Assessing the Impact and Effectiveness of the Advanced Technological Education (ATE) Program

Information to Guide Science, Mathematics, Technology, and Engineering Educators' Technical Education Efforts Into the 21st Century

Status Report I
The Nature of the ATE Program

May 2000

Preface

This document was prepared as a collaborative effort by all of this project's staff.   Sharon Barbour, Frances Lawrenz, Gloria Tressler, and Arlen Gullickson contributed portions of the document and collaborated on preparation of the combined full document. David Toh helped in the development of spreadsheet databases to summarize data and organize information. Christine Hummel and Brian Carnell contributed clerical support. Evaluators from several projects--Norm Gold, Ann Igoe, Gloria Rogers, and Lester Reed reviewed a preliminary draft of this report and provided feedback and suggestions for improvement.

Just as the ATE program is evolving, so too has this first status report. Prepared as a means to help us understand the ATE program and make preparations for forthcoming survey and site visit efforts, we took this opportunity to develop a preliminary set of findings.

We prepared a summary of findings as a final step in preparation of the report and placed it at the close of the report. At the suggestion of one the project's consultants, we moved that summary to the beginning. We hope that reading the summary of findings will prompt reading of the full document.

Assessing the Impact and Effectiveness of the Advanced Technological Education (ATE) Program

This evaluation project seeks to assess the impact and effectiveness of the Advanced Technological Education (ATE) program. As stated in its proposal to the National Science Foundation (NSF), the project intended to address four basic questions important to ATE and its stakeholders: (1) To what degree is the program achieving its goals? (2) Is it making an impact, reaching the individuals and groups intended? (3) How effective is it when it reaches its constituents? (4) Are there ways the program can be significantly improved? This is the first of three status reports that will focus on these questions.

This report addresses on the nature of the ATE program and describes the work done by the Advanced Technological Education Program. It will also begin to assess the congruence between the goals of the ATE program and its funded projects[1].

The report serves two purposes. First, information used in this report was gathered to give us a clearer understanding of the ATE program. That understanding provided the basis for design and development of evaluation instruments and procedures. Second, the ATE program is of direct interest to a wide array of educators, especially those in associate degree institutions, and to the general public. Congress specifically stated its strong interest in this program by passing the "Scientific and Advanced-Technology Act" (October 23, 1992). This status report is intended to help these audiences better understand the ATE program.

The various audiences are likely to have different reasons for attending to this report. We expect many persons to read the report to assist their own understanding, perhaps to help prepare grant applications to the ATE program. We expect those who participated in the federal legislation process and/or in developing the ATE program to read it with interest to determine whether the program is developing as expected. We anticipate that NSF ATE program staff will already know most, if not all, information contained in this report. Thus, the report will help us to confirm that we have a clear, correct, general understanding of the ATE program.

We gathered information for this report in several ways. We met with NSF staff on several occasions, queried them about the ATE program, and obtained numerous documents that described the Congressional action and law leading to the program, and program itself. Dr. Arlen Gullickson, Project Director of the ATE Program Evaluation, and Ms. Sharon Barbour, Project Coordinator, reviewed project information maintained by NSF. Dr. Frances Lawrenz, Senior Associate of the ATE Program Evaluation, made two trips to NSF. In the first visit, Dr. Lawrenz collected information about the ATE program operation via interviews with program staff. In the second visit she observed the panel review process where ATE obtains field-based evaluative input regarding funding proposals submitted by institutions and organizations. All three persons--Barbour, Gullickson, and Lawrenz--attended and participated in at least one annual PI meeting in Washington, DC. Dr. Gullickson attended two meetings (1998 and 1999). Ms. Barbour and Dr. Lawrenz also attended the 1999 meeting. Additional information about the program and individual projects was obtained from meetings and discussions with project staff there. Finally, substantial information was obtained from The American Association of Community Colleges (AACC) and from "visits" to individual project web sites.

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[1] The ATE program funds both centers and projects. Centers are generally larger, more complex, and are expressly identified as centers. We will refer to projects and centers as projects, except where we explicitly refer to centers to distinguish them from projects.

This report begins with a summary and then is divided into five parts. Part 1 provides an overview of the program including brief descriptions of the origins of the ATE program. It also includes the legislation that called for the program, the purposes the program is intended to serve, and the current structure and size of the program. Part 2 addresses the programmatic nature of the ATE program as implemented by NSF and the mechanisms it uses to provide grant support to educational institutions and organizations. Part 3 describes the ATE centers; while Part 4 addresses ATE projects. Part 5 contains the appendices, which include brief summaries of selected projects and centers, an expanded review of one center, and notes about data discrepancies and inconsistencies.

Summary of Findings

This report is a preliminary description of the ATE program. In addition, it begins the assessment of the congruence between the stated goals of the program and its accomplishments. The report provides a summary of the program's activities at the NSF and project levels.

The basis for the ATE program lies in the Scientific and Advanced-Technology Act of 1992. That Act directs the NSF ATE program to make awards primarily to associate-degree-granting colleges and to various groupings of educational institutions or organizations to assist them in providing education in advanced-technology fields. The program is complex, consisting of many different components and variations within these components. Projects are grouped into 20 technical areas that range from agriculture to information technology to semiconductor manufacturing. Each targets a particular technician work force field and is expected to address one or more of five primary ATE program objectives:

1. Develop model instructional projects in advanced technology fields
2. Provide professional development to faculty and instructors in advanced technology fields
3. Establish innovative partnership agreements
4. Acquire and implement state-of-the-art instrumentation
5. Develop and disseminate instructional materials

From the inception of the program in August 1993 through April 2000, 256 project awards have been made. Nineteen of these awards were to projects also designated as centers. Centers are larger, receive funding for multiple years, generally address all 5 program objectives rather than 1 or 2, and disseminate information to a designated region. Presently there are 11 centers throughout the United States.

This report presents information and findings based on several types of data: publications such as those reporting Congressional mandates and NSF program descriptions, project abstracts, NSF award data, several in-depth project reports, and other documents. Our description of NSF procedures is based on interviews with NSF program managers. Centers are described using a summary table, brief narratives, and a detailed description of one center. Projects are described with a summary table, brief narratives of some projects, and a synthesized description of 10 projects. These descriptions reveal a variety of technologies, collaborations, instructional programs, professional enrichment opportunities, and materials development.

Our analysis of these preliminary data indicates that the ATE program is meeting its overall Congressional mandate to enhance the training of technicians by using the capacity of the nation's two-year colleges. Project abstracts and other descriptions show they plan to meet

objectives specified for the ATE program. Actual accomplishment of the objectives is less clear but appears to be moving in a positive way. Eight specific findings are elaborated below.

Finding 1. The ATE program is consistent with its original Congressional mandate.

Two primary indicators show the congruence between the ATE program and the Congressional mandates. First, the NSF publications and guidelines for funding explicitly and consistently demonstrate that it intends to fulfill the purposes and objectives identified in the Scientific and Advanced Technologies Act of 1992 (cf. the program's announcement for the year 2000 at http://www.nsf.gov/pubs/2000/nsf0062/start.htm). Second, our review of 77 abstracts and a more in-depth review of approximately a dozen funded projects found all to be directly focused on objectives that are consistent with the stated ATE objectives and the undergirding public law.

Implications/Recommendations: Continue to organize and conduct ATE work to be congruent with the congressional mandate. Because the ATE program is so directly regulated by federal law and funding acts, the program should annually review the actions of the program to ensure compliance with the Scientific and Advanced Technologies Act of 1992 and subsequent legislation.

Finding 2: There is good alignment between the goals of the ATE program and the goals of the funded projects.

In a sample of 77 published project abstracts for 1998 and 1999 (66 projects and 11 centers), all abstracts identified objectives consistent with one or more ATE program objectives. There is also a good distribution of projects for each of the four objectives. At least two primary program objectives could be identified in 95 percent of the abstracts reviewed. Of the five objectives, the most common objective was materials development (90 percent). Different types of collaborations (e.g., with business and industry) could be identified in 85 percent of the abstracts. One objective was seldom addressed. Only 5 percent specifically mention instrumentation (acquisition and implementation of state-of-the-art instrumentation) as an objective.

Informal discussions with project staff as well as NSF program officers suggest that projects do request and receive funding for purchase and implementation of instruments. Program officers specifically note that many project budgets contain these requests. When purchase and use of instrumentation equipment is essential to achieving other stated objectives, projects may have viewed a separate description as redundant. Moreover, for this specific objective of acquisition and implementation of state-of-the-art instrumentation, NSF also offers the Instrumentation and Laboratory Improvement (ILI) program. It is possible that projects are directing their instrumentation funding requests via this alternate route.

Implications/Recommendations: Project objectives generally match the work prescribed by Congress and the NSF ATE program from which they obtain their funds. In the case of the reported low emphasis on instrumentation, two actions seem warranted. First, the budget sections of a sample of projects should be checked to confirm project attention to the instrumentation. If the actual number of projects with instrumentation objectives is indeed low, additional attention and support should be given to this objective. Second, because the abstracts provide the public view of ATE program efforts, projects should be strongly encouraged to ensure consistency between their stated objectives and their budgeted work.

Finding 3: Two-year institutions of higher education play lead roles in this program.

The ATE program consistently involves the nation's two-year institutions of higher education. They are given the majority of program awards. In turn, many of them work with other institutions at the secondary school and baccalaureate levels. All centers are located at or are closely affiliated with two-year institutions, and other awardees often include two-year institutions in substantial ways. For example, in a sample of 66 current projects, 44 abstracts (67 percent) identify collaborations between community colleges and business and industry.

Implications/Recommendations: ATE is meeting the requirements of the undergirding public law to use the resources of the nation's two-year associate-degree-granting colleges to expand the pool of skilled technicians. The procedures employed by ATE to involve associate-degree-level institutions appear to be sound. The ATE program should continue its current efforts to ensure the central role of associate-degree-level institutions in its grant awards.

Finding 4: The program focuses on improving the nation's work force capabilities in science, mathematics, and technology.

Our review of project, and program materials finds that all projects focus on development of products (e.g., preparation of course materials), instructional programs, professional development, or collaborations that directly and indirectly serve to improve work force capabilities. There is great variety in the technical areas covered by the ATE program, and funding varies across the areas. Twenty different technology categories are listed for the projects and nine different areas for the centers. Funding for the centers is greater for environmental technology, engineering technology, and information technology. Funding for projects is greater for manufacturing and industrial technology, multidisciplinary fields, and information technology.

Although the available information describes an abundance of work being done, there is less information available on whether these projects effectively address the work force needs of the nation as a whole. For example, we uncovered no "national assessment of work force needs" in our initial study of the ATE program.

The apparent lack of assessed national work force needs seems to arise from two factors. First, the ATE program mandate calls for funding of associate-degree-level institutions. Such institutions serve local and regional areas. Second, the ATE program is required to fund proposals based on merit. As such, a national needs assessment could not effectively serve ATE's determination of grant awards.

Some needs-based data are available. ATE program officers told us that they rely on individual projects to provide evidence of work force needs in proposals submitted for funding. Our review of abstracts and other project materials provided examples where the funded projects indicated that they had conducted needs assessments and intend to address the specific technology needs of their local area or region. How large a role these assessed needs play in the decisions to make awards is not clear. Also, we did not find evidence to show how effective projects have been in addressing needs.

Implications/Recommendations: Because the program is predicated upon addressing "shortages of scientifically and technically trained workers in a wide array of fields" [Scientific and Advanced-Technology Act of 1992, Sec 2. (a) (4)], it is incumbent upon the program to

assess needs and to the extent possible fund projects to meet those needs. The evaluation survey efforts and site visits will provide a more careful look at this. More importantly, the program can demonstrate its compliance by regularly reporting on the needs-assessment efforts conducted by the funded projects. Those studies should demonstrate individually and in aggregate that the program is directed toward well-documented work force needs. These needs can then be developed into clear, realistic objectives upon which indicators of progress can be constructed and measured. Additionally, the program should encourage needs assessments or analyses that include documentation of the political environment necessary to achieve the goals of the project. For example, training technicians who do not ultimately have the industry-authorized certification or who cannot transfer their training into other programs is counterproductive.

Finding 5: Sustainability of accomplishments and dissemination of lessons learned and materials and processes developed need more attention.

The abstracts and reports we reviewed often stated the project's intention to change academic programs, disseminate course materials, and to conduct professional development activities. However, we found little information on how the sites planned to do this. Such plans would provide good evidence of the follow-through needed to actually accomplish project goals and to produce something that is sustainable.

The funding guidelines call for development of materials, instructional programs, collaborative arrangements, and professional development programs that will be sustained beyond the grant award term. Published criteria pertaining to the review process give limited attention to this matter. For example, the current statement on proposal review information (http://www.nsf.gov/pubs/2000/nsf0062/start.htm#review, 8/15/00) provides three exemplars that fairly directly addresses the issue of sustainability: (1) "Are the proposed activities integrated into the academic program(s) of the participating institution(s)?" (2) "Are the results of the project likely to be useful at other institutions?" and (3) "What is the potential for the project to produce widely used products that can be disseminated through commercial or other channels? Are plans for producing, marketing, and distributing these products appropriate and adequate?" These criteria seem heavily oriented toward materials development as opposed to instruction or other processes. None of the criteria addressed sustainability of collaborative arrangements and at best only indirectly address professional development.

Implications/Recommendations: The issue of sustainability and actual dissemination of lessons learned needs to be an integral part of the evaluation of the ATE program. These matters must be addressed in this evaluation's surveys and site visits. Additionally, this preliminary review suggests that ATE would be well served to identify what it considers to be key indicators of growth toward sustainability and dissemination. These indicators and project accomplishments relative to the indicators can then be embedded in guidelines for ATE proposals and expectations for annual project reports.

Finding 6: Evaluation is underemphasized in the ATE projects.

The reviewed materials and interviews with NSF staff indicate that limited information is available on the actual outcomes of the projects. Annual progress and evaluation reports provide some data, but reports on outcomes are rare. Several project abstracts mention collaborations with advisory boards, industry consultants, and other experts. It is possible that

these persons and groups serve in evaluation roles. But such evaluative roles were not described.

Evaluations can be expected to provide substantial information on outcomes, but not all evaluation reports are available, not all projects have evaluators, and some evaluations do not provide useful information. The lack of substantive evaluation is especially crucial given that many of the two-year institutions and their faculty are new to the grant business. Proposal writing and project management are recently gained skills. Recognition of the need for management skills is important, and competent evaluators could play an important role to help managers conduct their projects.

Implications/Recommendations: Evaluation can and should encompass data gathered from a variety of project efforts that are not always thought of as evaluative in nature (e.g., advisory boards, peer visits, industry checks, and site visit teams). These groups should be explicitly included in project planning to serve the evaluation needs for the projects. Early and consistent involvement of evaluators can help in planning and using such information to serve management and accountability needs. We recommend that the ATE program work directly with and support project efforts to identify ways to improve their use of evaluators and the usefulness of evaluations obtained.

Finding 7: The ATE program is evolving in terms of management, types of projects, and definitions of components.

Two branches of the Directorate for Education and Human Resources jointly manage the ATE program: the Division of Undergraduate Education (DUE) and the Division of Elementary, Secondary, and Informal Education (ESIE). Across time these two branches and the lead persons from each branch, Dr. Teles from DUE and Dr. Salinger from ESIE, appear to have developed clear ideas of how to balance the work between these divisions. There appears to be good communication across divisions, and the staff serving ATE is committed to implementing a strong program.

The guidelines for development of proposals and the types of proposals funded have changed across years. Each year guidelines differ from those of the previous year in discernable ways. These changes show an evolving program. Importantly, in this evolution abstracts show a consistent alignment of project goals with the ATE program goals. Both the observation of the panel review process and other interactions with NSF staff suggest that this alignment results from the program's focus on coherence between guidelines and awards. The program has also funded special projects that help to meet the overall program goals in more indirect ways (e.g., annual PI conferences).

The documents reviewed for this report were inconsistent in some of the technology field designations. These inconsistencies appear to result from changes in the ways the terms are being used in real world environments as well as some changes in work being done by individual projects. These variations, in turn cause some difficulties in tracking funding by technology field categories. The inconsistencies also extended to the manner in which each year's awards were tallied in terms of number of awards and what types of awards are included in these numbers. Also inconsistencies occurred in the way funding amounts were designated in indices, tables, and on web sites. For example(s), an award in the 1996 version of a publication is listed as "Environmental Technology," but then the same award in the 1997 version of the same publication is listed as "Marine Technology, Aquaculture"; a 1995 award

year publication lists 36 "new" regular projects for that fiscal year in its introductory section and then has 37 "new" regular projects in its index.

Implications/Recommendations: The ATE program appears to be effectively managing the inevitable changes that occur with a new program. Though "dual management" complicates such development, this program appears to be handing the process well. The reporting inconsistencies noted here can lead to misunderstandings. All ATE program information sources should be clearly labeled and documented. As changes occur, the changes should be footnoted in new documents so that changes can be readily traced across time and reasons for the changes understood.

Finding 8: The ATE program clearly promotes diversity of the work force. Whether such diversity is being achieved could not be determined from our preliminary review.

The ATE program directly promotes the inclusion of traditionally underrepresented groups such as women, African Americans, Latino/Hispanic Americans, and special needs populations in the technician work force. Diversity is approached through two main channels. The funding guidelines and ATE program staff encourage projects to recruit a diverse group of students and other participants. ATE also funds projects that serve minority institutions. As a result, many projects appear to be addressing these issues, but information about activities and accomplishments in these areas is not readily available.

Implications/Recommendations: We encourage the ATE program to define and describe indicators that projects should use to show accountability and to annually publish the findings and strategies used to gain diversity. We know that the ATE program has already taken some steps in this direction in concert with center evaluators although, to our knowledge, the process has not been completed.

Part I - Overview

Origins of the ATE Program

The Advanced Technological Education (ATE) program grew out of a national interest in and concern for a balanced approach to developing and using technology[2] to meet the nation's educational and work force needs. The importance of such initiatives is clearly developed and described in *Technology for All Americans: A Rationale and Structure for the Study of Technology* (1996) and *Gaining the Competitive Edge: Critical Issues in Science and Engineering Technician Education* (1993). As those documents indicate, this country has a critical need for trained, professional technicians with unique skills in technology and technological systems. These persons must be educated to serve emerging needs of business and industry and must be able to work on applications that build on theoretical understandings.

On October 23, 1992, Congress passed the *Scientific and Advanced-Technology Act of 1992* (PL 102-476), which called for the National Science Foundation (NSF) to establish a national program to improve the education for technicians in advanced technology fields. Table 1 identifies the primary issues that led Congress to pass this act.

Based on those issues, the Act was intended to serve the ultimate goal of improving the competitiveness of the U.S. in international trade by increasing the productivity of the nation's industries, which in turn was to be accomplished by increasing the pool of skilled technicians in *strategic* advanced-technology fields. It is noteworthy that Congress emphasized the role of two-year colleges for this program. As House Report 102-508, p. 4 states, " Two-year colleges are a major contributor to higher education and have become the largest pipeline to postsecondary education in the United States. In 1990, 1350 two-year colleges enrolled approximately 5 million students, representing 43 percent of all undergraduate students and constituting 40 percent of all institutions of higher education. Approximately 30 percent of students enrolled in two-year colleges transfer to four-year colleges and universities."

Additionally, Congress sought to define and delimit what it included in the realm of advanced technology. As stated in the bill, "the term 'advanced technology' includes advanced technical activities such as the modernization, miniaturization, integration, and computerization of electronic, hydraulic, pneumatic, laser, nuclear, chemical, telecommunication, fiber optic, robotic, and other technological applications to enhance productivity improvements in manufacturing, communication, transportation, commercial, and similar economic and national security activities."

This increased pool of technicians was to be accomplished through a direct focus on and funding of targeted educational programs. Congress identified four purposes to be served by the Act (see Table 2).

ATE Program Purposes

NSF initiated a new program, Advanced Technological Education (ATE), to address the Congressional mandate. The ATE program was created in the Education and Human Resources Directorate (EHR) and co-managed by two Divisions, the Division of Undergraduate

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[2] "technology" is defined as the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, applied science, and pure science.

Education (DUE) and the Elementary, Secondary, and Informal Education Division (ESIE). ATE set its goal as expanding the pool of skilled technicians in strategic advanced-technology fields. It focused its funding efforts at the community college level in order to strengthen and expand the scientific and technical education and training capabilities of associate-degree-granting colleges. ATE set priorities for what types of work would be supported and how it would allocate funding (see Table 3).

Table 1. Issues That Led Congress to Pass the Scientific and Advanced-Technology Act of 1992

< "the position of the United States in the world economy faces great challenges from highly trained foreign competition

< the work force of the United States must be better prepared for the technically advanced, competitive, global economy

< the improvement of our work force's productivity and our international economic position depends upon the strengthening of our educational efforts in science, mathematics, engineering, and technology (SMET), especially at the associate-degree level

< shortages of scientifically and technically trained workers in a wide variety of fields will best be addressed by collaboration among the nation's associate-degree-granting colleges and private industry to produce skilled, advanced technicians

< the NSF's traditional role in developing model curricula, disseminating instructional materials, enhancing faculty development, and stimulating partnerships between educational institutions and industry, makes an enlarged role for the Foundation in scientific and technical education and training particularly appropriate"

Source: Scientific and Advanced-Technology Act of 1992, Public Law 102-476, S. 1146, 102d Congress, 138 Congressional Record 2297-2301 (1992)

Table 2. Purposes to Be Served by the Scientific and Advanced-Technology Act of 1992

1. Improve science and technical education at associate-degree-granting colleges

2. Improve secondary and postsecondary school curricula in mathematics and science

3. Improve the educational opportunities of postsecondary students by creating comprehensive articulation agreements and planning between two-year and four-year institutions

4. Promote outreach to secondary schools to improve mathematics and science instruction

Source: Scientific and Advanced-Technology Act of 1992, Public Law 102-476, S. 1146, 102d Congress, 138 Congressional Record 2297-2301 (1992)

Table 3. Objectives to be Served by ATE Centers and Projects

1. Develop model instructional programs in advanced-technology fields

2. Provide professional development of faculty and instructors in advanced-technology fields

3. Establish innovative partnership arrangements that

    a. Strengthen the relationships between associate-degree-granting colleges and secondary schools in the communities

    b. Build strong working relationship between the associate-degree-granting colleges and the businesses, industries, and other appropriate public and private sector entities that need skilled technicians in their work forces

    c. Provide for private sector donations, faculty opportunities, etc.

4. Acquire and implement state of the art instrumentation

5. Develop and disseminate instructional materials

Source: Scientific and Advanced-Technology Act of 1992, Public Law 102-476, S. 1146, 102d Congress, 138 Congressional Record 2297-2301 (1992)

Grant awards are made in two categories, centers and projects, with centers receiving substantially more funds and having a broader scope. Each center or project uses these funds to develop technicians for a particular field. Table 4 provides a year-by-year breakdown of grant awards for both projects and centers.

The *Scientific and Advanced-Technology Act of 1992* mandated that the number of centers not exceed 10, but placed no limits on the number of other types of awards to be funded. To date the ATE program has funded centers at 11 locations, 1 more than approved. The expansion to 11 appears to be the result of NSF negotiations with Congress, though not codified in law.[3] As such the program appears to be consistent with Congressional expectations, if not the letter of the 1992 law. Additionally, the discrepancy appears to be brief in nature as one center completes it funding period on August 31, 2000 and two others complete their funding within the last quarter of the year 2000.

While a project tends to focus on only one or two of the above objectives, centers typically address all or most of the objectives. Centers always receive funding for multiple years, serve as model programs for other institutions and organizations, and disseminate information to a region (e.g., several states or the nation as a whole). Initially the number of centers to be

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[3] Dr. Norman Fortenberry's email message on Tuesday, August 29, 2000, 4:45 PM to Elizabeth Teles and James Lightbourne and copied to Gerhard Salinger states, "NSF's public budget documents do speak to supporting additional centers with additional funds in ATE. For example, the public version of the FY-99 budget request indicates, 'An increase of $2.29 million results in one new multi-organizational center and up to four new individual projects.'"

developed was set at a maximum of 10. In the first 2 years, 6 centers received funding; by 1998 10 centers were in operation, and in 1999 that number was increased to 11.

Advanced technology and the need for technicians is an ever-growing field and includes a broad array of disciplines. As such, what constitutes an advanced technological field is not simply defined. Any list is likely to either not fully describe current technician options and opportunities or miss emerging opportunities that NSF will see fit to fund in the future. In Parts 3 and 4 of this document we briefly describe the various technical field areas the projects and centers intend to serve. Those descriptions remain tentative as the respective fields change quickly and the centers and projects themselves evolve.

Table 4. Grant Award Summary by Year				
Year	Number of New Awards	Median Length of Award (years)	Median/Average Annual Award	Total Funding Amount
Projects				
1994	37	3	$100,000 / $158,644	$17,609,500
1995	46	3	$78,553 / $117,562	$16,223,645
1996	35	3	$128,000 / $141,838	$14,892,975
1997	41	2	$199,528 / $210,250	$17,240,520
1998	38	2	$192,330 / $237,343	$18,038,051
1999	40	3	$136,662 / $165,435	$19,852,141
Centers				
1994	3	3	$999,955 / $845,723	$7,611,503
1995	3	3	$997,351 / $972,663	$8,753,969
1996	2	3	$765,841 / $765,841	$4,595,046
1997	5	3	$666,667 / $750,063	$11,250,943
1998	4	3	$666,657 / $749,741	$8,996,886
1999	2	3	$666,667 / $666,667	$4,000,000

Sources:
 - *Advanced Technological Education Program Awards and Activities,* 1994-1998
 - NSF web site: www.nsf.gov/verity/srchawdf.htm for 1999
Notes:
 - Median annual award was calculated by dividing the median award by the median award length
   (in years) for the ATE program year in question.
 - Average annual award was calculated by dividing the average award by the median award length
   (in years) for the ATE program year in question.
 - The number of awards for ATE centers reflects a total of 11centers (sites) and the fact that some
   of them have had renewed funding.

Program Structure and Size

Operationally, the ATE program is straightforward. The program solicits and reviews preliminary proposals from institutions and their partners. The preliminary proposals are reviewed, and feedback is provided to applicants, together with an overall judgment as to whether or not a full proposal is encouraged. The applicants, regardless of the ATE program feedback, can then submit a full proposal. Submitted full proposals are reviewed and funded on a merit basis. Funded institutions then use the grant fund to conduct the proposed project/center.

Program officers handle oversight of grant awards. The nature and extent of oversight varies depending on the size of the grant. NSF hosts annual PI meetings for all projects, which provide opportunities for interactions among projects and with program officers. Small project monitoring appears to depend upon interactions between the program officer and the project director. Large projects (e.g., over $500,000 per year) and all centers are expected to have advisory boards or National Visiting Committees that review grant activity and productivity and provide input to the grant director and to NSF.

ATE made its first grant awards in the summer of 1994. As Table 4 shows, by the close of the 1999 fiscal year, the ATE program had made 19 center and 237 project awards for $45,208,347 and $103,856,832 respectively. Because award length typically varies from 1 to 3 years, the number of active projects climbed steadily for the first 3 years of the program and then began to stabilize. Currently, the program has approximately 120 active grants.

In addition, the ATE program provides some funding each year (estimated at less than $100,000 per year) to projects that are managed by other NSF programs. The ATE co-funding helps ensure an emphasis on the education of technicians within these projects. Because other programs manage these projects, they are not considered to be ATE projects (correspondence with Corby Hovis, 3/23/00).

As the data in Table 5 indicate, the centers receive approximately 30 percent of annual funding. The program's current annual funding exceeds $31 million.

The ATE Program and Evaluation

ATE oversight. The ATE program is subject to evaluation and oversight from several NSF bodies. These include the Committee of Visitors, three-year systemic reviews, federal reporting requirements for the Government Performance and Results Act (GPRA) of 1993, and this project's external evaluation study of the ATE program.

Reports (e.g., from the first three-year systemic review) and other documents created to serve these other ongoing evaluative efforts have provided important background information for this project's planning for evaluation of the ATE program. However, GPRA has most directly influenced this project's evaluation efforts. GPRA requires all federal agencies to develop indicators of progress and to then use these to report on achievement of goals and objectives. GPRA seeks to shift the focus of government decision making and accountability away from a preoccupation with the activities that are undertaken—such as grants dispensed or inspections made—to a focus on the results of those activities, such as real gains in employability, safety, responsiveness, or program quality.

Currently, the federal government requires an annual report on productivity from all of NSF per the Government Performance Results Act (GPRA). In 1999 ATE began preparing annual responses for GPRA that are folded into the larger NSF responses to the government. Because both the GPRA requirements and the ATE program continue to evolve, developing evaluation indicators that effectively address GPRA questions is like shooting at a moving target. For example, there is no clear assurance that collecting the same type of information that served the GPRA response in 1999 will be responsive in 2000.

Table 5. ATE Center and Project Funding				
Year	Projects		Centers	
	Number of Awards	Award Totals[a]	Number of Awards	Award Totals[a]
1994	37	$17,609,500	3	$7,611,503
1995	46	$16,223,645	3	$8,753,969
1996	35	$14,892,975	2	$4,595,046
1997	41	$17,240,520	5	$11,250,943
1998	38	$18,038,051	4	$8,996,886
1999	40	$19,852,141	2	$4,000,000
Total	**237**	**$103,856,832**	**19**	**$45,208,347**

Sources:
 - *Advanced Technological Education Program Awards and Activities,* 1994-1998
 - NSF web site: www.nsf.gov/verity/srchawdf.htm for 1999 awards
Notes:
 - This table does include special projects.
 - Sixteen planning grants, not included in this table, were awarded in 1994 with an ATE program funding total of $844,232.
 [a] Due to shared funding across programs, the total amount of the listed awards is not congruent with funding provided by the ATE program

In 1999 NSF determined that, based on NSF's strategic plan, the ATE program contributes to NSF Outcome Goal 3, which calls for "a diverse, globally oriented work force of scientists and engineers." Therefore, ATE's performance and progress under this Act will be judged to be successful to the extent that funded projects meet the following indicators:

1. Participants in ATE activities experience world class professional practices in research and education, using modern technologies and incorporating international points of reference.
2. Academia, government, business, and industry recognize projects' and/or participants' quality.
3. The science and engineering work force shows increased participation by underrepresented groups.

Part 2 - The ATE Program

This section provides an overview of the ATE program at NSF as conducted by ATE program officers.   This portion of the report is based on perusal of NSF documents, interviews with NSF personnel involved with the ATE program, and supporting information that they provided. Persons interviewed include Elizabeth Teles from the Division of Undergraduate Education (DUE); Gerhard Salinger from the Division of Elementary, Secondary and Informal Education (ESIE); Don Jones from ESIE; Tom Howell from DUE; and Conrad Katzenmeyer from the Division of Research, Evaluation, and Communication (REC). An interview was also conducted with West Ed, the company contracted briefly to conduct an evaluation of the ATE program. This section relies heavily on the perspectives and opinions of the NSF program staff members as a means to describe the work and productivity of the ATE program staff.

History

The first question after the passage of the *Scientific and Advanced Technology Act of 1992* was whether NSF should present the ATE program as a distinct entity or as combined within several existing programs. This issue was intertwined with others surrounding the interpretation of the major impetus of the ATE program. Many thought the main impetus suggested by the Act was for a new program focused on the education of skilled technical workers at associate-degree-granting institutions. Others at NSF thought that the real thrust of the program involved broader issues of work force capacity building and that many of these broader issues were already being addressed by existing NSF programs.

The two areas of NSF that were most involved in programs that addressed purposes similar to those of the proposed new ATE program were the Division of Undergraduate Education (DUE) and the Division of Elementary, Secondary, and Informal Education (ESIE). DUE focused on improving undergraduate education across a broad array of institutions, and ESIE focused on improving curricular materials and achieving excellence in professional development for science, mathematics, and engineering. Discussions designed to determine how best to deliver the program resulted in the establishment of a new, distinct ATE program that was administered jointly across DUE and ESIE. In this way the efforts in the two divisions to advance programs that complemented the goals of ATE could be integrated with efforts to advance the ATE program. At the time of the *Scientific and Advanced-Technology Act of 1992*, seven American Association of Community Colleges (AACC) fellows were working at NSF. Several of these individuals helped directly with the development and implementation of the new ATE program.

Working together, these two NSF divisions developed and nurtured the ATE program into what it is today. The NSF commitment to involving faculty from associate-degree-granting institutions also continues. Two of the original seven AACC fellows now serve as ATE program officers, and NSF has recruited other community college level staff to serve the ATE program.

ATE Program Management

The NSF program officers' vision of ATE has been one of a coherent program, not a series of projects. This focus on coherence is important because ATE is created from two separate NSF divisions--DUE and ESIE--and is led by two Lead Program Directors: Dr. Elizabeth Teles from DUE and Dr. Gerhard Salinger from ESIE. ATE program officers come from both divisions and serve both the ATE program and their respective divisions. Although dual allegiance of program

officers could lead to fragmentation of ATE projects and competition to serve the separate division objectives, this has not happened.   Coherence is obtained through use of grant portfolios, collaboration across portfolio and DUE-ESIE lines, cross-fertilization with other NSF programs, an extensive support system for proposal developers, a strong merit-based review and funding process, and attention to emerging needs of proposers from the two-year colleges.

Altogether, about 20 program officers from both DUE and ESIE serve in the preproposal and full proposal review processes. Approximately one-third are from ESIE and two-thirds are from DUE. Although each project has only one manager from either DUE or ESIE, program officers have portfolios of funded projects based on work force needs. This helps to make the project-based approach more comprehensive and provides cross-fertilization.

To further promote the goal of coherence, there have been meetings for projects to share what they have learned. This sharing is extended to the National Visiting Committees (NVC) for the large projects and centers, where committees cross-reference each other, with principal investigators or NVC members on one project serving on the NVC for another. The NSF program managers report that these opportunities for communication and collaboration have led to an esprit de corps among the projects, with few feelings of competition. The ATE Center PIs offered a joint presentation at a national meeting. Having the block of centers together presented a unified picture of their accomplishments where all gained prestige from one another. Linked to these opportunities for sharing, the program officers thought there was also a growing sense of connectedness among the high schools, two-year colleges, and four-year colleges.

Program officers gave two other examples of cross-fertilization. One was the impact of the new Course, Curriculum and Laboratory Improvement (CCLI) program on ATE. The CCLI program highlights the need for funding directed toward the adaptation and implementation of existing curricular materials or instructional methods. This notion was carried into the ATE program, which now has funding for these types of activities as well.

The second example is the effect the ATE program has on the NSF program officers. Many program officers are not familiar with the capacity and opportunity that is available in the community college setting. Working with the ATE program provides these program officers with valuable insights. Opportunity for insight is strengthened by the way the ATE program is spread out across many program officers and two divisions.

The ATE program is funded and run on an annual award cycle. This cycle divides into four distinct but interrelated phases: dissemination of application information and proposal guidelines, review of preliminary proposals, review of formal proposals and determination of grant awards, postaward monitoring and support of centers and projects that have been funded.

<u>Dissemination of application information and proposal guidelines.</u> Each year the information about the program is disseminated in a variety of ways: through the presence of NSF staff at various meetings such as those of the American Association of Community Colleges, through web-based publications, and through a variety of NSF and project-based printed materials (e.g., *Synergy,* March 1999). Most directly, the ATE program annually announces the availability of funds and provides guidelines via a common description in DUE and ESIE publications to institutions and individuals who may desire to submit proposals to receive those funds. Because the ATE program is announced by both DUE and ESIE, the program effectively gets double exposure.

The current ATE program announcement is available on the web at <http://www.nsf.gov/pubs/2000/nsf0062/start.htm>. Preliminary proposals were due by May 25, 2000, and full proposals are due by October 19, 2000. The announcement's introduction states:

> This program promotes improvement in technological education at the undergraduate and secondary school levels by supporting curriculum development; the preparation and professional development of college faculty and secondary school teachers; internships and field experiences for faculty, teachers, and students; and other activities. With an emphasis on two-year colleges, the program focuses on the education of technicians for the high-technology fields that drive our nation's economy. The program also promotes articulation between programs at two-year colleges and four-year colleges and universities--in particular, articulation between two-year and four-year programs for prospective teachers and between two-year and four-year programs in science, mathematics, engineering, and technology (with a focus on disciplines that have a strong technological foundation).

Proposals are solicited in two major tracks: projects and centers. Projects may include the design and implementation of new courses, laboratories, and educational materials; the adaptation and implementation of exemplary curricula and programs in new educational settings; the preparation and professional development of college, faculty, and secondary school teachers; internships and field experiences for students, faculty, and teachers; or national conferences, workshops, and similar activities focusing on issues in technological education. Centers serve as national or regional hubs with a comprehensive mission. Centers engage in the full range of activities described for projects, provide models and leadership for other projects, and act as clearinghouses for educational materials and methods.

This year the program has identified the following new emphases:

❑   Regional Centers for manufacturing or information technology education

❑   Articulation Partnerships between two-year colleges and four-year colleges and universities that have two foci:

  • The role of two-year colleges in the science, mathematics, and technology preparation of prospective K-12 teachers
  • Students' transition from associate's degree programs in science, mathematics, engineering, or technology to related bachelor's degree programs, especially those having a strong technological basis.

During the most recent funding year, the program announcements set deadline dates of April 14, 1999, and October 14, 1999, for receipt of preliminary and formal proposals respectively (see, for example, *The Undergraduate Education Science • Mathematics • Engineering • Technology Program Announcement and Guidelines,* NSF, 99-53). ATE received 132 preliminary proposals from potential applicants. Following its review and feedback to those who submitted preliminary proposals, it received 98 proposals for its funding consideration.

As this report is being prepared, ATE staff are making final decisions and anticipate making 39 awards, a funding rate of approximately 40 percent.   Funding for the coming year is expected to increase by approximately $10 million over funding in 2000.   As a result, the program

anticipates making approximately 75 awards in 2001 for a total amount of approximately $41 million.

Once funding determinations have been made, ATE program officers provide general oversight to the projects, read annual reports, serve as ex-officio members of National Visiting Committees, and assist the funded projects in various additional ways. The funded project's director is required to conduct the proposed work within the time frame specified in the award and meet NSF and their local institution's requirements in such matters as budget, employment practices, and the like. [The NSF document *Grant General Conditions (GC-1)*, October 1998, identifies 41 compliance points in an 11-page document.] As part of these expectations and requirements, each project director/principal investigator is expected to attend the annual ATE meeting of principal investigators, report annually on project progress, and submit a final report of project accomplishments and project budget accounting to NSF. Project staff now comply with reporting requirements by inputting data to FastLane <http://www.fastlane.nsf.gov/>, which is an NSF web-based system for data entry.

Review of preliminary proposals. ATE program staff conduct an extensive preliminary proposal process, which provides detailed feedback on initial proposals. Proposers are given feedback to help them improve their proposals and, when appropriate, encouraged to develop full proposals. When the ATE program first began, this feedback was provided by panels similar to those constituted for advising the actual funding process. Groups of five or six people would write their responses to the preproposals, and these responses were provided to the proposers. Although this process worked well, it was thought that the proposers would benefit from more focused feedback. To provide that focus, this past year a small group of people, selected for their expertise and ability to provide quality feedback, reviewed preliminary proposals. Each reviewer read and commented on about 15 preliminary proposals. These comments were provided to the program officers,who then wrote their own detailed responses to the proposers as well. Initial feedback to program officers suggests that this process provided the proposers with more usable feedback because of the combination of the outsider review and the detailed knowledge of the NSF program officer.

Review of formal proposals and determination of grant awards. Selection of proposals for funding is based on a panel review process. The full proposal review process operates like that for other NSF programs, with panels of five to six persons assigned a set of proposals to be evaluated. The panelists are selected by NSF program officers and are scientists, educators, and specialists knowledgeable in the fields being addressed by the proposals. Panelists come from high schools, two- and four-year colleges, professional societies, government agencies, and industry. All panelists receive, read, and rate these proposals prior to participating in a two-day panel review meeting in Washington, DC.

At the meeting, panel members discuss and make final recommendations about all proposals in their assigned set. All panels meet at the same time and are given a common set of instructions. NSF program officers serve as resource persons to the panels at these meetings.

Following the group discussion of an individual proposal, each panelist finalizes his/her rating and critique of the proposal. Like their initial premeeting ratings, panelists record their finalized ratings in an NSF database through its "FastLane" web interface. Presumably, this database can serve to verify ratings in case questions arise in the final processing of proposals. Although panels summarize their discussion and findings for individual projects in different ways, one panel member typically will draft a full panel summary statement, share it with the other panel members, and then the panel as a whole will reach consensus on the summary

statement. Through these summary statements and the individual written reviews, panels provide advice for funding, including which projects are first or second priority or not competitive.

After the panel meetings the program officers meet to discuss panel findings and recommendations. As this suggests, the panel recommendations are integral to program officers' funding decisions and a primary means by which NSF seeks to ensure validity in its grant-funding decisions.

Funding is based on merit. That is, proposals are grouped based on proposal quality. Therefore, the process is somewhat independent of the national work force needs except insofar as the proposals are required to show need for the proposed program.

Because of the importance of the panel reviews, Dr. Lawrenz attended the most recent panel meeting on December 2-3, 1999. She used that opportunity to gain a better understanding of the process and to provide evaluative feedback to the ATE program. Following the panel meeting she provided a report to NSF giving her description of the meeting along with findings and recommendations.

Post award monitoring and support. When funded, the projects are separated into groups (portfolios) based on the discipline area addressed. Two to three program officers manage each portfolio of projects. There is no "typical" program load since the program officers are involved in ATE to different extents. The range is from 3 to 20 or more. All projects and centers have 1 prime program officer although, in the case of the large centers, 2 officers may work jointly. Permanent staff rather than rotators generally manage centers. (Rotators are professionals who come to NSF from funded institutions, work at NSF for 1 to 3 years, and then return to their home institutions.)

This evaluation project provides perhaps one of the more complicated examples of ATE project oversight. ATE and the Research, Evaluation, and Communications Division jointly fund the evaluation. The official program officer for the grant is Dr. Katzenmeyer, whose involvement ensures both a level of compliance with NSF requirements and provides needed separation and independence of the project from the ATE program. This enables the project to conduct its work without interference from or being unduly influenced by ATE program staff. Matters of compliance such as budget, annual reports, and staffing are addressed with and by Dr. Katzenmeyer. For example, the project submitted its annual report via FastLane, and Dr. Katzenmeyer approved it. Similarly, he acted upon the project's request for use of carryover funds from year 1 to year 2.

To facilitate the evaluation work, the project works directly with both Lead Program Directors, with Dr. Salinger serving as the primary contact. Our project staff has met with Drs. Salinger and Teles on several occasions. Both attended our project's 1999 Advisory Panel meeting. Dr. Salinger regularly reviews draft materials (e.g., the survey of ATE projects) and distributes it to other NSF staff members for input. He responds to e-mail requests and, where needed, directs questions to other NSF staff members.

The Changing Nature of the ATE Program

In the opinion of the program officers interviewed, the ATE program leadership and program announcements have gained clarity and sophistication as NSF understands more about the needs in technological education. Different themes have emerged over the years (e.g.,

information technology), and the program has remained flexible to support the broad range of issues. At the beginning there was more emphasis on professional development and creation of instructional materials. More recently the program has placed more emphasis on dissemination and use of developed materials and methods through the support of consortia that work together to promote increased use. These emphases show up in the projects being funded, as described in Parts 3 and 4 of this report.

The program officers interviewed see the ATE program as one way to introduce the two-year colleges to the broad range of programs available to them and to teach them how to be successful in obtaining funding. They think this has worked well so far.

When the ATE program began, the program officers reported that the proposals received were not generally well constructed. Consequently, the ATE program officers have provided many opportunities for proposers to improve their proposal writing skills and to become more familiar with the other programs available to them at NSF and other federal agencies. The extensive feedback provided as part of the preproposal process is one example of this assistance. The program officers report that this has resulted in more success for the two-year colleges in obtaining funding, especially from the former Instructional and Laboratory Improvement program (ILI) and the current CCLI program in DUE. They report talking more with community college personnel and think more community colleges send in proposals. The program officers also report an overall increase in NSF funding for community colleges, particularly from a large number of ILI and networking awards in the $100,000 to $250,000 range.

While the quality of proposals has increased, the number of proposals appears to have decreased. This has occurred despite NSF's efforts to introduce colleges to the program and increased funding to two-year colleges. Program officers note an overall decline in the numbers of proposal submissions including the numbers from two-year colleges within the past few years for Course and Curriculum Development (CCD), UFE, and ILI.

In the opinion of the program officers, it is likely that in the future the ATE program will continue as a standard program offering at the present or slightly elevated funding levels. The proposal pressure for ATE has been fairly flat at about 120-150 proposals per year with a slight decline in preproposals over the past few years.   Appendix D provides an overview of the most recent application process and results. The program plays well with the public and fits the growing interest in economic development. It also helps to counteract the somewhat elitist image of NSF as being interested in only Ph.D. level scientists, mathematicians, and engineers.

At the time program officers were interviewed in 1999, they indicated their belief that as the ATE program matures, there will be changes in emphases. Some apparent issues that may drive these changes are listed below:

> There may be a need for one or two more centers in emerging areas.

> New pedagogical issues may arise, such as the use of case studies for technicians.

> Recruitment will continue to be an important issue.

> • There may be a move toward serving more people who are working, but presently undereducated or in need of updating.

- The most critical issue in recruitment is guaranteeing that the ATE projects reflect work force needs (i.e., getting students to enroll in programs that prepare them for high demand jobs).
- The program will continue to focus on developmental learning because many of the students entering two-year colleges are underprepared in some critical areas.

Partnerships with industry should continue to increase and strengthen.

ATE program offerings need to be linked across levels to provide students with the potential for a seamless articulation of their studies from high school through four-year or advanced degrees.

Several of these points are already visible in the guidelines for 2001 funding.

Part 3 – ATE Centers

This section provides overview information about the centers by identifying what appear to be the major objectives of centers generally and their fit with stated ATE program objectives This approach was taken as a means to gain general understanding of centers and also to identify special issues that might arise in the construction of instruments and planning for site visits to centers. Please see Appendix A for brief summaries of selected centers and Appendix B for one center's activities described in greater detail.

As noted in the introduction section, data were gathered from a variety of sources. First, we perused materials available at NSF. Second, we reviewed previous reports created by NSF sources; NSF abstracts of centers, available in print and on the web; and a focused description in the NSF publication, *Synergy* (March, 1999). Third, we accessed the web sites provided by the respective centers. These web sites provide extensive information about centers and their work and accomplishments.

Centers typically receive initial support for three years at $1 million per year for a total of $3 million. Centers are expected to generate additional support and funding from collaborating partners in education, business, and industry. To date, centers that have completed their initial three years have to date received a second three-year award for a reduced amount of approximately $2 million for the three-year period. This reduced level of funding is consistent with the NSF expectation that centers develop other resources to sustain them for the long term.

Table 6 provides a summary of center funding organized by technology field.   As the table shows, the centers currently address 8 technology fields. No technology field has more than two centers addressing different aspects of that field. As a result, while the total amount of money spent, $45 million, seems large, the actual amount devoted to any one field of technology is modest and spread over a substantial span of time.

Major Center Objectives and Their Fit with ATE Objectives

Table 7 lists major center objectives using the previously identified ATE program objectives. This table also suggests that each center's proposed objectives target all the identified ATE program objectives except one, which addresses acquiring and implementing state-of-the-art instrumentation. Typically, each center's abstract has stated or implied areas of emphasis. However, each center also addresses the broader array of objectives as well. It is quite likely

that each center has requested monies for state-of-the-art equipment, but has not identified such requests as being central objectives for the center. The table illustrates several points:

- ❑ All are developing new instructional programs in their targeted fields.
- ❑ All provide professional development of faculty and instructors in advanced-technology fields.
- ❑ All focus on establishing innovative partnership arrangements with collaborating education institutions, businesses, industries, and/or public and private agencies serving the targeted work force area.
- ❑ None specifically targeted the acquisition and implementation of state-of-the-art instrumentation.
- ❑ All engage in development and dissemination of instructional materials

Consistently, those centers that have been funded for their second three years extend their reach through greater collaboration and additional focus on dissemination of programs, materials, and information both regionally and nationally.   In every case the centers' objectives and stated plans of actions seem directly in line with the ATE program objectives.

Table 6. Center Funding by Targeted Technology Fields for the Years 1994-1999

Technology Field	Number of Awards	Number of Centers	Funding	Percentage of Funding
Biotechnology	1	1	$2,999,995	7%
Electronics, Instrumentation, Laser and Fiber Optics	1*	1*	$2,645,046	6%
Engineering Technology (General)	4	2	$8,716,473	19%
Environmental Technology	4	2	$9,992,258	22%
Information Technology, Telecommunications	3	2	$7,991,995	18%
Manufacturing and Industrial Technology	2	1	$5,000,000	11%
Marine Technology	1	1	$2,997,246	7%
General, Multidisciplinary, or Interdisciplinary	2	1	$2,865,334	6%
Semiconductor Manufacturing	1*	1*	$2,000,000	4%
Totals	**19**	**12***	**$45,208,347**	**100%**

Sources:
- *Advanced Technological Education Program Awards and Activities, 1994-1998*
- NSF web site: www.nsf.gov/verity/srchawdf.htm

Notes:
- Technology fields for 1999 were designated by The Evaluation Center because the NSF publication of the <u>ATE 1999 Awards and Activities</u> booklet was not available.
- *One center was initially funded under the Electronics technology field and was later re-funded under the Semiconductor Manufacturing technology field.

Table 7. Targeting of Work Objectives by Centers Noted by the Year of New or Renewed ATE Award

Name of Center	Year of Funding	Work Objective Targeted by Center with Examples			
		Program Improvement	Professional Development	Collaboration	Materials Development and Dissemination
Southwest Center for Advanced Technological Education	1994	*developing new AAS programs in polymer and electromechanical technology		*collaboration with 2-,4-year colleges, universities, industries, and Tech Prep consortia in 3 states	converting courses for delivery via distance learning
	1997	*developing new AAS programs in polymer and electromechanical technology	*increasing its role in professional development of faculty	some course being developed in coordination with other ATE centers	development and testing of courses that require a hands-on laboratory component
National Center of Excellence for Advanced Manufacturing Education	1994	*developing new seamless curriculum from grade 11 through associate and bachelor degrees		joint effort of Sinclair Community College and the University of Dayton	*writing, pilot testing, and publishing curricular materials
	1997	*developing interdisciplinary curricular material leading to associate's degree in manufacturing engineering technology	*faculty developmental workshops for high school, community college, and university educators	*partners with Miami Valley Tech Prep Consortium, manufacturers, and several others/ funded in part by the NSF's ATE program	*curriculum materials emphasize hands-on problem solving
Advanced Technology Environmental Education Center	1994	developing standards for teaching and curriculum in environmental education	comprehensive programs of professional development	partners with HMTRI, PETE, and University of Northern Iowa Center for Environmental and Energy Education	dissemination of information by serving as national clearinghouse of environmental information
	1997	program improvement in the nation's community colleges and secondary schools	professional development	supported through public and private partnerships	advance environmental technology education through curriculum development

Table 7. Targeting of Work Objectives by Centers Noted by the Year of New or Renewed ATE Award

Name of Center	Year of Funding	Work Objective Targeted by Center with Examples			
		Program Improvement	Professional Development	Collaboration	Materials Development and Dissemination
Northwest Center for Emerging Technologies	1995	***develop new associate's and baccalaureate degrees**	faculty-industry fellowships	***develop the Regional Advanced Technology Education Consortium**	***specialized technical curriculum for Information Technology**
	1998	***provide students with pathways to new Information Technology and Advanced Technology degrees**	professional development of faculty	collaboration with Harcourt Brace, the Gartner Group, and the Educational Development Center	***dissemination of best practices in Information Technology education**
New Jersey Center for Advanced Technological Education	1995	***create new program called "Mecomtronics"**	professional development for teachers and faculty	each component of Center's efforts coordinated by one of six academic institutions in its consortium	instructional materials development
	1998	developed the Mecomtronics Engineering Technology Program	professional development for academic and industry personnel	moving toward increasing level of self-sufficiency (financially) through marketing of its products and services	***disseminating innovative curricula and instructional materials**
Northwest Center for Sustainable Resources	1995	***connection of programs leading to bachelor's and advanced degrees in the field of natural resources**		faculty internships bringing real-world experience to its programs	***development and enhancement of natural resources curricula**
	1998	***produce national models for high school and technical natural resource and environmental science programs**	***faculty and teacher enhancement institutes**	***collaborative effort of partners from Oregon, Washington, and Northern California**	***curriculum being developed and disseminated by 5 lead-site colleges and 6 test-site colleges**

Name of Center	Year of Funding	Work Objective Targeted by Center with Examples			
		Program Improvement	Professional Development	Collaboration	Materials Development and Dissemination
Maricopa Advanced Technology Education Center	1996	***to increase the number of students, especially women and minorities…for…the semiconductor manufacturing/supportive industries**	technical and instructional support and access to resources for faculty and trainers	faculty internships/ partnership with giants like Intel, Motorola	***to create new curricular systems/materials**
	1999	possible development of a certification of semiconductor manufacturing technicians	promotion of faculty development opportunities	seeking to become a self-sustaining entity via collaboration with industry	***development of over 100 instructional modules**
South Carolina Advanced Technological Education Center of Excellence	1996	particular emphasis on attracting women and underrepresented minorities	faculty development emphasizes use of interdisciplinary and intercampus teams	project work teams made up of industry representatives, high school teachers, college and university faculty, and others	engineering technology core curriculum reform using a systems-based approach
	1999	to increase…diversity of engineering technology graduates throughout the state's 16 technical colleges	implementing a model of faculty development		continuing development of pre-engineering technology and first-year engineering technology curricula
The Northeast Center for Telecommunications Technology	1997	***recruiting and educating a diverse student population including nontraditional workers**	***ensuring continuing competency of faculty**	***partners from the telecommunications industry, government agencies, community and technical colleges, six senior institutions, secondary schools, and the New England Board of Higher Education**	***developing and disseminating relevant curricula and materials**

Table 7. Targeting of Work Objectives by Centers Noted by the Year of New or Renewed ATE Award

Name of Center	Year of Funding	Work Objective Targeted by Center with Examples			
		Program Improvement	Professional Development	Collaboration	Materials Development and Dissemination
Marine Advanced Technology Education Center	1997	*development of national standards…will lead to standardized certificates and degree programs	*summer institutes for faculty	*development of ongoing funding and in-kind support to sustain the center	*creation of a clearinghouse to disseminated curricula and information
Bio-Link	1998	*implement new programs/ recruit and retain underrepresented minorities	*professional development activities including hands-on laboratory training	*paid instructor internships/ collaboration with six regional centers, baccalaureate institutions, industry, high schools, and national laboratories	*identifying and testing instructional materials

Work Objectives Key:
"Program Improvement": Develop model instructional programs in advanced-technology fields
"Professional Development": Professional development of faculty and instructors in advanced-technology fields
"Collaboration": The establishment of innovative partnership arrangements that
 - strengthen the relationships between associate-degree-granting colleges and secondary schools in the communities
 - build strong working relationship between the associate-degree-granting colleges and the businesses, industries, and other appropriate public and private sector
   entities that need skilled technicians in their work forces
 - provide for private sector donations, faculty opportunities, etc.
"Materials Development & Dissemination": The development and dissemination of instructional materials
Notes and Sources:
 - An asterisk (*) denotes objectives identified as receiving special (greater) emphasis
 - Examples of each targeted work objective are phrases or paraphrases of information found in the following sources:
   Advanced Technological Education Awards and Activities, 1994-1998; the NSF web site: www.nsf.gov/verity/srchawdf.htm with reference to specific award numbers,
   especially for 1999 awards
 - Scientific and Advanced-Technology Act of 1992, Public Law 102-476, S. 1146, 102d Congress, 138 Congressional Record 2297-2301 (1992)

Part 4 – ATE Projects

This section first provides overview information about the projects as a whole, followed by an analysis of the objectives and activities of projects funded in 1998 and 1999 and more in-depth descriptions of ten projects. As noted in Part 1, data were gathered from a variety of sources. For this part of the report, information was drawn from various NSF documents, but primarily the award and activities booklets from 1994-1998. In addition, NSF-ATE web sites provided some query data, particularly for 1999, and Corby Hovis at NSF provided some information regarding NSF's definitions and data management for ATE. Data for the more in-depth descriptions of ten projects were obtained from a review of project materials at NSF. See Appendix E for information on possible sources of data discrepancies and inconsistencies.

Overview of the Projects

ATE projects are generally funded for 3 years with some projects receiving funding for 1 or 2 years. A few early projects received 5 years of funding, contingent upon a 3-year review. Grants for projects have ranged from $25,000 to $1.7 million, but most are in the $25,000 to $300,000 per year range (Program Solicitation NSF 00-62, p. 8). Most projects receive their total funding in 1 lump sum, although some are funded in 1-year increments (correspondence with Corby Hovis at NSF). The total amount of funding available to the projects exceeds the NSF-awarded amount because of funding available to the projects from other sources. According to *Advanced Technological Education Program 1998 Awards and Activities* (page 2), "official cost-sharing in the program is about 35 percent of NSF funds; however, project reports show that institutions are leveraging NSF funds with other funds better than 1:1."

Table 8 provides a summary of project funding organized by the year of funding and the type of institution that is funded. The ATE program made 237 awards over 6 funding cycles to support project work. These awards have totaled approximately $104 million and represent approximately 70 percent of the allocation between projects and centers. An estimated 54 percent of awards have been made to 2-year community and technical colleges, 23 percent to 4-year colleges and universities, and 23 percent to other types of organizations. As of February 29, 2000, a query of the NSF web site shows that ATE supports a total of 112 active projects across the country.

As shown in Table 9 the ATE projects currently represent 20 technology fields (including a "general or multidisciplinary" category). To date, projects addressing the Manufacturing and Industrial Technology field have received the most support, approximately one-sixth of the projects and funding provided, while no projects have been funded in the Marine Technology field.

Table 8. Project Awards by Type of Funded Institution for Years 1994-1999

| Year of Funding | Type of Funded Institution | | | | | | Total Funding for Year |
| | Two-Year College | | Four-Year College | | Other (Association, Society) | | |
	Number of awards	Percentage of funding for year	Number of awards	Percentage of funding for year	Number of awards	Percentage of funding for year	
1994	25	68%	4	11%	8	22%	$17,609,500
1995	22	48%	14	30%	10	22%	$16,223,645
1996	12	34%	13	37%	10	29%	$14,892,975
1997	18	44%	9	22%	14	34%	$17,240,520
1998	21	55%	11	29%	6	16%	$18,038,051
1999	30	75%	3	8%	7	18%	$19,852,141
TOTAL	**128**	**54%**	**54**	**23%**	**55**	**23%**	**$103,856,832**

Sources:
 - *Advanced Technological Education Program Awards and Activities*, 1994-1998
 - NSF web site: www.nsf.gov/verity/srchawdf.htm
Notes:
 - The type of institution was determined by The Evaluation Center.
 - These data do not include co-funded, supplemental, or planning grants.
 - Planning Grants: 16 planning grants, not included here, were awarded in 1994 with an ATE
   program funding total of $844,232.

Table 9. Project Funding by Targeted Technology Field for the Years 1994-1999

Technology Field	Number of Awards	Percentage of Total Awards	Funding for Specific Technology Field	Percentage of Total Funding
Agriculture	4	1.8%	$1,024,387	1.0%
Aquaculture	2	0.9%	$497,657	0.5%
Biotechnology	20	9.0%	$8,441,099	8.5%
Chemical Technology	14	6.3%	$7,886,871	7.9%
Distance Learning	2	0.9%	$688,999	0.7%

Table 9. Project Funding by Targeted Technology Field for the Years 1994-1999

Technology Field	Number of Awards	Percentage of Total Awards	Funding for Specific Technology Field	Percentage of Total Funding
Electronics, Instrumentation, Laser and Fiber Optics	10	4.5%	$3,931,567	3.9%
Engineering Technology (General)	10	4.5%	$3,181,360	3.2%
Environmental Technology	18	8.1%	$9,032,490	9.1%
Geographic Information Systems	8	3.6%	$4,071,224	4.1%
Graphics and Multimedia Technology	8	3.6%	$4,054,927	4.1%
Information Technology, Telecommunications	22	10.0%	$11,832,854	11.9%
Mathematics	15	6.8%	$4,425,519	4.4%
Manufacturing and Industrial Technology	33	15.0%	$15,634,713	15.7%
Machine Tools Technology, Metrology	4	1.8%	$2,069,484	2.1%
Marine Technology	0	0.0%	$0	0.0%
General, Multidisciplinary, or Interdisciplinary	31	14.0%	$14,249,995	14.3%
Other	4	1.8%	$3,106,064	3.1%
Physics	9	4.1%	$2,565,367	2.6%
Semiconductor Manufacturing	4	1.8%	$1,726,224	1.7%
Transportation	3	1.4%	$1,199,969	1.2%
Totals	**221**	**100%**	**$99,620,770**	**100.0%**

Table 9. Project Funding by Targeted Technology Field for the Years 1994-1999				
Technology Field	**Number of Awards**	**Percentage of Total Awards**	**Funding for Specific Technology Field**	**Percentage of Total Funding**

Sources:
 - *Advanced Technological Education Program Awards and Activities*, 1994-1998
 - NSF website www.nsf.gov/verity/srchawdf.htm
Notes:
 - This table does not include Special Projects, Planning Grants, Supplemental Grants, Supplements of an Outreach Grant, or Instrumentation and Laboratory Improvement funds.
 - Technology fields for 1999 were designated by The Evaluation Center because the NSF publication of the ATE 1999 Awards and Activities booklet was not available. Thus, some of the 1999 projects may actually be "Special" projects.

Objectives of Projects Funded in 1998-99

In order to better understand the emphases prevalent among the ATE projects, project abstracts for projects funded in 1998-99 were analyzed. These show that although the ATE projects focus their activities more narrowly than centers, they are still multifaceted. The following examples of project titles provide some insight into the variety of work being done by projects: "Distance Learning and Virtual Laboratories for Technician Training," "Integrated Mathematics and Physics for Technical Programs," "Development of a Two-Year Associate Degree in Agricultural Technology," and "High Quality Biotechnology Education."

The ATE program also funds "special projects" or projects with a "special activities" focus. These projects generally are designed to increase understanding of advanced technological education-related issues via organizing conferences, offering workshops, or conducting studies. The scope of these projects is typically national and the duration short in comparison to other projects. Examples of special projects include a research project examining "Case Studies of Mathematics in ATE Projects" and a national conference entitled "Forging Connections Between Business, Education, and Government for Strengthening Technological Skills Among Urban Students."

The abstracts reviewed show that strategies for program improvement include establishing articulation pathways between secondary, two-year and four-year colleges, and universities; providing faculty development opportunities; improving laboratories; and providing technical experiences for students, faculty, and teachers. Industry collaborations are included to improve the alignment of learning activities with work place needs and to facilitate on-site and hands-on experiences for students. Project staff say they will attempt to promote the involvement of underrepresented groups, for example, by recruitment of Native Americans. They also plan to disseminate their products and work widely.

Figure 1 presents the percentages of projects listing core ATE program objectives in their abstracts. The core program objectives include "Collaboration," "Materials Development and/or Dissemination," "Professional Development," "Program Improvement," and "Instrumentation and/or Laboratory Improvement." "Collaboration," as depicted in Figure 1, is defined by the working relationships between the funded institution and other entities. "Collaboration" is also separated into three subcategories: "Collaboration #1" indicates partnerships between educational institutions, "Collaboration #2" is concerned with business and industry, and "Collaboration #3" reflects cooperative relationships that provide private monetary support and/or faculty opportunities for professional growth. From Figure 1 we note that "Materials Development/Dissemination" is the most prevalent targeted objective at 90 percent. "Instrumentation" is the least commonly targeted objective at less than 1 percent. All other identified objectives were listed as primary objectives by at least half of the reviewed projects. The small percentage for "Instrumentation" is most probably due to underreporting. Even though informal discussions with project/center staff and NSF program officers indicate that projects routinely use or request support for equipment, that equipment is likely to be used in conjunction with program improvement, materials development, or other broader objectives, which may be more commonly mentioned in the project abstracts. Additionally, the requirement that projects must provide matching costs for equipment may reduce the amount of equipment requested.

Figure 1. Work Objectives Targeted by Sampled Projects
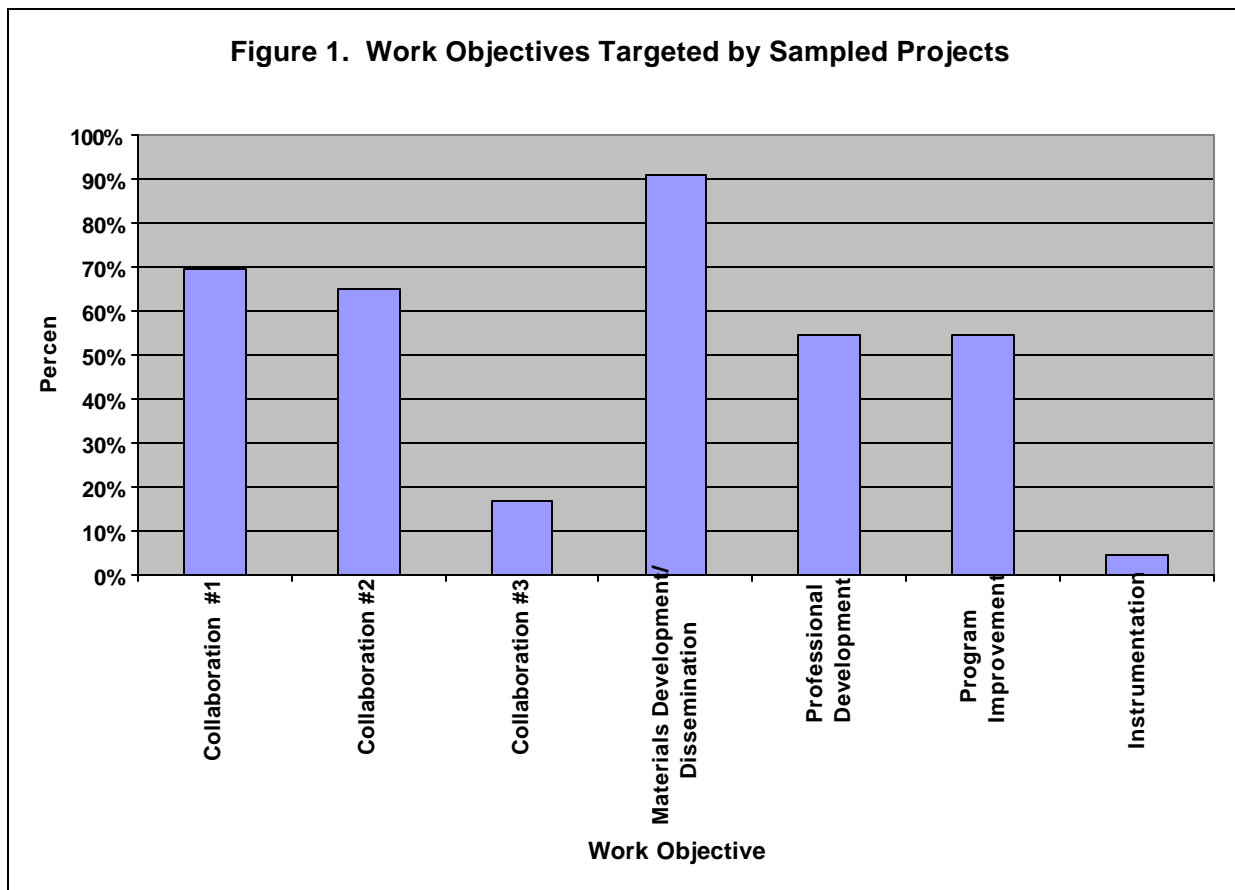
A More Detailed Look At Ten ATE Projects

This section presents the results from a review of 10 sets of project materials and includes information on project goals, activities and outcomes[4]. The characteristics of the final sample are presented in Table 10. The sample includes projects from 5 different years, 10 different fields, and 5 different types of institutions; funding levels that range from $83,333 - $200,000 per year for an average of $144,782; and project durations ranging from 12 to 48 months.

Available material for our review included a large amount of information, such as project proposals, review summaries, annual reports, site visit reports, correspondence, etc. A list of materials to consider was developed after examining all the materials for one project and receiving advice from NSF staff. All of the materials in the list were looked for in the 10 sets of proposal information, and the available information was consolidated. Some of the materials on the list were not applicable to every project, and not all projects had all applicable materials. Several annual reports and most final reports were not available for review. Information on project goals, activities, and outcomes is presented in the next sections followed by a section analyzing the match of the information to ATE program goals.

Project Goals and Activities

The diversity of work in the ten projects is seen in the following list of projects' goals:

- Development of a new chemistry text and CD-ROM
- Enhancement of a biotech education project
- Development of a revised articulated coherent mathematics curriculum
- Development of an integrative classroom
- Identification of visualization technician skill sets
- Development of an on-line classroom and laboratories in engineering technology
- Integration of educational technologies into earth and space science curricula
- Development of a new environmental technology option at a community college
- Provide assistance in the coordination, review, and dissemination of ATE work
- Development of a degree program in electric vehicle engineering technology

Some of the ten projects were starting from scratch with their work and others were building on existing programs or materials. In this sample, one project is developing a new degree program in a specific technology field while another is revising a basic course within SME (Science, Math, and Engineering) for use at the community college level. Another is developing course modules to be used together as a course package or separately as an addition to an existing course. Others are developing course materials that include, but are not limited to, textbooks, teacher handbooks, laboratory experiments, and supplementary materials such as videos and handouts. Most of the courseware appears to strive to utilize current technologies. For example, one project is using the World Wide Web as an instruction medium as well as distributing some multimedia course content on CD-ROM.

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[4] Originally 26 projects were selected to offer a diverse view of the projects by technology field, size of award, location, product type (e.g., materials development, program improvement), institution type, and number of years funded. The final set of projects was constrained by the time required to amass and review materials and availability of project information.

Table 10. Characteristics of Sampled Projects

Year of Funding	Technology Field	Number of Years Funded	Total Funding Amount	Type of Funded Institution
1994	Biotechnology	3	$250,000	four-year college
1994	Multidisciplinary	4	$475,000	Other-Secondary
1994	Mathematics	4	$469,923	two-year college
1995	Chemical Technology	2	$191,590	two-year college
1995	Environmental Technology	3	$516,219	two-year college
1996	Geographic Information Systems	3	$594,869	Other-Society
1996	Information Technology	3	$600,000	two-year college
1997	Graphics and Multimedia Technology	1	$96,959	two-year college
1997	Special Project	2	$396,937	Other-Association
1998	Transportation Technology	3	$500,000	two-year college

Many of these projects include faculty enhancement workshops aimed at preparing instructors to use the new curricula and technologies effectively in their classrooms. These efforts often include follow-up sessions several months to a year later. One project provides ongoing support to faculty via a web-based discussion group and "office hours." A "special project" describes the work of other projects and centers and seeks to increase awareness of the ATE program in general. Another project hopes to replace or supplement the traditional high school classroom format with an environment where traditional discrete disciplines are integrated and build upon each other. In this project the students would be exposed to more hands-on learning and "working life" skills such as time management and task planning. Other projects include identifying skill sets needed in particular fields and developing on-line classrooms and laboratories.

Almost all of these projects use collaborative relationships to strengthen their work. Of these relationships, collaborations with major corporations in the project's vicinity are most common.

Companies reportedly provide consultants, faculty fellowship opportunities, student internships, and less often, grants and cost-sharing funds. The industry consultants provide projects with input into skill requirements, relevance of course content, and examples of real-life problems. One project resides in a research facility where tenant firms and industries were able to provide mentors and expert advice directly to students. In another case, businesses provided a pilot test site for the curriculum that was developed.

Other, nonindustry collaborators have provided faculty training, hosted workshops, helped establish articulation agreements, and provided education consultants to these projects. Three of the ten sampled projects worked with other institutions. One community college partnered with a neighboring four-year university; a national society partnered with both a university and an institute; and a university partnered with a two-year college and another four-year university.

All but one of these projects formed advisory boards to guide their work. One project organized a large review team in addition to its advisory board in order to elicit varied feedback on its curriculum before pilot and field-testing it.

Other activities present in at least two projects included performing needs assessments, conducting pilot tests of curriculum or modules, providing faculty training in the new curriculum, developing mentor programs, working with Tech Prep programs, and incorporating standards into their new curriculum. The types of standards used included industry skill and knowledge standards, state performance standards, and national science education standards.

Information on the student population touched by these projects was reported by only three of the ten projects reviewed. One of these three commented that its student selection process does not adequately reach minority groups because it accepts only a small number of applicants from a select population. In contrast, another project is expanding its program to help develop courses, library resources, mentors, and tutors in association with a local high school, which has a high dropout rate and a minority student population over 90 percent. The third project reported a student body composed mainly of professionals attending continuing education/retraining classes, but did not supply demographic information.

It appears that the PI or his or her staff usually conducts the project evaluation. In one case where an external evaluator was hired, the evaluation work did not begin until late in the project's life. In the three projects where final reports were available, evaluation activities appear to consist mainly of surveys of attendees of faculty enhancement workshops and comparison course test scores. Some of the results are based on subjective questions such as "did you feel more confident about your ability?"; others use more objective measures, such as change in test scores and cost per pupil. At least one evaluation included collecting more diverse feedback from faculty, current students, and former students.

Project Outcomes

Only three final reports were available for review. Therefore, information on project outcomes is very limited and does not reflect the broad array of objectives presented by the ten projects reviewed. Outcomes discussed below include products, evaluation, dissemination, and side effects.

Based on this very small sample, it appears that the most common outcome was related to professional development. Most of this professional development was conducted in workshops and summer institutes. The next most common product was written material, such as

handbooks with instructions on establishing similar programs, class materials (e.g., handbooks for laboratory activities), texts, and CD-ROMs.

Conference presentations and faculty workshops appear to be the main methods of product dissemination and promotion. Project staff from these three projects attended regional and national conferences and disseminated project activities through presentations. Professional development workshops for dissemination purposes vary in scope from local to national training sessions. One project required workshop graduates to conduct a minitraining workshop for their peers, thus aiding dissemination efforts. An additional common approach to dissemination is publishing articles in industry journals and newsletters distributed by the project office. Web sites have also been used for dissemination, as well as for instructional purposes by at least two of the sampled projects. Physical products, like textbooks and CD-ROMs, have served as dissemination devices; one project published handbooks written to help other institutions starting a similar program.

These projects intend to continue their work beyond the initial NSF funding period. One of the three secured financial support from a state department of education and a local education/technology firm. Another planned to apply to NSF for further support and the third appeared to be working toward institutionalization.

Unanticipated side effects were reported. While planning for an initial grant, one project identified other ATE program needs and received additional funding to expand its work to address those needs. Another project provided faculty enhancement workshops, which required an application process that led 25 percent of the applicants to form new secondary-higher education partnerships. These applicants reported that the new relationships would be useful even without the workshop training. The same project found that their professional development model could be adapted to serve other areas of science and mathematics education.

Alignment of Projects with ATE Program Goals

In keeping with the ATE program, project goals generally relate to developing materials, courses, and programs in specific fields of technology or involve improving basic science and math curriculum. Each of the ten projects has worked on one or more areas of curriculum or program improvement. Curriculum improvement and development activities focused on either basic SMET or specific technologies and often were based on industry standards and/or studies of current and future skill needs. The curricula also generally provided real world applications and activities that required problem solving. Program improvement activities included faculty enhancement through developing and conducting workshops and efforts to instigate or improve articulation between secondary schools, two-year colleges, and four-year colleges and universities. It appeared that most projects from this sample actively collaborate or collaborated with industry and other schools to enhance the effectiveness of their efforts. Of all the program goals, the one regarding increasing the proportion of underrepresented groups entering the advanced technology work force is the least represented by this sample's reported activities.

Although complete final reports were available for only three of the reviewed projects, combined with other documents these indicated that, in general, the ten projects' activities and preliminary products were aligned with their plans. Two of the three projects that had final reports available for review reported success at meeting project goals, enthusiasm for project expansion, and some evidence of project work continuing beyond the NSF award. The third appeared to meet most of its goals but not all. However, this project appeared to be expanding dissemination of

its major product and appears to have ongoing non-NSF support for continuation. The project reports that "NSF . . . has been the seed for beginning a long-term project . . . "

Part 5 - APPENDICES

INDEX OF APPENDICES

APPENDIX A - Brief Descriptions of Selected Centers

A Note to the Reader

The summaries that follow are provided only for the purpose of understanding the general nature of the work of ATE projects and centers. Specific sites are mentioned in order to illustrate the variety in geography, structure, and mission among projects and centers. The information presented is based on the sources cited. Please be aware that many projects and centers have revised and refined their work over time. Therefore, these summaries should not be considered as current or complete reviews of the sites shown here.

Southwest Center for Advanced Technological Education
(SCATE)
First award as a Center: DUE 9454643, 1993, 3 years, approx. $1.7 million
Technology Field: Core and One or More Specific Technologies
Renewed award: DUE 9714435, 1997, 3 years, approx. $1.3 million
Technology Field: Multidisciplinary

The Southwest Center for Advanced Technological Education (SCATE) was funded to explore the possibilities of providing technical education via distance learning to students in rural areas of our country, specifically in Texas, New Mexico, and Oklahoma. This "center without walls" has used the resources and expertise of its collaborative partners to develop new instructional materials and new AAS programs in polymer technology and electromechanical technology. It has also converted existing courses for delivery to secondary schools and two-year colleges via distance learning. This center has developed electronic networking with its partners such as the Department of Education at Texas Technical College, two- and four-year colleges, universities, industries, and Tech Prep consortia.

With the renewal of its funding in 1997, this center is now refocused on courses that require a hands-on laboratory component, some of which are being developed in cooperation with two other ATE Centers, Maricopa Advanced Technology Education Center and the NorthWest Center for Emerging Technologies. SCATE is now placing more emphasis on professional development. Other activities include the development of an A.A.S. degree program for distance learning technicians.

Sources: *Advanced Technological Education Program Awards and Activities*, 1994, p. 10
Advanced Technological Education Program Awards and Activities, 1997, p. 7
[For Current Information: http://www.scate.net]

New Jersey Center for Advanced Technological Education
(NJCATE)
First Award as a Center: DUE 9553749, 1995, 3 years, $3 million
Renewed Award: DUE 9813444, 1998, 3 years, $2 million
Technology Field: Engineering Technology

This center first set out to address the need for a multifunctional engineering technician by creating a new program called "Mecomtronics." "Mecomtronics" is a coined word that helps describe the functional areas in which an engineering technician would need to be trained. It

stands for MEchanical/COMputer/teleCOMmunications/elecTRONICS. To restructure engineering technology education from grade 11 through an associate's degree and on to the baccalaureate degree level, NJCATE has created a collaborative group with six other institutions. Each academic institution in this consortium took on a leadership role in developing one part of NJCATE's efforts. For example, faculty development was coordinated by the County College of Morris.

With the renewal of its ATE award in 1998, this center's previous work to create the Mecomtronics Engineering Technology Program is serving as a model of curriculum development for all other engineering and science technology fields. Its mission is now redefined to focus on becoming a national resource and catalyst for improved technician education. Most activities seem consistent with those of its first award cycle, the exception being a new emphasis on increasing its level of self-sufficiency, especially by marketing its educational products and services nationally.

Sources: *Advanced Technological Education Program Awards and Activities*,1995, pp. 15,16
Advanced Technological Education Program Awards and Activities, 1998, p. 5
[For Current Information: http://www.mccc.edu/njcate]

South Carolina Advanced Technological Education Center of Excellence
(SC ATE)
First Award as a Center: DUE 9602440, 1996, 3 years, approx. $2 million
Renewed award: DUE 9908409, 1999, 3 years, $2 million
Technology Field: Engineering Technology

SC ATE's mission in 1996 was to help manufacturing industries stay globally competitive by increasing the number of available technicians trained in the advanced engineering technology fields. Its original objectives are listed as three broad areas: curriculum reform, program improvement, and faculty development. This center seems to have used partnerships extensively. For example, interdisciplinary and intercampus teams were used to design and use new curricula. Looking to prepare future engineering technicians as well as future engineering technology educators, SC ATE has collaborated with more than 25 partners of diverse interests and expertise such as Clemson University, Michelin North America, and the Governor's Math/Science Advisory Board.

The efforts to create high quality educational opportunities in the engineering technology field seem to continue with the renewal of this center's ATE award. SC ATE credits a "reform-ready faculty" as the main element of its success. It has identified what it calls four critical success factors. Summarized, these factors are development of pre-engineering and first-year engineering technology curricula; faculty development; recruitment and retention of students, especially women and minorities; and developing a statewide model to create a seamless pipeline of educational opportunities.

Sources: *Advanced Technological Education Program Awards and Activities,* 1996, pp. 21, 22
NSF web site: www.nsf.gov/verity/srchawdf.htm, award #9908409
[For Current Information: http://scate.org]

The Northeast Center for Telecommunications Technology
(NCTT)
First Award as a Center: DUE 9751990, 1997, 3 years, $3 million
Technology Field: Information Technology, Telecommunications

Attempting to meet the challenge of the rapidly advancing industry of telecommunications, the Northeast Center for Telecommunications Technology is using its ATE award to research and keep abreast of the latest trends and best educational practices. This center's goal is to work in partnership with 36 schools, 36 industries, government, and the New England Board of Higher Education to ensure American competitiveness in this field. The NCTT is developing model curricula and actively recruiting nontraditional workers to the telecommunications work force. Its program of study in telecommunications articulates with Bachelor of Science in Engineering Technology degrees at four regional universities and with the Bell Atlantic "Next Step" program. This center provides educational opportunities in the following major areas of study of telecommunications: networking, wireless/RF, Microwave/Millimeterwave, and Lightwave technologies.

Sources: NSF web site: www.nsf.gov/verity/srchawdf.htm, award #9751990
         Advanced Technological Education Program Awards and Activities, 1997, p. 5
 [For Current Information: http://www.nctt.org]

Marine Advanced Technology Education Center
(MATE)
First Award as a Center: DUE 9752028, 1997, 3.5 years, $3.1 million
Technology Field: Marine Technology

The MATE Center began its work in partnership with educational institutions, industry, the military, government, and labor organizations to create a national program for marine technology education and training. Its original abstract lists nine ambitious goals. The goals, in brief, are to develop the following: a national consortium; national standards; new curricula and their distribution; an accreditation mechanism; a directory of educational programs and their articulation strategies with other programs; models of student recruitment and retention; summer institutes and internships for students, technicians, and faculty; newsletters and a clearinghouse of information; and ongoing funding and in-kind support.   The MATE Center's more recent abstract indicates that it has already achieved success in each of these nine goal areas. For example, this center has put together a consortium of school districts; community colleges; technical schools; universities; and industrial, scientific, and government partners to create a national MATE Center and regional MATE Centers.

Sources: NSF web site: www.nsf.gov/verity/srchawdf.htm, award #9752028
         Advanced Technological Education Program Awards and Activities, 1997, p. 5
[For Current Information: http://www.marinetech.org]

APPENDIX B – One Center in Greater Detail

As the thumbnail sketches and brief objectives summaries show, the centers address a multitude of issues in a large variety of ways. One of the most difficult challenges of this evaluation effort is to clearly and accurately understand and describe these centers so that their impact and effectiveness can be understood. Therefore, this description of a single center cannot provide substantial understanding of them all. However, we expect that a more in-depth understanding of one project provides some insight to all.

We focused on one center that has addressed a technology field for which currently there is a huge demand for qualified technicians: information technology (IT). It is a matter of common knowledge that information technology is undergoing explosive growth. Virtually every day newspapers, television, and other media address the proliferation of new technology and the personnel demands accompanying this growth. For example, the Information Technology Association of America's (ITAA) January 1998 study showed a dramatic nationwide need for qualified workers in the field of information technology (IT). It was estimated that 346,000 positions in this career field were unfilled in that year. For Washington State specifically, it was estimated that 10,000 IT positions were available in 1998, with an expectation of 57,000 openings in the following three years (October 1998 Washington Software Association study). The North West Center for Emerging Technologies (NWCET) directly addresses this need for qualified technicians in IT.

The NWCET Center[5]

Funded in 1995, NWCET is located at Bellevue Community College in Bellevue, Washington. Its geographical setting places it with world leaders in high technology work such as Microsoft and The Boeing Company. These two companies are not only strong local influences on the economy and job market surrounding NWCET, they also act as integral partners with this center in fulfilling its mission.

NWCET states its mission as that of improving the supply, quality, and diversity of the information technology (IT) work force. To this end NWCET set four primary goals:

1.   Advance model partnerships linking business, education, and government to promote information technology education.
2.   Provide student pathways to new IT programs and new advanced technology degrees.
3.   Develop information technology curriculum, curriculum products, and teaching and learning resources.
4.   Contribute national leadership through the dissemination of "best practices" in instructional technology education.

NWCET Organization

The project identifies a 5-person "Directorate" including an Executive Director, two Co-Principal Investigators from Bellevue College, a Co-Principal Investigator from The Boeing Company, and

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[5] In preparing this description we made extensive use of the NWCET web site. It is well organized and comprehensive, even including the Center's most recent annual report.

an Associate Director. Nine members are listed as staff including a project director, 2 directors for programs within the center, 3 project specialists, an administrative assistant, and a curriculum associate. The 13 members of the NWCET National Advisory Board (NAB) are specifically chosen from business, education, and government to represent varied and current interests in information technology training. They meet three times annually to provide strategic direction, business analysis, and national dissemination to the NWCET Directorate. The NAB also gives evaluative feedback to the NSF.

Organization/Collaboration

The Center identifies seven "strategic partners" that have joined their efforts in promoting IT education. In addition to the major financial support by NSF, two of these strategic partners, The Boeing Company and Microsoft, each have contributed $1 million to help construct the NWCET building. Altogether, NWCET reports that it has been able to garner significant financial support from more than 400 donors. The Washington State legislature, the William H. Gates Foundation, the *Seattle Times*, Puget Sound Energy, and Wells Fargo are examples of this extensive list.

Staff from these companies have also given their time and efforts by serving on the Directorate or Advisory Board, and have worked with NWCET on professional development initiatives. Other strategic partners include

> Harcourt College Publishers in development of on-line IT courseware
> The Chauncey Group International (a subsidary of ETS) in offering state-of-the-art assessment systems
> The Education Development Center in constructing model curricula, skills standards, and best practices for high school and community colleges in the field of IT education
> Western Governors' University in adopting NWCET's skill standards for their cyber university while also creating on-line courseware for IT courses

NWCET reports that it has 19 additional partners, including 10 from educational establishments such as the American Association of Community Colleges, the University of Washington, and RATEC (a consortium of educational institutions and advanced technology businesses); 6 from business including the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the Washington Software Alliance; and 3 from federal government bodies such as the Department of Commerce. As this list suggests the Center is developing an array of partnerships that embed it in important local industries and provide outreach to others throughout the country.

The Center's IT professional skill standards is perhaps the most significant product resulting from collaborative efforts. In developing the standards, the Center involved 200 managers and professionals to craft reference materials about IT professional skill standards. Then, the information was sent to 2,400 companies in Washington State for validation. The result is a publication called *NWCET Building a Foundation for Tomorrow: Skill Standards for Information Technology*.

Student Information

Recruitment. Efforts to recruit students to NWCET and IT technician positions focus on creating awareness of opportunities for employment as IT technicians. Additionally, the Center is seeking to enhance classroom instruction methods as a means to retain recruited students.

In these recruitment efforts, the Center focuses on nontraditional students. In 1998 nearly 12,500 took technology classes at NWCET's Bellevue campus, with about 25 percent enrolling in courses leading to 1- or 2-year degrees.

The NWCET web site helps to recruit nontypical students by explaining community-based training and offering links to web sites of other organizations that could assist students in their search for education and employment in the IT field. Additionally, this Center web site provides extensive electronic links to student-specific interests, such as internships and jobs, financial assistance, and initiatives to attract a more diverse work force in IT. The Center also maintains six PC work stations that are accessible to students with some types of physical disabilities.

The Center is currently developing a video titled, "Cyber Careers for the Net Generation." This video will be specifically targeted to attract underrepresented populations. Planned for release in Fall 2000 and focusing on IT careers, the video will be based on feedback from nationwide focus groups to examine middle and high school students' and teachers' awareness of and application to careers in the IT field. In addition to identifying the types of skills needed for successful careers in IT, the focus groups also provided insight into the most effective methods of classroom presentation (format, length of presentation, and types of media). The next step for this center's outreach will be to hold similar focus groups for adults who are seeking updated job skills or new careers.

In March 1999 a team-based competition called "IT All Stars" involved more than 100 middle and high school students as a means of promoting Information Technology education. This event was the result of a collaboration with the Women's Community Impact Consortium (WCIC), which works to provide technology skills to minority women and children. Additionally, the *Tech Prep Information Technology Skill Standards-Based Curriculum* is available to teachers as a tool to simulate potential real-life situations in the IT field for high school students.

        Outcomes. NWCET's Technical Support Program boasts a record of placing 93 percent of its graduates in jobs, while programs in software programming, web design, and computer networking have placement rates close to 90 percent. On average, graduates of Bellevue Community College make between $15 and $19 an hour right out of school, the college says. Students at NWCET have expressed their high expectations that a degree or training in IT will open promising avenues of employment for them with quotations such as "I'll be working towards something big . . . right now there is a big demand for tech support [and employers] are hungry to get people out of college" and "In web design I can compete against anybody . . . " These assertions by the college and students are to be substantiated by work of the Northwest Regional Educational Laboratory (NWREL). NWREL serves as the Center's evaluator and in its report, *NWCET Evaluation Design for 1998-1999* (p. 3), it states that it will track the success of students who completed the IT program, by interviewing the former students as well as the employers.
Sources: http://www.seattle-pi.com/local/bell181.shtml
        http://www.seattle-pi.com/local/coll18.shtml

Products

        Materials development. NWCET cites the previously noted publication called *Building a Foundation for Tomorrow: Skill Standards for Information Technology* as its centerpiece publication. With the "Millennium Edition" now available for sale on their web site, this publication provides information about eight career clusters as well as the specific skills identified as necessary to be competitive in these areas. The eight clusters are Database

Development/Administration, Digital Media, Enterprise Systems Analysis/Integration, Network Design/Administration, Programming/Software Engineering, Technical Support, Technical Writing, and Web Development/Administration. This publication is said to be used nationwide.
Source: http://www.nwcet.bcc.ctc.edu/products/preview_ITSS.htm

As follow-up to the skill standards book, there are also *A Development Kit for Skill Standard-Based Information Technology Curriculum* and *Tech Prep Information Technology Skill Standards-Based Curriculum*. These publications offer step-by-step guidelines to curriculum development, assessment, and implementation.
Source: http://www.nwcet.bcc.ctc.edu/products/curdev.htm

NWCET is currently developing a series of ten on-line courses that will lead to a certificate program in web authoring. First composed by instructional designers, a subject matter expert (SME), and a curriculum design specialist, each new course is then passed on to a peer review cycle and finally to pilot sites. This program is expected to become available in Winter 2000. This Center also plans to develop a vendor independent certification of IT professionals as well as to publish *NWCET Best Practices* and to disseminate it at the Emerging Technologies and Careers Conference.
Source: http://www.nwcet.bcc.ctc.edu/products/webProg.htm

NWCET has a curriculum group that, among other duties, researches and develops models and tools for performance-based teaching and learning and develops curricular elements for Tech Prep and on-line courses.

Though not always thought of as materials development, the Center has developed an extensive web site. It disseminates news and products to national and international audiences, helping NWCET to develop its role as a leader in IT education.

Professional development.   The Center identifies three major types of professional development work: expert resources, summer inservice for technician instructors, and compliance reviews. NWCET's senior staff has functioned as an expert resource by participating in national conferences, including the National Summit "21st Century Skills for 21st Century Jobs," which reached more than 1,000 leading public policymakers and educational and business leaders. Last summer (1999) Bellevue Community College provided a week-long training program for tech instructors from 32 community colleges in Washington (funding, $200,000, was provided by Microsoft). This same program is to be offered again in 2000. NWCET offers the service of compliance review of IT curricula to educators who wish to determine if their curricula are meeting national skill standards.

The above-noted development of on-line courses leading to a certificate program in web authoring appears to be the primary program development effort of the Center.

Sustainability

According to the Northwest Regional Educational Laboratory report of November 2, 1998, this center is successfully targeting all the right areas in order to sustain itself after federal funding ends. It cited three factors as being critically important: institutionalizing some Center activities into existing organizations, building ongoing relationships with other organizations, and generating new revenue. In this regard, NWCET has established itself at Bellevue Community College, aligned itself with organizations such as Harcourt College Publishers and the American

Electronic Association, and is selling its skill standards and curriculum development kits nationally.
Source: NWREL Report: NWCET Evaluation Design for 1998-1999, p. 4

The progress made by NWCET in disseminating its work may also be a good indicator of sustainability. Educational programs in the 8 career clusters described previously are available at Bellevue Community College as well as at partner colleges in the region and nationally. It has distributed over 3,000 copies of its skill standards publication and has sponsored two national conferences with more than 800 participants at Edu.Tech @Work-96 and Edu.Tech @Work-97. It planned to hold additional conferences in collaboration with other organizations featuring nationally known speakers such as Ira Magaziner and Rick Smolan where NWCET's project and products will be showcased.
Source: NWCET's document: Project Summary, November 5, 1998, p. 10

The Center is also planning to act as host of the first annual NWCET Partners Summit 2000 as an opportunity for its partners and stakeholders in IT issues to share concerns and information among other agenda items.
Source: http://www.nwcet.bcc.ctc.edu/whats_new/events.htm

The NWCET continues to work with local businesses on application of skill standards to employee recruitment, training, and development.

Another way in which NWCET has ingrained itself in the fabric of IT education nationally is by being named by WebCT as one of its first 14 institutes. As a WebCT institute, NWCET will serve as a campus-based regional outreach center for faculty training on the use of web-based course tools.
Source: http://www.nwcet.bcc.ctc.edu/whats_new/whtsnew.htm

APPENDIX C – Brief Descriptions of Selected Projects

A Note to the Reader

The summaries that follow are provided only for the purpose of understanding the general nature of the work of ATE projects and centers. Specific sites are mentioned in order to illustrate the variety in geography, structure, and mission among projects and centers. The information presented is based on the sources cited. Please be aware that many projects and centers have revised and refined their work over time. Therefore, these summaries should not be considered as current or complete reviews of the sites shown here.

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

Award as a project: DUE 9454627,1994, 4 years, $469,923
Technology Field: Mathematics

The title of this project is a synopsis of the focus of its work. Mount Hood Community College has set out three major objectives for its endeavors under the ATE Program. The first objective is to develop and publish course materials for certain levels of algebra. These materials are to be integrated with technology and based on real-world applications. The second objective is to support the effective delivery of a mathematics curriculum by ongoing professional development at the community college level. The third objective is to address the need for content-based proficiency assessment strategies, which also promotes the use of national standards in mathematics such as SCANS and NCTM. This project is making use of partnerships with middle schools, high schools, four-year colleges, and industry to address these objectives.

Sources: *Advanced Technological Education Program Awards and Activities,* 1994, pp. 6, 29
NSF website: www.nsf.gov/verity/srchawdf.htm, for award #9454627

Southeast Community College – Chemical Technology Curriculum and Materials Development Project

Award as a project: DUE 9553674, 1995, 3 years, $191,590
Technology Field: Chemical Technology

Southeast Community College is coordinating and directing a comprehensive curriculum and educational materials project for chemistry-based technician education at an associate degree level. Traditional and technologically advanced materials are being developed and disseminated. This is being done in collaboration with a variety of knowledgeable sources, both educational and vocational, such as the American Chemical Society's National Voluntary Industry Standards project, educators from high school through university level, and employed technicians. Additionally, a curriculum is being developed for chemistry technicians already working in the field. Summer workshops, which focus on the modern work place, are offered to faculty of high schools and community colleges. Recruitment of underrepresented groups is also an objective of this project's marketing strategy. An ultimate goal of this project is to have a national network of community colleges supporting a national model for chemistry technology curriculum with Southeast Community College as the center.

Technology Instruction for the 21st Century – Phase II
Award as a project: DUE 9602369, 1996, 4 years, $639,625
Technology Field: Engineering Technology

CUNY Queensborough Community College is working to improve marketable skills of science and technology students, curricula development processes, and faculty skills by use of, and for the benefit of, telecommunications technology. Products of this project include on-line (networked) laboratory manuals and instructional multimedia presentations. These products also support work by SUNY and CUNY colleges and the NYNEX Next-Step AAS degree program in telecommunications technology. A key feature of this project is that all materials are kept current and are disseminated by the same telecommunications technology they hope to promote.

Study of Present and Future Skill Levels of Visualization Technicians
Award as a project: DUE 9752014, 1997, 1.5 years, $96,959
Technology Field: Visualization Technology

Because of the demand in northern Alabama for technicians with skills in visualization technology, virtual reality programming, and multimedia applications, John C. Calhoun State Community College is heading this project. A first step in the work of this project is to gather information. Businesses, industries, and government agencies are sources of information concerning current and future projected necessary core skills for technicians. Currently available educational offerings are being assessed through contacts with two-year colleges. Additional information on related subjects is being gleaned at conferences. The next step and major goal of this project is to combine the accumulated data and produce a web page. The contents of this web page would then be used to set skill standards and curricula for visualization technician education.

Alternative Transportation Energy Education System Technology (ATEEST)
Award as a project: DUE 9850269, 1998, 3 years, $500,000
Technology Field: Transportation Technology

Project ATEEST, coordinated through York Technical College, is developing a two-year program to certify electric vehicle technicians. It is also developing course materials and laboratory experiments for use at both secondary schools and two-year colleges. Additionally, the ATEEST project is conducting professional development activities such as workshops for two-year college faculty and secondary school teachers.

Sources: *Advanced Technological Education Program Awards and Activities*, 1998, p. 9
NSF web site: www.nsf.gov/verity/srchawdf.htm, for award #9850269

APPENDIX D – Preliminary Proposals to Awards ATE 2000

	Preliminary Proposals	Formal Proposals Submitted	Anticipated Awards
Prelim discouraged	57	6	2
Prelim encouraged	63	47	20
Prelim encouraged as a project	9	7	3
Renewal of present funded project		10	7
Spin-off from funded project		5	2
Previously declined proposal		8	4
No previous proposal		15	1
Other	3		
Totals	**132**	**98**	**39**
Source: Information provided by Dr. Gerhard Salinger via e-mail attachment on March 30, 2000			

APPENDIX E – Data Discrepancies and Inconsistencies

This evaluation project has built an ATE database from which this report's statistics, tables, and charts were derived. The NSF publication of ATE awards and activities booklets provided the majority of the information for the database. Queries via NSF web sites were also used to update data and to provide award data for 1999 in the absence of an ATE awards and activities booklet for that year.

Discrepancies between NSF's numerical reports of ATE program data and those reported here may be due to a number of factors in two major areas: categorizing and counting.

Categorizing

1. This project's categorization of projects into "technology fields" is closely aligned with NSF's categorization, but may not match exactly. NSF has presented modifications of these fields each year in the ATE awards and activities booklets. We used the most current list of technology fields from *Advanced Technological Education Program Awards and Activities 1998* and, where needed, recategorized technology fields from earlier editions, which were no longer used, into the 1998 categories. For 1999 projects, this project estimated the categorization since that information was not yet available from NSF (the ATE 1999 awards and activities booklet is not available as of 4-17-00). Those 1999 projects that were difficult to categorize were placed in our newly designated "Other" category. Special projects from 1994 -1998 were not included in our data concerning technology field for two reasons: NSF did not always assign them a technology field, and the work of special projects is quite different from regular projects. It is possible that there are a few special projects included in the technology field data for 1999 due to the type of information available for this year.

2. In order to estimate the percent of awards going to various institution types, we initially sought reliable definitions for different institutions (e.g., community college vs. technical college, etc.). According to Kent Phillipe, Senior Research Associate at the American Association of Community Colleges, there are no consistent definitions. Thus, we estimated the institution type (2-yr., 4-yr., society, etc.) by the name of the funded institution and, where needed, read project abstracts for more information.

3. This project's "count" of ATE projects and centers, unless otherwise noted, includes only the categories of regular and special grants. Planning grants were only awarded in 1994. Their funding is summarized in Table 5 concerning "Center and Project Funding." "Supplemental," "Co-funded," and "ILI" grants listed in ATE awards and activities booklets were not included in our database. We cross-checked projects listed in each booklet's index with their categorization within the body of the same publication. The publications available to us contain some inconsistencies in the way funded activities were categorized.

Counting

Each award year's booklet published by NSF has an index with projects and centers listed along with funding information and technology field designation. The same publications usually have a narrative introductory section as well as an abstract section. There were instances when the information contained in these sections was contradictory and we attempted to keep some type of consistency.

1. Therefore, we counted ATE program funding by the dollar amounts listed in most booklets as "Total Award/ATE." If that particular designation was not published for a certain year (e.g., the 1998 booklet), we then used non-source-specified award amounts quoted with each abstract. For 1999 we used the "expected total amount/estimated" quoted via individual project queries of the NSF web site <www.nsf.gov/verity/srchawdf.htm>. It should be noted that the use of the web site <www.fastlane.nsf.gov/a6/A6Start.htm> may provide the investigator with vastly discrepant figures when compared with the "verity . . . " web search. This is probably due to the fact that the "fastlane" search will usually give the amount of money already disbursed to the recipient rather than including the future-year commitments of a continuing grant.

2. We were consistent in counting the number of awards for regular projects, special projects, and centers since they were printed as "new" awards in each ATE awards and activities booklet. Their year of entry to our database matches the year of the publication that included them as "new." This is not always the same as an award that starts in a certain fiscal year (e.g., award #9702044 listed as new in the 1997 booklet but having funding starting in fiscal year 1996). Furthermore, there is not always an exact correlation with the year of an award's inclusion as new in a publication and the first two digits of its award number, which would typically indicate its year of funding (e.g., award #9455105 listed as new in the 1995 booklet).