute of Technology at Utica-Rome	Dean Richardson	DUE-9651324	ILI	88
Pennsylvania State Univ., University Park	James Rehg	DUE-9651001	ILI	80
Alabama A&M University	Rhonda Hockelberg	DUE-9650946	ILI	88
Springfield Technical Community College	Peter D. Vangel	DUE-9650745	ILI	77
SUNY College of Technology Farmingdale	Dimitrios Maltezos	DUE-9650653	ILI	87
CUNY Queensborough Community College	David H. Lieberman	DUE-9650617	ILI	75
Trident Technical Colleges	Martha J. Vann	DUE-9650053	ILI	74
College of the Desert	Dan Baxley	DUE-9602448	ATE	39
South Carolina St. Brd. of Tech. & Comp. Ed.	Elaine Craft	DUE-9602440	ATE	21
New Mexico State University	Howard Smolleck	DUE-9602430	ATE	37
Iowa State University	David Holger	DUE-9602370	ATE	32
CUNY Queensborough Community College	Bernard Mohr	DUE-9602369	ATE	32
Purdue University	Dennis Depew	DUE-9602355	ATE	29
Middlesex County College	Jack Waintraub	DUE-9553749	ATE	23
Piedmont Technical College	Lynn Mack	DUE-9553740	ATE	51
Rose-Hulman Institute of Technology	Buck F. Brown	DUE-9553705	ATE	48

Environmental Technology

Dallas County Cmty. College System Office	Connie M. Hendrickson	DUE-9650948	ILI	78
Purdue University	Michael Munoz	DUE-9650891	ILI	87
Columbus State Community College	Wendy McCullen	DUE-9650526	ILI	75
Indiana University Bloomington	Maurice Bluestein	DUE-9650223	ILI	85
Northeast State Technical Community College	Matthew D. Mills	DUE-9650210	ILI	74
Monterey Peninsula College	Nicole Crane	DUE-9602384	ATE	34
Partnership for Environmental Tech. Educ.	Paul Dickinson	DUE-9602365	ATE	31
University of Nevada - Desert Research Institute	Melanie Wetzel	DUE-9602351	ATE	28
Stark Technical College	Jeffrey Cramer	DUE-9553768	ATE	53

Chemeketa Community College	Wynn W. Cudmore	DUE-9553760	ATE	24
Trident Technical College	Catherine Almquist	DUE-9553696	ATE	47
University of Alaska SE Juneau	Gary L. Bowen	DUE-9553680	ATE	45
Eastern Iowa Community College District	Ellen Kabat	DUE-9454638	ATE	25
Mesa State College	Karl F. Topper	DUE-9454633	ATE	57
Intelecom Intelligent Telecommunications	Sally V. Beaty	DUE-9454521	ATE	55

Geographical Information Systems

Holyoke Community College	Gary Beluzo	DUE-9651211	ILI	81
University of Massachusetts Boston	Zong-Guo Xia	DUE-9650395	ILI	86
Geological Society of America	Edward Geary	DUE-9602408	ATE	37
University of California-Santa Barbara	Michael Goodchild	DUE-9602348	ATE	27
Indiana State University	William A. Dando	DUE-9553694	ATE	46
Prince George's Community College	Patricia A. Cunniff	DUE-9553662	ATE	43
Kansas State University-Salina	James L. Keating	DUE-9454618	ATE	57

Manufacturing

Cleveland State University	Frederick Schoenig	DUE-9602457	ATE	40
Edison Industrial Systems Center	Lionel Sully	DUE-9602431	ATE	38
Wytheville Community College	John Tice	DUE-9602397	ATE	35
Oklahoma State University-Okmulgee	Rick Allison	DUE-9602390	ATE	35
University of Washington	Thomas Stoebe	DUE-9602360	ATE	30
West Valley Community College District	Charlotte Behm	DUE-9602345	ATE	27
Mississippi State University	Sandra H. Harpole	ESI-9555646	IMD	70
Keene State College	Robert W. Simoneau	DUE-9553767	ATE	552
Texas State Technical College-Waco	John D. Pierson	DUE-9553716	ATE	50
North Carolina State Board of Cmty. Colleges	J. Parker Chesson	DUE-9553709	ATE	49
Colorado Community College System	Don E. Goodwin	DUE-9553706	ATE	49
Rio Grande Center for Manufacturing	Wayne Wells	DUE-9553701	ATE	47
Wayne State University	Mulchand S. Rathod	DUE-9553692	ATE	46
Johns Hopkins University	Arnold H. Packer	DUE-9553664	ATE	43
Consortium for Adv. Manu.-Interntl. (CAM-I)	James A. Jordan	DUE-9454655	ATE	59
Sinclair Community College	David T. Harrison	DUE-9454571	ATE	25
Minuteman Science & Tech. High School	James Amara	ESI-9453921	ATE	53

Mathematics

Community College Finger Lakes	Carol L. Freeman	DUE-9651271	ILI	82
University of Kentucky	Anthony L. Newberry	DUE-9651142	ILI	81
St. Petersburg Junior College	Sharon Griggs	DUE-9650960	ILI	79
Brevard Community College	Jacquelyn Wozniak	DUE-9650737	ILI	77
CUNY Laguardia Community College	Jorge Perez	DUE-9650658	ILI	76
Capital Community-Technical College	John Pazdar	DUE-9602456	ATE	40
Maricopa County CC District	Alan Jacobs	DUE-9602386	ATE	34
Center for Occupational Research & Devel.	John Souders	DUE-9602361	ATE	30
SUNY at Stony Brook	Alan Tucker	DUE-9555401	CCD	69
Amer. Mathematical Assoc. of Two-Yr. Col.	Marilyn E. Mays	DUE-9555059	CCD	68
SUNY Adirondack Community College	Alfred Patrick	DUE-9553765	ATE	52
Wentworth Institute of Technology	Gary M. Simundza	DUE-9553704	ATE	48

Rensselaer Polytechnic Institute	William E. Boyce	DUE-9552465	CCD	64
University of Pennsylvania	Dennis DeTurck	DUE-9552464	CCD	64
Mount Hood Community College	Catherine Curtis	DUE-9454627	ATE	57
University of Kentucky Cmty. College System	Anthony Newberry	DUE-9454585	ATE	56

Multidisciplinary

Palomar College	Patricia Schmidt	DUE-9651115	ILI	81
Seminole Junior College	Gerhard Laule	DUE-9650726	ILI	77
Harold Washington College	Nancy DeSombre	DUE-9634670	ATE	61
Indian River Community College	Jeanne K. Deisen	REC-9628036	REC	63
Phi Theta Kappa Headquarters	Rod Risley	DUE-9602459	ATE	41
Harvard University	Philip Sadler	DUE-9602404	ATE	36
Colorado State University	Keith James	DUE-9602376	ATE	33
National Alliance of Business	Peter Joyce	DUE-9602352	ATE	28
American Association of Community Colleges	James Mahoney	DUE-9552975	ATE	61
Amarillo College	Therese A. Jones	DUE-9454651	ATE	59
Texas State Technical College-Sweetwater	Robert L. Musgrove	DUE-9454643	ATE	24
West Valley Community College District	Wade Ellis	DUE-9454513	ATE	54
Hawaii Department of Education	Bill Woerner	ESI-9452790	IMD	65
International Tech. Education Association	William E. Dugger	ESI-9355826	IMD	70

Physics

Columbia State Community College	Bryan H. Long	DUE-9651477	ILI	84
College of the Redwoods	David S. Mills	DUE-9651375	ILI	83
Central Maine Technical College	Alfred Amatangelo	DUE-9651318	ILI	83
Central Oregon Community College	Bruce Emerson	DUE-9651038	ILI	81
Purdue University	Purna C. Das	DUE-9650594	ILI	86
Panola College	Norma S. Evers	DUE-9650100	ILI	74
Austin Community College	Stephen B. Rodi	DUE-9553689	ATE	46
Seminole Community College	Alexander K. Dickison	DUE-9553665	ATE	44
Dickinson College	Priscilla W. Laws	DUE-9455561	CCD	68
Concord Consortium	Robert Tinker	DUE-9454575	ATE	56
American Institute of Physics	Michael Neuchatz	DUE-9453180	ATE	61
American Association of Physics Teachers	Mary Beth Monroe	DUE-9450160	ATE	62

Telecommunications

Minnesota Riverland Techn. College-Austin	Michael P. Seymour	DUE-9651242	ILI	82
Springfield Technical Community College	Kirk T. Smallman	DUE-9650693	ILI	76
Springfield Technical Community College	Gary Mullett	DUE-9602433	ILI	38
Nashville State Technical Institute	Sydney Rogers	DUE-9602401	ATE	35

Index of Principal Investigators

W

X

* ATE Center

DIVISION OF UNDERGRADUATE EDUCATION
DIVISION OF ELEMENTARY, SECONDARY AND INFORMAL EDUCATION
ADVANCED TECHNOLOGICAL EDUCATION PROGRAM STAFF
FOR FY 1995[1]

Division Directors

Robert F. Watson, DUE	
Margaret B. Cozzens, ESIE	

ATE Section Heads

Duncan McBride, DUE	Physics, Astronomy
Wayne W. Sukow, ESIE	Physics

ATE Lead Program Directors

Gerhard Salinger, ESIE	Physics
Elizabeth Teles, DUE	Mathematics

ATE Program Staff

Ashok Agrawal, DUE*	Engineering
Rodney Custer, ESIE*	Technology Education
J.D. Garcia, DUE*	Physics
Michael Haney, ESIE	Technology Education
Jack Hehn, DUE	Physics
Dan Hodge, DUE	Engineering
Donald Jones, ESIE	Chemistry
Bettye Blakney-Lawrence, DUE*	Life Sciences
Patricia Morse, ESIE	Biology
David Mogk, DUE*	Geology
Herbert Richtol, DUE	Chemistry
Paul Rodgriquez, DUE*	Biology
John Rudzki, DUE*	Engineering
Janet Rutledge, DUE	Engineering
Chalmers Sechrist, DUE*	Engineering
Frank Settle, DUE	Chemistry
Ted Sjoerdsma, DUE	Computer Science
Joseph Stewart, ESIE	Technology Education
Margaret (Peggie) Weeks, DUE	Engineering
Terry Woodin, DUE	Biology
Lee Zia, DUE	Mathematics

ATE Staff

Tim Kashmer, Program Assistant, DUE
Melissa Lee, Senior Program Assistant, ESIE
Lori-Anne Mooney, Science Education Analyst, DUE*

[1] All individuals listed contributed to the FY 1996 Advanced Technological Education Program.
* These individuals contributed to the FY 1996 Program but are no longer at NSF.