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REPT. 107–505
Part 1

UNDERGRADUATE SCIENCE, MATHEMATICS, ENGINEERING, AND TECHNOLOGY EDUCATION IMPROVEMENT ACT

JUNE 12, 2002.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. BOEHLERT, from the Committee on Science, submitted the following

R E P O R T

[To accompany H.R. 3130]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science, to whom was referred the bill (H.R. 3130) to provide for increasing the technically trained workforce in the United States, having considered the same, report favorably thereon with an amendment and recommend that the bill as amended do pass.

CONTENTS

99–006

I. AMENDMENT

The amendment is as follows:
Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the "Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act".

SEC. 2. FINDINGS.

The Congress makes the following findings:

(1) Studies show that about half of all United States post-World War II economic growth is a direct result of technological innovation, and science, engineering, and technology play a central role in the creation of new goods and services, new jobs, and new capital.

(2) The growth in the number of jobs requiring technical skills is projected to be more than 50 percent over the next decade.

(3) A workforce that is highly trained in science, mathematics, engineering, and technology is crucial to generating the innovation that drives economic growth, yet females, who represent 50 percent of the United States population, make up only 19 percent of the science, engineering, and technology workforce.

(4) Outside of the biomedical sciences, the number of undergraduate degrees awarded in the science, mathematics, engineering, and technology disciplines has been flat or declining since 1987, despite rapid population growth and a significant increase in undergraduate enrollment over the same period.

(5) The demand for H-1B visas has increased over the past several years, suggesting that the United States is not training a sufficient number of scientists and engineers.

(6) International comparisons of 24-year olds have shown that the proportion of natural science and engineering degrees to the total of undergraduate degrees is lower in the United States than in Japan, South Korea, Taiwan, the United Kingdom, and Canada.

(7) Technological and scientific advancements hold significant potential for elevating the quality of life and the standard of living in the United States. The quality and quantity of such advancements are dependent on a technically trained workforce.

(8) Reversing the downward enrollment and graduation trends in a number of science and engineering disciplines is not only imperative to maintaining our Nation's prosperity, it is also important for our national security.

(9) The decline of student majors in science, mathematics, engineering, and technology is reportedly linked to poor teaching quality in these disciplines and lack of institutional commitment to undergraduate education as compared to research.

(10) Undergraduate science, mathematics, engineering, and technology faculty generally lack any formal preparation for their role as undergraduate educators. In addition, faculty members are generally not rewarded, and in some cases are penalized, for the time they devote to undergraduate education.

(11) Faculty experienced in working with undergraduate students report that undergraduate research experiences contribute significantly to a student's decision to stay in an undergraduate science, mathematics, engineering, or technology major and to continue their education through graduate studies.

SEC. 3. DEFINITIONS

In this Act—

(1) the term "academic unit" means a department, division, institute, school, college, or other subcomponent of an institution of higher education;

(2) the term "community college" has the meaning given such term in section 7501(4) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 7601(4));

(3) the term "Director" means the Director of the National Science Foundation;

(4) the term "eligible nonprofit organization" means a nonprofit research institute or a nonprofit professional association with demonstrated experience delivering science, mathematics, engineering, or technology education, as determined by the Director;

(5) the term "institution of higher education" has the meaning given such term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)); and

(6) the term "research-grade instrumentation" means a single instrument or a networked system of instruments that enable publication-quality research to be performed by students or faculty.

SEC. 4. TECHNOLOGY TALENT.

(a) SHORT TITLE.—This section may be cited as the "Technology Talent Act of 2002".

(b) GRANT PROGRAM.—

(1) IN GENERAL.—The Director is authorized to award grants, on a competitive, merit-reviewed basis, to institutions of higher education with physical or information science, mathematics, engineering, or technology programs for the purpose of increasing the number and quality of students studying and receiving associate or baccalaureate degrees in the physical and information sciences, mathematics, engineering, and technology. An institution of higher education that is awarded a grant under this section shall be known as a "National Science Foundation Science and Engineering Talent Expansion Center".

(2) REQUIREMENTS.—

(A) NUMBER.—The Director shall award not fewer than 10 grants under this section each year, contingent upon available funds.

(B) DURATION.—Grants under this section shall be awarded for a period of 5 years, with the final 2 years of funding contingent on the Director's determination that satisfactory progress has been made by the grantee during the first 3 years of the grant period toward achieving the increases in the number of students proposed pursuant to subparagraph (E).

(C) PRINCIPAL INVESTIGATOR.—At least 1 principal investigator for each grant awarded under this section must be in a position of administrative leadership at the institution of higher education, and at least 1 principal investigator must be a faculty member from an academic department included in the work of the project.

(D) SUBSEQUENT GRANTS.—An institution of higher education that has completed a grant awarded under this section may apply for a subsequent grant under this section.

(E) INCREASES.—

(i) INSTITUTIONS OF HIGHER EDUCATION WITH BACCALAUREATE DEGREE PROGRAMS.—An institution of higher education that awards baccalaureate degrees and desires to receive a grant under this section shall propose in its application specific increases in the number of students who are United States citizens or permanent resident aliens obtaining baccalaureate degrees at the institution within the physical or information sciences, mathematics, engineering, or technology, and shall state the mechanisms by which the success of the grant project shall be assessed.

(ii) COMMUNITY COLLEGES.—A community college that desires to receive a grant under this section shall propose in its application specific increases in the number of students who are United States citizens or permanent resident aliens pursuing degrees, concentrations, or certifications in the physical or information sciences, mathematics, engineering, or technology programs or pursuing credits toward transfer to a baccalaureate degree program in the physical or information sciences, mathematics, engineering, or technology, and shall state the mechanisms by which the success of the grant project shall be assessed.

(F) RECORDKEEPING.—Grantee institutions shall maintain, and transmit annually to the National Science Foundation, in a format indicated by the Director, baseline and subsequent data on undergraduate students in physical and information science, mathematics, engineering, and technology programs. Such data shall include information on—

(i) the number of students enrolled;

(ii) student academic achievement, including quantifiable measurements of students' mastery of content and skills;

(iii) persistence to degree completion, including students who transfer from science, mathematics, engineering, and technology programs to programs in other academic disciplines; and

(iv) placement during the first year after degree completion in postgraduate education or career pathways.

(G) PRIORITY.—The Director may give priority in awarding grants under this section to institutions of higher education whose application—

(i) indicates a plan to build on previous and existing efforts with demonstrated success, including efforts involving industry, in improving undergraduate learning and teaching, including efforts funded by

Federal grants from the National Science Foundation or other agencies; and

(ii) provides evidence of a commitment by the institution's administration to support and reward faculty involvement in carrying out the proposed implementation plan for the project.

(c) USES OF FUNDS.—Activities supported by grants under this section may include—

(1) projects that specifically aim to increase the number of traditionally underrepresented students in the physical or information sciences, mathematics, engineering, or technology, such as mentoring programs;

(2) projects that expand the capacity of institutions of higher education to incorporate current advances in science and technology into the undergraduate learning environment;

(3) bridge projects that enable students at community colleges to matriculate directly into baccalaureate physical or information science, mathematics, engineering, or technology programs, including those targeted at traditionally underrepresented groups in such disciplines;

(4) projects including interdisciplinary approaches to undergraduate physical and information science, mathematics, engineering, and technology education;

(5) projects that focus directly on the quality of student learning, including those that encourage—

(A) high-caliber teaching, including enabling faculty to spend additional time teaching participating students in smaller class settings, particularly in the laboratory environment, by, for example, providing summer salary or other additional salary for faculty members or stipends for students;

(B) opportunities to develop new pedagogical approaches including the development of web-based course strategies, distributed and collaborative digital teaching tools, or interactive course modules; and

(C) screening and training of teaching assistants;

(6) projects that—

(A) facilitate student exposure to potential careers, including cooperative projects with industry or government that place students in internships as early as the summer following their first year of study;

(B) provide part-time employment in industry during the school year; or

(C) provide opportunities for undergraduates to participate in industry or government sponsored research;

(7) projects that assist institutions of higher education in States that participate in the Experimental Program to Stimulate Competitive Research (EPSCoR) to broaden the science, engineering, mathematics, and technology student base or increase retention in these fields;

(8) projects to encourage undergraduate research on-campus or off-campus;

(9) projects that provide scholarships or stipends to students entering and persisting in the study of science, mathematics, engineering, or technology;

(10) projects that leverage the Federal investment by providing matching funds from industry, from State or local government sources, or from private sources; and

(11) other innovative approaches to achieving the purpose described in subsection (b)(1).

(d) ASSESSMENT, EVALUATION, AND DISSEMINATION OF INFORMATION.—

(1) PROJECT ASSESSMENT.—The Director shall require each recipient of a grant awarded under this section to implement project-based assessment that facilitates program evaluation under paragraph (2) and that assesses the impact of the project on achieving the purpose stated in subsection (b)(1), as well as on institutional policies and practices.

(2) PROGRAM EVALUATION.—Not later than 180 days after the date of the enactment of this Act, the Director shall award at least 1 grant or contract to an independent evaluative organization to—

(A) develop metrics for measuring the impact of the program authorized under this section on—

(i) the number of students enrolled;

(ii) student academic achievement, including quantifiable measurements of students' mastery of content and skills;

(iii) persistence to degree completion, including students who transfer from science, mathematics, engineering, and technology programs to programs in other academic disciplines; and

(iv) placement during the first year after degree completion in postgraduate education or career pathways; and

(B) conduct an evaluation of the impacts of the program described in subparagraph (A), including a comparison of the funded projects to identify

best practices with respect to achieving the purpose stated in subsection (b)(1).

(3) DISSEMINATION OF INFORMATION.—The Director, at least once each year, shall disseminate information on the activities and the results of the projects assisted under this section, including best practices identified pursuant to paragraph (2)(B), to participating institutions of higher education and other interested institutions of higher education.

(e) UNDERREPRESENTED GROUPS.—In carrying out the program authorized by this section the Director shall strive to increase the number of students receiving baccalaureate degrees, concentrations, or certifications in the physical or information sciences, mathematics, engineering, or technology who come from groups underrepresented in these fields.

(f) REPORTS.—

(1) LIST.—Not later than 90 days after the date of the enactment of this Act, the Director shall develop, and disseminate to institutions of higher education, a list of examples of existing institutional and government efforts relevant to the purpose stated in subsection (b)(1).

(2) INTERIM PROGRESS REPORT.—At the end of the third year of the program authorized under this section, the Director shall transmit to the Congress an interim progress report of the evaluation conducted under subsection (d)(2).

(3) FINAL REPORT.—Not later than 6 years after the date of the enactment of this Act, the Director shall transmit to the Congress a final report of the evaluation conducted under subsection (d)(2).

(g) ADVISORY COMMITTEE.—

(1) ESTABLISHMENT.—The Director shall establish an advisory committee, that includes significant representation from industry and academic leaders, for the grant program authorized under this section. The advisory committee shall—

(A) assist the Director in securing active industry, and State and local government, participation in the program;

(B) recommend to the Director innovative approaches to achieving the purpose stated in subsection (b)(1); and

(C) advise the Director regarding program metrics, implementation and performance of the program, and program progress reports.

(2) DURATION.—Section 14 of the Federal Advisory Committee Act shall not apply to the advisory committee established under this subsection.

(h) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the National Science Foundation to carry out this section—

(1) $25,000,000 for fiscal year 2003; and

(2) such sums as may be necessary thereafter.

(i) RELATED PROGRAMS.—The Director shall give consideration to achieving the purpose stated in subsection (b)(1) by awarding grants to institutions participating in the Louis Stokes Alliances for Minority Participation.

SEC. 5. INSTITUTIONAL REFORM.

(a) IN GENERAL.—The Director shall award grants, on a merit-reviewed, competitive basis, to institutions of higher education to expand previously implemented reforms of undergraduate science, mathematics, engineering, or technology education that have been demonstrated to have been successful in increasing the number and quality of students studying and receiving associate or baccalaureate degrees in science, mathematics, engineering, or technology.

(b) USES OF FUNDS.—Activities supported by grants under this section may include—

(1) expansion of successful reform efforts beyond a single course or group of courses to achieve reform within an entire academic unit;

(2) expansion of successful reform efforts beyond a single academic unit to other science, mathematics, engineering, or technology academic units within an institution;

(3) creation of multidisciplinary courses or programs that formalize collaborations for the purpose of improved student instruction and research in science, mathematics, engineering, and technology;

(4) expansion of undergraduate research opportunities beyond a particular laboratory, course, or academic unit to engage multiple academic units in providing multidisciplinary research opportunities for undergraduate students;

(5) expansion of innovative tutoring or mentoring programs proven to enhance student recruitment or persistence to degree completion in science, mathematics, engineering, or technology;

(6) improvement of undergraduate science, mathematics, engineering, and technology education for nonmajors, including teacher education majors; and

(7) implementation of technology-driven reform efforts, including the installation of technology to facilitate such reform, that directly impact undergraduate science, mathematics, engineering, or technology instruction or research experiences.

(c) SELECTION PROCESS.—

(1) APPLICATIONS.—An institution of higher education seeking a grant under this section shall submit an application to the Director at such time, in such manner, and containing such information as the Director may require. The application shall include, at a minimum—

(A) a description of the proposed reform effort;

(B) a description of the previously implemented reform effort that will serve as the basis for the proposed reform effort and evidence of success of that previous effort, including data on student recruitment, persistence to degree completion, and academic achievement;

(C) evidence of active participation in the proposed project by individuals who were central to the success of the previously implemented reform effort; and

(D) evidence of institutional support for, and commitment to, the proposed reform effort, including a description of existing or planned institutional policies and practices regarding faculty hiring, promotion, tenure, and teaching assignment that reward faculty contributions to undergraduate education equal to, or greater than, scholarly scientific research.

(2) REVIEW OF APPLICATIONS.—In evaluating applications submitted under paragraph (1), the Director shall consider at a minimum—

(A) the evidence of past success in implementing undergraduate education reform and the likelihood of success in undertaking the proposed expanded effort;

(B) the extent to which the faculty, staff, and administrators are committed to making the proposed institutional reform a priority of the participating academic unit;

(C) the degree to which the proposed reform will contribute to change in institutional culture and policy such that a greater value is placed on faculty engagement in undergraduate education and that a commensurate reward structure is implemented to recognize faculty for their scholarly work in this area; and

(D) the likelihood that the institution will sustain or expand the reform beyond the period of the grant.

(3) GRANT DISTRIBUTION.—The Director shall ensure, to the extent practicable, that grants awarded under this section are made to a variety of types of institutions of higher education.

(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the National Science Foundation to carry out this section $15,000,000 for each of fiscal years 2003 through 2007.

SEC. 6. FACULTY DEVELOPMENT.

(a) IN GENERAL.—The Director shall award grants, on a merit-reviewed, competitive basis, to—

(1) institutions of higher education;

(2) eligible nonprofit organizations; or

(3) consortia of institutions and organizations described in paragraphs (1) and (2),

for professional development of undergraduate faculty in support of improved undergraduate science, mathematics, engineering, and technology education.

(b) USES OF FUNDS.—Activities supported by grants under this section may include—

(1) support for individuals to participate in scholarly activities aimed at improving undergraduate science, mathematics, engineering, and technology education including—

(A) sabbatical funding, including partial or full support for salary, benefits, and supplies, for faculty participating in scholarly research in—

(i) science, mathematics, engineering, or technology;

(ii) the science of learning; or

(iii) assessment and evaluation related to undergraduate instruction and student academic achievement;

(B) stipend support for graduate students and post-doctoral fellows to participate in instructional or evaluative activities at primarily undergraduate institutions; and

(C) release time from teaching for faculty engaged in the development, implementation, and assessment of undergraduate science, mathematics,

engineering, and technology education reform activities following participation in a sabbatical opportunity or faculty development program described in this subsection; and

(2) support for institutions to develop, implement, and assess faculty development programs focused on improved instruction, mentoring, evaluation, and support of undergraduate science, mathematics, engineering, and technology students, including costs associated with—

(A) stipend support or release time for faculty and staff engaged in the development, delivery, and assessment of the faculty development program;

(B) stipend support or release time for faculty, graduate students, or postdoctoral fellows from the host institution or external institutions who are engaged as participants in such faculty development programs; and

(C) support for materials, supplies, travel expenses, and consulting fees associated with the development, delivery, and assessment of such faculty development programs.

(c) APPLICATIONS.—An entity seeking a grant under this section shall submit an application to the Director at such time, in such manner, and containing such information as the Director may require. The application shall include, at a minimum—

(1) a description of the activities to be carried out under the proposed project and the projected impact of the project on undergraduate majors and nonmajors enrolled in science, mathematics, engineering, or technology courses or programs;

(2) a plan for assessment of the outcomes of the proposed project;

(3) a plan for dissemination of information regarding the activities and outcomes of the proposed project; and

(4) evidence of institutional support for implementation of the proposed project, including commitment to appropriate faculty sabbaticals and release time from teaching.

(d) ANNUAL MEETING.—The Director shall convene an annual meeting of awardees under this section to foster greater national information dissemination and collaboration in the area of undergraduate science, mathematics, engineering, and technology education.

(e) AUTHORIZATION OF APPROPRIATIONS.—There are to be authorized to be appropriated to the National Science Foundation to carry out this section $8,000,000 for each of fiscal years 2003 through 2007.

SEC. 7. ACCESS TO RESEARCH-GRADE INSTRUMENTATION.

(a) IN GENERAL.—The Director shall award grants, on a merit-reviewed, competitive basis, to institutions of higher education to support the acquisition of research-grade instrumentation and to support training related to the use of that instrumentation. Instruments provided through awards under this section shall be used primarily for undergraduate research, undergraduate instruction, or both, in science, mathematics, engineering, or technology.

(b) ELIGIBLE INSTITUTIONS.—Grants may be awarded under this section only to institutions of higher education that award fewer than 10 doctoral degrees per year in disciplines for which the National Science Foundation provides research support.

(c) AUTHORIZATION OF APPROPRIATIONS.—There are to be authorized to be appropriated to the National Science Foundation to carry out this section $10,000,000 for each of fiscal years 2003 through 2007.

SEC. 8. UNDERGRADUATE RESEARCH EXPERIENCES.

(a) IN GENERAL.—The Director shall award grants, on a merit-reviewed, competitive basis, to institutions of higher education, eligible nonprofit organizations, or consortia thereof to establish sites that provide research experiences for 10 or more undergraduate science, mathematics, engineering, or technology students. The Director shall ensure that—

(1) at least half of the students participating at each site funded under this section shall be recruited from institutions of higher education where research activities in science, mathematics, engineering, or technology are limited or nonexistent;

(2) the awards provide undergraduate research experiences in a wide range of science, mathematics, engineering, or technology disciplines;

(3) awards support a variety of projects including independent investigator-led projects, multidisciplinary projects, and multiinstitutional projects (including virtual projects);

(4) students participating in the projects have mentors, including during the academic year, to help connect the students' research experiences to the overall academic course of study and to help students achieve success in courses of study leading to a baccalaureate degree in science, mathematics, engineering, or technology;

(5) mentors and students are supported with appropriate summer salary or stipends; and

(6) all student participants are tracked through receipt of the undergraduate degree and for at least 1 year thereafter.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the National Science Foundation to carry out this section $10,000,000 for each of fiscal years 2003 through 2007.

SEC. 9. DISSEMINATION OF PROJECT INFORMATION.

The Director shall ensure that all National Science Foundation-sponsored undergraduate science, mathematics, engineering, or technology education projects, including those sponsored by National Science Foundation research directorates, shall disseminate via the Internet, at a minimum, the following information:

(1) Scope, goals, and objectives of each project.

(2) Activities, methodologies, and practices developed and implemented.

(3) Outcomes, both positive and negative, of project assessment activities.

SEC. 10. EVALUATION.

(a) IN GENERAL.—The Director, through the Research, Evaluation and Communication Division of the Education and Human Resources Directorate of the National Science Foundation, shall evaluate the effectiveness of all undergraduate science, mathematics, engineering, or technology education activities supported by the National Science Foundation in increasing the number and quality of students, including students from groups underrepresented in science, mathematics, engineering, and technology fields, studying and receiving associate or baccalaureate degrees in science, mathematics, engineering, and technology. In conducting the evaluation, the Director shall consider information on—

(1) the number of students enrolled;

(2) student academic achievement, including quantifiable measurements of students' mastery of content and skills;

(3) persistence to degree completion, including students who transfer from science, mathematics, engineering, and technology programs to programs in other academic disciplines; and

(4) placement during the first year after degree completion in post-graduate education or career pathways.

(b) ASSESSMENT BENCHMARKS AND TOOLS.—The Director, through the Research, Evaluation and Communication Division of the Education and Human Resources Directorate of the National Science Foundation, shall establish a common set of assessment benchmarks and tools, and shall enable every National Science Foundation-sponsored project to incorporate the use of these benchmarks and tools in their project-based assessment activities.

(c) DISSEMINATION OF EVALUATION RESULTS.—The results of the evaluations required under subsection (a) shall be made available to the public.

(d) REPORTS TO CONGRESS.—Not later than 3 years after the date of the enactment of this Act, and once every 3 years thereafter, the Director shall transmit to the Congress a report containing the results of evaluations under subsection (a).

SEC. 11. NATIONAL ACADEMY OF SCIENCES STUDY ON UNDERGRADUATE RECRUITMENT AND RETENTION.

(a) STUDY.—Not later than 3 months after the date of the enactment of this Act, the Director shall enter into an arrangement with the National Research Council of the National Academy of Sciences to perform a study on the factors that influence undergraduate students to enter and persist to degree completion in science, mathematics, engineering, and technology programs or to leave such programs and matriculate to other academic programs, as reported by students.

(b) TRANSMITTAL TO CONGRESS.—Not later than 18 months after the date of the enactment of this Act, the Director shall transmit to the Congress a report containing the results of the study under subsection (a).

(c) AUTHORIZATION OF APPROPRIATION.—There are authorized to be appropriated to the National Science Foundation for carrying out this section $700,000 for fiscal year 2003, to remain available until expended.

SEC. 12. MINORITY-SERVING INSTITUTIONS UNDERGRADUATE PROGRAM.

(a) IN GENERAL.—

(1) The Director shall establish a program to award grants to Hispanic-Serving Institutions, Historically Black Colleges and Universities, Alaska Native-Serving Institutions, Native Hawaiian-Serving Institutions, and tribally controlled colleges and universities to enhance the quality of undergraduate science, mathematics, and engineering education at such institutions and to increase the retention and graduation rates of students pursuing baccalaureate degrees in science, mathematics, or engineering.

(2) Grants shall be awarded under this section on a merit-reviewed, competitive basis.

(b) PROGRAM COMPONENTS.—Grants awarded under this section shall support—

(1) activities to improve courses and curriculum in science, mathematics, or engineering disciplines;

(2) faculty development, including support for—

(A) sabbaticals and exchange programs to improve the faculty's research competency and knowledge of technological advances;

(B) professional development workshops on innovative teaching practices and assessment;

(C) visiting faculty, including researchers from industry; and

(D) faculty reassigned time or release time to mentor students or to participate in curriculum reform and academic enhancement activities;

(3) stipends for undergraduate students participating in research activities in science, mathematics, or engineering disciplines on-campus or off-campus at industrial, governmental, or academic research laboratories; and

(4) other activities that are consistent with subsection (a)(1), as determined by the Director.

(c) APPLICATION.—An institution seeking funding under this section shall submit an application to the Director at such time, in such manner, and containing such information as the Director may require.

SEC. 13. ADVANCED TECHNOLOGICAL EDUCATION PROGRAM.

(a) CORE SCIENCE AND MATHEMATICS COURSES.—Section 3(a) of the Scientific and Advanced-Technology Act of 1992 (42 U.S.C. 1862i(a)) is amended—

(1) by inserting ", and to improve the quality of their core education courses in science and mathematics" after "education in advanced-technology fields";

(2) in paragraph (1) by inserting "and in core science and mathematics courses" after "advanced-technology fields"; and

(3) in paragraph (2) by striking "in advanced-technology fields" and inserting "who provide instruction in science, mathematics, and advanced-technology fields".

(b) ARTICULATION PARTNERSHIPS.—Section 3(c)(1)(B) of the Scientific and Advanced-Technology Act of 1992 (42 U.S.C. 1862i(c)(1)(B)) is amended—

(1) by striking "and" at the end of clause (i);

(2) by striking the period at the end of clause (ii) and inserting a semicolon; and

(3) by adding after clause (ii) the following new clauses:

"(iii) provide students with research experiences at bachelor-degree-granting institutions participating in the partnership, including stipend support for students participating in summer programs; and

"(iv) provide faculty mentors for students participating in activities under clause (iii), including summer salary support for faculty mentors.".

(c) ADVANCED TECHNOLOGICAL EDUCATION ADVISORY COMMITTEE.—

(1) ESTABLISHMENT.—The Director shall establish an advisory committee on science, mathematics, and technology education at community colleges consisting of non-Federal members, including representatives from academia and industry. The advisory committee shall review, and provide the Director with an assessment of, activities carried out under the Advanced Technological Education Program (in this section referred to as the "Program"), including—

(A) conformity of the Program to the requirements of the Scientific and Advanced-Technology Act of 1992;

(B) the effectiveness of activities supported under the Program in strengthening the scientific and technical education and training capabilities of community colleges;

(C) the effectiveness of the National Science Foundation and institutions receiving awards under the Program in disseminating information to other community colleges about activities carried out under the Program and about model curricula and teaching methods developed under the Program;

(D) the balance of resources allocated under the Program for support of national centers of excellence, individual institution grants, and articulation partnerships; and

(E) other issues identified by the Director.

The advisory committee shall make recommendations to the Director for improvements to the Program based on its reviews and assessments.

(2) ADVISORY COMMITTEE REPORTS.—The advisory committee established under paragraph (1) shall report annually to the Director and to Congress on the findings and recommendations resulting from the reviews and assessments conducted in accordance with paragraph (1).

(3) DURATION.—Section 14 of the Federal Advisory Committee Act shall not apply to the advisory committee established under this subsection.

(d) NATIONAL SCIENCE FOUNDATION REPORT.—Within 6 months after the date of the enactment of this Act, the Director shall transmit a report to Congress on—

(1) efforts by the National Science Foundation and awardees under the Program to disseminate information about the results of projects;

(2) the effectiveness of national centers of scientific and technical education established under section 3(b) of the Scientific and Advanced-Technology Act of 1992 in serving as national and regional clearinghouses of information and models for best practices in undergraduate science, mathematics, and technology education; and

(3) efforts to satisfy the requirement of section 3(f)(4) of the Scientific and Advanced-Technology Act of 1992.

(e) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the National Science Foundation—

(1) for activities to improve core science and mathematics education in accordance with section 3(a) of the Scientific and Advanced-Technology Act of 1992 (42 U.S.C. 1862i(a)), as amended by subsection (a) of this section, $5,000,000 for each of fiscal years 2003 through 2007;

(2) for acquisition of instrumentation in accordance with section 3(a)(4) of the Scientific and Advanced-Technology Act of 1992—

(A) $3,000,000 for fiscal year 2003;
(B) $3,500,000 for fiscal year 2004;
(C) $4,000,000 for fiscal year 2005;
(D) $4,500,000 for fiscal year 2006; and
(E) $5,000,000 for fiscal year 2007; and

(3) for support for research experiences for undergraduate students in accordance with section 3(c)(1)(B) of the Scientific and Advanced-Technology Act of 1992 (42 U.S.C. 1862i(c)(1)(B)), as amended by subsection (b) of this section, $750,000 for each of fiscal years 2003 through 2007.

II. PURPOSE OF THE BILL

The purpose of the bill is to make improvements in undergraduate science, mathematics, engineering, and technology education and to increase the number of graduates of programs in these areas.

III. BACKGROUND AND NEED FOR THE LEGISLATION

As U.S. economic growth continues to depend largely upon advances in science and technology, the nation's continued prosperity is linked inextricably to the ability to produce a technologically sophisticated workforce. However, since 1986, while the percentage of degrees awarded in the biological and social sciences has increased sharply, there has been a troubling decrease in the percentage of U.S. baccalaureate degrees awarded in the physical sciences, engineering, mathematics, and computer science. In contrast, Asian and European countries have shown strong growth in degree production in all science and engineering fields and Asian institutions of higher education produce approximately six times as many engineering degrees as do U.S. institutions.

The limited numbers of students pursuing science, mathematics, and engineering degrees appears to be a result of at least two factors: too few students who enter college wanting to major in one of those fields, and too many students who initially show such interest changing their minds during the first two years of their college education. Evidence of a decline in the percentage of freshmen choosing to enter and remain in mathematics and science-based majors first became apparent in the mid-1980s, as a result of a number of studies. Researchers determined that 40 percent of science, mathematics, and engineering undergraduates left the

major, and that most did so within the first 2.5 years of the undergraduate experience. Similarly, a 2002 report by the U.S. Department of Education's National Center for Educational Statistics showed that fewer than 50 percent of students who intend to major in science and engineering fields complete a science or engineering degree within five years.

There is some evidence that poor K–12 preparation in mathematics has a significant impact on a student's decision to enroll in undergraduate science, mathematics and engineering coursework. According to NSF's Science and Engineering Indicators 2002, more than 40 percent of freshmen at public two-year colleges and 22 percent of freshmen at public four-year colleges required remedial work in reading, writing or mathematics. Among its science and engineering disciplines, approximately 28 percent of first-year students intending to major in the social and behaviorial sciences and 25 percent of those intending to major in biological or agricultural science reported the need for remedial mathematics instruction. Fifteen percent of engineering and physical sciences majors reported a similar need for remedial mathematics instruction. A recent survey also found that students are facing increasing demands on their time, with nearly 75 percent of today's college students engaging in at least part-time work and 25 percent working full time.

However, factors not under the control of institutions of higher education, such as preparation at the K–12 level and non-academic workload, seem unlikely to provide the entire explanation for the current situation. While it has been difficult to determine the precise factors that precipitate an individual student's decision to leave a science or engineering major, a number of signs point of factors such as poor teaching and limited mentoring. For example, a 1997 study of students who scored high (above 650) on the mathematics section of the SAT I and who declared majors in science, mathematics and engineering showed that both those who switched out of science, mathematics and engineering majors and those who persisted in these majors through graduation had similar complaints of poor teaching and difficulty in getting help with academic problems. The authors of this study were unable to identify the precise factors that differentiated the "switchers" from the "survivors," but anecdotal evidence highlighted the positive impact of intervention by a faculty member at a crisis time in the student's academic or personal life.

Some experts who are critical of the current undergraduate education enterprise have pointed to factors such as lack of rewards for faculty engaged in undergraduate education, poor facilities, limited equipment and supplies for education-based activities, and a "survival of the fittest" mentality in science, mathematics and engineering departments as likely additional reasons for the high attrition rates evident in science and engineering programs.

Adding to the complexity of the problem is the diversity of undergraduate institutions in the U.S. Although research-intensive universities produce most of the engineering degrees and a large proportion of the natural and social science degrees at the undergraduate level, student enrollment at those institutions represents less than 30 percent of the total undergraduate enrollment nationwide. Comprehensive universities and colleges account for approximately 23 percent of the total U.S. undergraduate enrollment, and

liberal arts institutions for approximately 7 percent. Two-year colleges account for nearly 40 percent of the total undergraduate enrollment, and yet their impact on the number of science and engineering baccalaureate degrees conferred remains largely unrecognized since many students transfer to a four-year institution without first earning an associate degree. The diversity of U.S. institutions of higher education should be regarded as a strength, and not a liability, in improving scientific literacy broadly and in increasing the number of science and engineering graduates in particular, but it is clear that reform must not be a one-size-fits-all endeavor.

While current data provide no clear guidelines or best practices regarding undergraduate education reform, both the National Research Council's Committee on Undergraduate Science Education [1] and the National Science Foundation (NSF) [2] have made a number of recommendations regarding institutional arid departmental reforms necessary to improve undergraduate science and engineering education. Those recommendations include:

- Take an institutional approach to change and ensure that the undergraduate education activities of the institution are a high priority;
- Give all students math and science literacy so that all students can function in a technologically sophisticated world and so that more students can prepare for careers in science and engineering;
- Help faculty improve their teaching through the incorporation of research on learning into the classroom and through the inclusion of collaborative and active learning, discovery and inquiry in the classroom;
- Increase opportunities for undergraduate research so that all students, and especially students majoring in science and engineering and those preparing to be teachers, are engaged in the excitement of new research findings;
- Expand interdisciplinary teaching to better reflect the increased workplace emphasis on interdisciplinary approaches; and
- Include industry and potential employers in planning curricular changes.

This Act addresses each of the recommendations above and provides activities and funding intended to foster and facilitate improved undergraduate education at all institutions and for all students. The Act is focused on reforms that will improve student learning and increase the number and quality of science, mathematics, engineering and technology majors. In addition, this Act provides the framework for a national evaluation of "what works" through the identification of causal relationships between practices and outcomes.

IV. Summary of Hearings

On Wednesday, March 7, 2002, the Subcommittee on Research of the Committee on Science held a hearing to examine the current

[1] National Research Council Committee on Undergraduate Science Education, Center for Science, Mathematics, and Engineering Education, Transforming undergraduate education in science, mathematics, engineering, and technology, 1999.

[2] National Science Foundation, Shaping the future: New expectations for undergraduate education in science, mathematics, engineering and technology, 1996.

state of undergraduate mathematics, science, and engineering education, to learn about successful models of undergraduate education reform, and to hear recommendations for additional programs and opportunities that could advance the reform effort. Witnesses provided comments on and recommendations for additions to H.R. 3130, the Technology Talent Act of 2001, introduced by Chairman Boehlert and Rep. Larson on October 16, 2001. The Committee heard testimony from faculty and administrators at Sinclair College, James Madison University, the University of Colorado-Boulder, Swarthmore College, and the Georgia Institute of Technology. Witnesses addressed the need for increased access to instrumentation for the purposes of undergraduate teaching and research, additional research opportunities for undergraduate students, better mechanisms for tracking students, and improved institutional policies that reflect a commitment to undergraduate education reform.

On Wednesday, March 13, 2002, the Subcommittee on Research of the Committee on Science held a hearing to receive testimony on ways to determine the appropriate funding levels for NSF. The hearing witnesses included professors of engineering, economics and geology as well as a representative of General Electric Company. While the hearing was primarily focused on establishing criteria to be used in setting NSF budget levels, much of the testimony focused on the need to improve the education of undergraduates in science, mathematics and engineering. In particular, testimony was offered regarding the benefits of mentoring students and engaging them in research experiences beginning in middle school and continuing throughout the undergraduate years.

On Monday, April 22, 2002, the Subcommittee on Research of the Committee on Science held a field hearing in Dallas, Texas to receive testimony on K–12 and undergraduate science, technology, engineering, and mathematics education. The Committee heard testimony from representatives of the Dallas Independent School Board, Southern Methodist University, the University of Texas at Arlington, Jarvis Christian College, Texas Instruments, ExxonMobil, and Lockheed Martin. The witnesses examined challenges for improving K–12 and undergraduate STEM education; explored educational programs that could be developed or expanded to fill current gaps and stimulate STEM education reform; and discussed industry needs for a diverse and scientifically literate workforce for the 21st century.

V. Committee Actions

On October 16, 2001, Science Committee Chairman Sherwood Boehlert and Rep. Larson introduced H.R. 3130, the Technology Talent Act of 2001, a bill to provide for increasing the technically trained workforce in the United States.

The Subcommittee on Research met on May 9, 2002, to consider the bill. An Amendment in the Nature of a Substitute was offered by Chairman Boehlert, Mr. Larson, Research Subcommittee Chairman Smith (MI), and the ranking member of the Research Subcommittee, Ms. Johnson (TX). In addition to making technical corrections to the bill, the amendment (1) restricted disciplines included in the Technology Talent program to the physical and information sciences, mathematics, engineering and technology; (2) required the NSF Director to award Instutitional Reform grants to

expand previously implemented undergraduate reform activities that have proven to be successful in increasing the number and quality of students receiving degrees in science, mathematics, engineering, and technology; (3) required the Director to award grants for professional development of undergraduate faculty in support of improved undergraduate science, mathematics, engineering, and technology education; (4) required the Director to award grants to institutions of higher education to support the acquisition of research grade instrumentation and to support training related to its use; (5) required the Director to award grants to establish sites that provide research experiences for 10 or more undergraduate science, mathematics, engineering, and technology students; (6) required that all science, mathematics, engineering, and technology projects sponsored by NSF disseminate project information and results via the Internet; (7) required the Director to evaluate the effectiveness of all undergraduate science, mathematics, engineering, and technology education activities supported by NSF; and (8) required a study on the factors that influence undergraduates to enter and complete degrees in science, mathematics, engineering, and technology programs. The amendment was adopted by a voice vote. Ms. Johnson moved that the Subcommittee favorably report the bill, H.R. 3130, as amended, to the Full Committee on Science with the recommendation that it be in order for the amendment, in the nature of a substitute adopted by the Subcommittee, to be considered as an original bill for the purpose of amendment under the five minute rule at Full Committee, and that staff be instructed to make technical and conforming changes to the bill as amended. With a quorum present, the motion was agreed to by a voice vote.

The Full Committee on Science met on Wednesday, May 22, 2002, to consider the bill. An amendment making technical changes to the bill was offered by Chairman Boehlert. An amendment was offered by Ms. Woolsey that would require the Director to strive to increase the number of underrepresented students receiving baccalaureate degrees in science, mathematics, engineering and technology and to require the program evaluation to include disaggregated data reflecting minority enrollment and graduation rates. Mr. Baca offered an amendment that would establish a Minority Serving Institutions Undergraduate Program to award grants to enhance the quality of science, mathematics, engineering, and technology education at qualifying minority-serving institutions. Mr. Baird offered an amendment that would amend the Scientific and Advanced Technology act of 1992 by: (1) expanding the purpose of NSF's Advanced Technological Education (ATE) program to include improvement of core math and science courses; (2) expanding the activities under the articulation partnerships section to include student research experiences at four year institutions; (3) establishing an ATE program Advisory Committee; and (4) authorizing additional funding for acquisition of state-of-the-art instruments required for science and technology education. These four amendments were merged into one En Bloc amendment, which was passed by a voice vote. Mr. Hall moved that the Committee favorably report the bill, H.R. 3130, as amended, to the House with the recommendation that the bill as amended do pass and that the staff be instructed to make technical and conforming changes to the bill as amended and prepare the legislative report and that the

Chairman take all necessary steps to bring the bill before the House for consideration. With a quorum present, the motion was agreed to by a voice vote.

VI. Summary of Major Provisions of the Bill

- Authorizes NSF to provide grants to institutions of higher education to increase the number and quality of graduates from science, mathematics, engineering and technology programs. Allows priority to be given to institutions with proposals that build on existing, successful efforts. Requires awardees to submit to the Director annual reports outlining their success in achieving the goals outlined in their application. Requires the Director to award a grant to an independent organization to evaluate the impact of the program and identify the best practices. Authorizes $25 million for fiscal year 2003, and such sums as necessary thereafter.
- Requires NSF to provide grants to institutions of higher education to expand successful science, mathematics, engineering, and technology reform beyond a single course to an entire department as well as to improve science, mathematics, engineering, and technology courses for non-majors. Requires grantees to provide multidisciplinary research opportunities for students and expand tutoring or mentoring programs to enhance recruitment and completion of a degree. Requires applicants to submit a description of the previously implemented reform effort and requires the Director to assess the feasibility of the proposed expansion. Authorizes $15 million per year for fiscal years 2003–2007.
- Requires NSF to provide grants to institutions of higher education, non-profits, or consortia thereof, for professional development projects aimed at improving science, mathematics engineering, and technology teaching. Allows grants to cover sabbatical funding, salary support, and stipends for graduate students and post doctoral fellows as well as support for mentoring undergraduate science, mathematics, engineering, and technology students. Requires the Director to hold an annual meeting of all awardees to foster information dissemination and collaboration. Authorizes $8 million per year for fiscal years 2003–2007.
- Requires NSF to provide grants to institutions of higher education to support the acquisition of research grade instrumentation, which must be used primarily for research, instruction, or both, in science, mathematics, engineering, and technology courses. Authorizes $10 million per year for fiscal years 2003–2007.
- Requires NSF to provide grants to institutions of higher education, non-profit entities, or consortia thereof, to establish sites that provide research experiences for ten or more undergraduate science, mathematics, engineering, and technology students. Requires that at least half of the students participating at each site come from an institution where there is little or no science, mathematics, engineering, or technology research activity. Requires that awards also include a wide range of science, mathematics, engineering, and technology disciplines as well as appropriate summer stipends or salary for mentors and students. Authorizes $10 million per year for fiscal years 2003–2007.
- Requires the Director to evaluate the effectiveness of all undergraduate activities supported by NSF and every three years to submit a report to Congress detailing the results.

• Requires the National Academy of Sciences to perform a study detailing the factors that influence students to pursue a degree in science, mathematics, engineering, and technology or to leave those majors for other disciplines. Authorizes $700,000 for fiscal year 2003 which is to remain available until expended.

• Requires the Director to award grants to minority serving institutions to enhance the quality of science, mathematics, engineering and technology education. Allows grants to support activities to improve courses and curriculum, faculty development, and stipends for undergraduate students.

• Amends the Scientific and Advanced Technology Act of 1992 by expanding the purpose of the ATE program to include improvement of core math and science courses and student research experiences at four-year institutions. Authorizes the Director to establish an advisory committee on science, mathematics, engineering and technology education at community colleges to evaluate the effectiveness of activities supported under the ATE program, and the effectiveness of NSF in disseminating information to other community colleges. Provides additional funding for acquisition of state-of-the-art instruments required for science and technology education at community colleges.

VII. Section-by-Section Analysis (By Title and Section)

Sec. 1. Short title

The "Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act".

Sec. 2. Findings

Discusses the impact of technological advancement on economic growth and the concern that inadequate numbers of U.S. graduates in science and technology fields will slow the pace of U.S. technological advancement. Discuss weaknesses in current undergraduate science, mathematics, engineering, and technology education—including poor teaching and lack of institutional reward for teaching as a scholarly activity—that may contribute to the declines in enrollment in some areas of science, mathematics and engineering.

Sec. 3. Definitions

Defines the terms "academic unit" to mean a department, division, institute, school, college or other subcomponent of an institution of higher education; "community college" to have the meaning given in section 7501(4) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 7601(4)); "Director" to mean the Director of NSF; "eligible nonprofit organization" to mean a nonprofit research institute or professional association with demonstrated experience delivering science, mathematics, engineering or technology education; "institution of higher education" to have the meaning given in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)); and "research-grade instrumentation" to mean a single instrument or a networked system of instruments that enable publication-quality research to be performed by students or faculty.

Sec. 4. Technology talent

Designates this section as the Technology Talent Act of 2002 and authorizes the Director to award on a competitive, merit-reviewed basis, no fewer than ten five-year grants to institutions of higher education to increase the number and quality of students receiving degrees in the physical or information sciences, mathematics, engineering and technology. Requires applicants to propose strategies for generating specific increases in the number and quality of students studying toward and receiving these degrees. Allows the Director to give priority in awarding grants to institutions that plan to build on past success in improving undergraduate education, and suggests possible uses of funds. Requires that awardees provide annual reports to NSF on their progress toward meeting the goals identified in their application. Continued participation in the program beyond the third year is contingent upon demonstrated progress toward meeting the specific goals contained within the application. Requires the Director to award at least one grant or contract to an independent organization to evaluate the program and identify best practices in undergraduate education.

Authorizes $25,000,000 for fiscal year 2003, and such sums as may be necessary thereafter to carry out this section.

Sec. 5. Institutional reform

Requires the Director to award merit-reviewed, competitive grants to institutions of higher education to expand previously implemented reforms of undergraduate science, mathematics, engineering or technology education that have been successful in increasing the number and quality of students studying and receiving degrees in these areas. Allowable uses of funds include: (1) the expansion of successful efforts beyond a single course or group of courses to an entire academic unit; (2) expansion of successful reform efforts beyond a single academic unit to another science, mathematics, engineering or technology academic unit; (3) creation of multidisciplinary courses or programs that formalize collaborations between various academic units; (4) expansion of undergraduate research opportunities; (5) expansion of innovative tutoring and mentoring programs; (6) improvement of science and mathematics education for non-majors, including education majors; and (7) implementation of technology-driven reform efforts that impact undergraduate instruction or research experiences.

Requires institutions funded under this section to provide evidence of support for, and commitment to, the proposed reform effort including implementation of policies and practices regarding faculty hiring, promotion, tenure and teaching assignment that reward faculty contributions to undergraduate education equal to, or greater than, scholarly scientific research. Instructs the Director to ensure, to the extent practicable, that grants awarded under this section are made available to a variety of types of institutions of higher education. Authorizes $15,000,000 for each of fiscal years 2003 through 2007 to carry out this section.

Sec. 6. Faculty development

Requires the Director to award merit-reviewed, competitive grants to institutions of higher education, eligible nonprofit organizations, or consortia thereof, for professional development of cur-

rent and future faculty to improve undergraduate science, mathematics, engineering, and technology education. Permits funds to be used to support individual professional development opportunities, including sabbatical or stipend support to enable faculty to engage in research in science, mathematics, engineering, technology, the science of learning, or educational assessment; stipend support for graduate students and post-doctoral fellows to participate in instructional activities at primarily undergraduate institutions; and release time from teaching for faculty engaged in the development, implementation, and assessment of undergraduate science, mathematics, engineering and technology education reform activities.

Also permits funds to be used to support institutions seeking to develop and implement faculty development programs focused on improving instruction and mentoring, as well as evaluations of undergraduate science, mathematics, engineering and technology students. Requires the Director to convene an annual meeting of awardees under the section to foster greater national information dissemination and collaboration in this area. Authorizes $8,000,000 for each of fiscal years 2003 through 2007 to carry out this section.

Sec. 7. Access to research-grade instrumentation

Requires the Director to award merit-reviewed, competitive grants to institutions of higher education that award fewer than 10 doctoral degrees per year in disciplines that are supported by NSF research grants to support the acquisition of research-grade instrumentation. Requires that instruments acquired through awards under this section be used primarily for undergraduate research, instruction, or both. Authorizes $10,000,000 for each of fiscal years 2003 through 2007.

Sec. 8. Undergraduate research experiences

Requires the Director to award merit-reviewed, competitive grants to institutions of higher education, eligible nonprofit organizations, or consortia thereof, to establish sites that provide research experiences for 10 or more undergradaute science, mathematics, engineering or technology students. Requires the Director to ensure that at least half of the students participating at each site are recruited from institutions of higher education where research is limited or nonexistent and that awards reflect the range of science, mathematics, engineering or technology disciplines supported by NSF. Requires the Director to support a variety of types of projects including multi-disciplinary and multi-institutional projects and requires that all student participants have mentors throughout the academic year. Requires awardees to track student participants through receipt of the undergraduate degree and for at least one year thereafter. Authorizes $10,000,000 for each of fiscal years 2003 through 2007.

Sec. 9. Dissemination of project information

Requires the Director to ensure that all NSF-sponsored undergraduate science, mathematics, engineering, or technology education projects, including those sponsored by NSF's research directives, disseminate via the Internet information regarding the scope, goals and objectives of each project; the activities, methodologies

and practices developed and implemented; and the outcomes—both positive and negative—of project assessment activities.

Sec. 10. Evaluation

Requires the Director to evaluate the effectiveness of all undergraduate science, mathematics, engineering, or technology education activities supported by NSF in increasing the number and quality of students studying and receiving associate or baccalaureate degrees in science, mathematics, engineering and technology. Requires the Director to establish a common set of assessment tools for use by grant recipients in their project-based assessment activities. Requires the Director to disseminate the results of the evaluations described in this section to the public and transmit to Congress a report containing the results of evaluations described in this section every three years. Requires the Director to evaluate and report the effectiveness of undergraduate science, mathematics, engineering and technology programs on increasing the number and quality of students, including disaggregated data indicating the number of traditionally underrepresented students, who receive baccalaureate degrees in these areas.

Sec. 11. National Academy of Sciences study on undergraduate recruitment and retention

Requires the Director to enter into an arrangement with the National Research Council to perform a study of the factors that encourage undergraduate students to enter and obtain degrees in science, mathematics, engineering and technology programs or to leave such programs and matriculate to other academic programs. Requires the Director to transmit a report of the results of this study to Congress not later than 18 months after the date of the enactment of this section. Authorizes $700,000 for fiscal year 2003.

Sec. 12. Minority-serving institutions undergraduate program

Requires the Director to establish a program to award grants to minority-serving institutions to enhance the quality of undergraduate science, mathematics, engineering education at such institutions and to increase the retention and graduation rates of students pursuing baccalaureate degrees in those areas. Provides support for activities aimed at improving course and curricular materials, at providing faculty development opportunities in scholarly research or in improving instruction and assessment capabilities, and at engaging students in academic and industry research experiences.

Sec. 13. Advanced technological education program

Amends and expands the Scientific and Advanced-Technology Act of 1992 to include support for improvement of core science and mathematics courses, including engineering and computer technology courses at community colleges that prepare students for transfer to four-year institutions. Expands activities supported under the Articulation Partnerships section of the 1992 Act to include stipends for students engaged in undergraduate experiences at four-year institutions and support for faculty who serve as mentors to those students engaged in such research activities. Establishes an advisory committee that must include industry and aca-

demic representatives to evaluate, report, and make recommendations annually regarding the effectiveness and compliance of the ATE program with the 1992 Act. Requires the Director to report on efforts to disseminate information about ATE-sponsored programs, the effectiveness of the national centers of excellence in serving as national and regional resources and clearinghouses, and efforts to maintain an accessible inventory of projects funded under this program. Authorizes $5,000,000 annually for fiscal years 2003 through 2007 for activities related to the improvement of core science and math education courses; $3,000,000 for fiscal year 2002, $3,500,000 for fiscal year 2004, $4,000,000 for fiscal year 2005; $4,500,000 for fiscal year 2006, and $5,000,000 for fiscal year 2007 for support the acquisition of state-of-the-art instruments required for preparing students in science and advanced technology; and $750,000 for support of research experiences for undergraduate students at four-year institutions as part of Articulation Partnerships grants.

VIII. COMMITTEE VIEWS

The Committee believes that undergraduate science, math, engineering and technology reform efforts have not been successful enough in achieving the changes in institutional culture that are required to better prepare increased numbers of undergraduate students in science, mathematics, engineering and technology. In addition, the Committee has concluded that, despite nearly twenty years of undergraduate education reform efforts, there is little understanding of the factors that truly influence a student's decision to enroll in, or withdraw from, a major in a science, mathematics, or engineering field.

The programs authorized by this act are designed not only to address a number of barriers to high quality undergraduate education, such as inadequate facilities and poor preparation of faculty for their role as educators, but also to determine empirically those factors key to a student's success in science and engineering courses and majors. In addition, this Act provides opportunities and incentives for institutions to implement changes in policies and practices that will increase the number and quality of students who study, and ultimately earn degrees, in science, mathematics, engineering and technology.

The Committee strongly believes that NSF is well positioned to run these programs given its historical relationship with institutions of higher education and its past work in the area of undergraduate education reform.

Section 4—The Technology Talent Act of 2002

The Technology Talent Act of 2002 was sparked in part by concern over U.S. dependence on foreign workers in some areas of science and engineering—as evidenced by increasing H1–B visa petitions—and suggestions by Stanford economist Paul Romer that a disconnect exists between the private sector, with its demand for scientists and engineers, and the educational system, whose policies and practices are driven more by internal decisions and historical practices than by external supply and demand pressures.

However, the Committee does not envision the Technology Talent Act of 2002 as a remedy to any particular workforce shortage. Rec-

ognizing the difficulty in accurately predicting future workforce needs, the Committee believes that directing funds solely toward today's specific workforce shortages risks leaving the nation unprepared to meet the challenges and demands of tomorrow. Rather, the primary goal of the Technology Talent program is to ensure that the Nation has a continuing supply of science, mathematics, engineering and technology majors both to maintain our leadership in technological innovation and to ensure a scientifically and technologically literate citizenry.

The Technology Talent Act of 2002 provides incentives to institutions of higher education to implement programs, activities, and services that will have a direct impact on the number and quality of graduates in the physical and information sciences, mathematics, engineering and technology. The Committee values the contributions of the biological and social sciences, and the decision to focus this particular program on the physical sciences, mathematics, engineering, and technology in no way indicates that support for the biological or social sciences should be reduced or eliminated from any other NSF research or education activity. The Committee recognizes the success these disciplines have had in increasing the number of their graduates, and encourages other science and engineering disciplines to adopt and implement strategies that have been successful in the social and biological sciences.

For the purposes of this section, the physical sciences include such fields as chemistry, physics, astronomy, and earth and atmospheric sciences, while the information sciences include such fields as computer science and bioinformatics. Mathematics includes such fields as theoretical and applied mathematics, and engineering includes such fields as electrical engineering, chemical engineering, bioengineering, biomedical engineering, aeronautical and astronautical engineering, computer engineering, software engineering, civil engineering, mechanical engineering, and materials engineering. The Committee strongly encourages the participation of interdisciplinary programs such as ones focused on nanotechnology, that prepare students for the contemporary workplace and that teach students to assimilate and transfer ideas from one science or engineering discipline to another.

The term "technology" is intended to mean those programs offered primarily by two-year colleges that train individuals for direct employment by the high technology sector including information technology, engineering technology, computer technology, and biotechnology. The Committee assumes that students completing two-year technology degrees will be able to enter the workforce directly or transfer to a four-year school where credits earned under the technology degree could be applied toward a baccalaureate degree in a related area.

To qualify for funding under the Technology Talent Act of 2002, an institution of higher education must state a specific goal for increases in student enrollment and graduation that will result from the implementation of the proposed project, for all academic disciplines included in the proposed project. In addition, the applicant must provide a clear programmatic plan for meeting those projections. The Committee believes strongly that an institution of higher education must not reduce the rigor of its curriculum nor the standards by which student success is measured to increase enroll-

ment and completion rates. An institution of higher education seeking funding under this section, therefore, must describe the metrics by which student performance will be measured and by which the quality of the instructional program will be evaluated.

The Committee recognizes that many two-year colleges do not allow students to select majors or earn degrees in particular academic areas and may award degrees broadly in the arts or sciences. In such cases, those programs that prepare students for transfer to baccalaureate degree programs in the physical and information sciences, mathematics, engineering and technology, or that provide concentrated program of study or a certificate in one or more of those academic areas, do qualify for funding under this section. The Committee understands that many students transfer to four-year institutions prior to completing the associated degree at the community college. The Committee intends that, for the purposes of this section, a student's transfer to a physical or information science, mathematics or engineering program at a four-year institution or completion of a certificate program in one of these areas be considered a successful outcome equal to graduation from a community college program.

The Committee intends that awards made under this section be five years in duration to allow adequate time to plan, implement and assess the activities proposed by the awardee. The Committee believes that by the third year of the grant, the awardee should have made significant progress toward the enrollment and graduation goals stated in the grant application. While the Committee recognizes that programmatic changes may not result in increased graduation rates for at least four years, the Committee believes that by the end of the third year of the grant, indications of future success, such as increased enrollment and retention rates, should be observable. The Committee assumes that an institution that is not making progress toward its projected goals and is not likely to achieve the projected increased by the end of the funded period will not receive the final two years of funding for an award made under this section.

Because the focus of the Technology Talent Act of 2002 is increasing the number—while maintaining or improving the quality—of graduates in the specified academic areas, and because the final two years of funding depend upon demonstrated progress by the awardee during the first three years, the Committee believes that accurate record keeping and reporting are an important requirement of the program. Therefore, each grantee must report annually the number of students enrolled in the academic programs funded under their award and must track and report each student's academic performance, persistence to degree completion, and placement during the first year after graduation. The Committee assumes that a web-based data collection portal, similar to the one designed and used for NSF's Computer Science, Engineering and Mathematics scholarship program, will be established and operated by NSF to streamline the collection of student enrollment, graduation and performance data.

It is the objective of the program to increase the number and quality of new majors rather than to encourage the transfer of students from one science, mathematics, or engineering discipline to another. Section 4(b)(2)(F) requires awardees to collect the data

necessary to demonstrate that the projects funded through this program successfully attract new students into these majors and retain them through to graduation (or in the case of a community college, transfer to a four-year institution). The Committee also expects that NSF will ensure that the program as a whole meets this objective of attracting new students to these majors.

In accordance with section 4(e), the Committee expects NSF, in selecting projects for support under this program, to take into consideration proposals that have promise for increasing the numbers of women and minorities pursuing and persisting in studies in these fields. Success in this regard should also be considered as one criterion for making subsequent awards under the program.

The Committee believes that it should be up to the awardee institution to determine the particular metrics for evaluating student achievement. However, the Committee strongly believes that these metrics must be quantitative in nature and enable meaningful determinations of the quality of student academic achievement. These metrics might include grade point average, the use of standardized assessments, or other discipline-developed quantitative measures of student academic achievement.

The Committee believes that an important indicator of the quality of an educational program is the placement of graduates in either jobs or advanced educational programs. For this reason, institutions receiving funding under this section must determine placement of students within the first year after their graduation in a job or advanced educational program.

The Committee understands that tracking students can be particularly difficult for community colleges where students frequently transfer to different institutions prior to degree completion. A community college awardee under this section therefore may establish procedures for tracking transfer students that include student-reported information, or data from four-year institutions to which these students are likely to transfer.

The Committee recognizes the value of innovation in advancing the goals of the Technology Talent Act of 2002 but understands that results are also likely to come from the implementation of programs and practices already proven to have had success in increasing student enrollment and graduation rates. For that reason, the Committee encourages the Director to give priority to those institutions of higher education whose proposals build on successful previous efforts. In particular, the Committee recognizes that activities support under NSF's Louis Stokes Alliances for Minority Participation (LSAMP) program have been successful in increasing the number of underrepresented minority student in science and engineering and, in accordance with section 4(i), expects NSF to consider grants to institutions participating in LSAMP as one approach in meeting the goals of the program established under this section.

The Committee also recognizes the important of faculty in helping students through critical points in their academic careers and, therefore, encourages the Director to give priority to institutions of higher education that support and reward faculty for their productive involvement with undergraduate students. The Committee also strongly encourages institutions of higher education to work with industry in designing effective curricula, student internship pro-

grams, and student assessment activities and to leverage the federal investment with matching funds from industry, state or local government sources, or private sources.

As is the case in all reform programs, the Committee believes that it is imperative that the activities supported under this section be evaluated to determine causal relationships between practices and outcomes. It is important that reform efforts help determine which activities have the greatest impact on student enrollment and graduation rates in each of the academic disciplines supported under this section and in relation to different student demographics and institutional types. Activities that are highly successful in one institution setting may not be effective or even possible to implement in another one. Therefore, the Director is required to implement a comprehensive assessment and evaluation program intended to identify best practices based on desired outcomes as well as student and institutional characteristics. This assessment and evaluation program must include project-based assessment as well as program-wide evaluation.

Project-based assessment is intended to evaluate the effectiveness of each project funded under this section and to identify those activities that were most important to the overall success of the awardee in meeting the projected increases in the number and quality of graduates and in achieving positive changes in institutional policies and practices in support of those goals. The Committee believes that project-based assessment should be fully planned and implemented at the outset of the funding period so that adequate baseline data can be collected and analyzed. It is important for each awardee to report both positive and negative findings related to the work supported under this section, as negative results are as important to increasing understanding of best practices as are positive ones. The Committee expects awardees to utilize appropriate controls and standards in performing the assessment.

While individual projects must report project-based outcomes, the Committee also expects NSF to thoroughly evaluate and compare the results of all projects supported under this section to identify those elements of undergraduate education reform that are most critical to increasing the number and quality of science and engineering graduates. For that reason, the Director is instructed to retain the services of an independent evaluative organization to develop metrics for measuring the impact of the Technology Talent program on student enrollment and graduation rates, student performance as measured by quantifiable means, and student placement following graduation.

Because the independent evaluator will rely heavily on data collected and reported by grantees, the Committee recognizes that the evaluator must inform each awardee of the data that must be collected prior to the awardee initiating the proposed activities. Therefore, the Director is to contract with the independent evaluator within 180 days of the enactment of this section so that the evaluation metrics can be developed and disseminated to all awardees in a timely manner.

The Committee believes that NSF can play an important role in helping institutions of higher education engage in effective reform activities simply by providing information about current and prior

reform efforts. The Committee expects that the Director, in reports that summarize the evaluation of particular programs, such as those specified in sections (4)(f)(2) and (4)(f)(3), will include a comparison of enrollment and graduation trends at institutions supported by the Technology Talent program as well as those that are not.

The Director must establish an advisory committee that can secure active participation by industry and state and local governments in this program, and can recommend innovative strategies to meet the goals and evaluate the impact of the program. The Committee believes that a Committee of Visitors, typically established by NSF for the purpose of program direction and evaluation, would fulfill the requirement for the Advisory Committee described in section (4)(g) so long as the constitution and responsibilities of the Committee of Visitors reflect that of the Advisory Committee described by this paragraph.

Section 5—Institutional reform

The Committee is aware that a number of NSF-funded undergraduate education reform programs have enabled institutions of higher education to implement small-scale efforts to improve individual courses and programs. However, the Committee believes that to be truly effective, reform efforts must encompass entire academic units and drive significant cultural changes in education practice and institutional policy. The Committee feels that additional investment in those institutions that have demonstrated their capacity for reform through small-scale efforts is an important step towards implementing reforms that will have an impact on greater numbers of undergraduate students.

This Act requires the Director to create a new program to meet the goals of section 5, or to modify an existing program to do so. Institutional reform grant funds may be used for activities that expand successful reform efforts beyond a single course or group of courses to achieve reform within an entire academic unit or within another academic unit at the awardee institution. The Committee strongly encourages the use of Institutional Reform funds to create multidisciplinary courses or programs that formalize collaborations among various science, mathematics, engineering and technology departments or between schools of science and engineering and schools of education for the purpose of improving the education of future K–12 teachers.

In awarding Institutional Reform grants, the Director must consider the quality of the reform effort proposed, the likelihood of success based on the results of past reform efforts, and evidence that those engaged in the previous effort will play a key role in the proposed effort. The Committee strongly believes that an important element of institutional reform is the commitment by the institution to implementing hiring, promotion and tenure policies that reward faculty for contributions to undergraduate education. The Committee intends that this program help drive cultural changes at institutions of higher education so that teaching and mentoring are valued as important faculty scholarly activities. The Committee believes that if faculty are to invest time and energy in productive education reform activities, they must do so knowing that they will receive professional advancement and reward for their work.

Section 6—Faculty development

The Committee is concerned that most undergraduate science and engineering faculty have received little or no training to prepare them for their roles as undergraduate teachers and mentors. Without training; faculty tend to teach as they were taught, often using ineffective methods and perpetuating the "survival of the fittest" culling process for science and engineering majors.

The Committee views sabbatical research opportunities as an important way to enhance undergraduate faculty performance in both research and teaching. In addition, to better prepare future faculty for their role as undergraduate educators and mentors, the Committee feels that it is very important to provide opportunities for graduate students and post-doctoral fellows to receive instructional training. Therefore, the Faculty Development program established by this section includes stipends to graduate students and post-doctoral fellows for the purpose of participating in an undergraduate education training opportunity.

The Committee realizes that some institutions of higher education, professional societies and non-profit entities have been successful in developing programs that engage a number of faculty in professional development and undergraduate reform activities, and this Act provides support for these programs. The Committee encourages NSF to include adjunct faculty as participants in these programs. Similarly, the Committee encourages NSF to consider the unique needs of teaching assistants and to encourage institutions of higher education to provide instructional training to teaching assistants as part of NSF-supported faculty development programs.

Section 7—Access to research grade instrumentation

Currently, NSF provides support for small instruments used in undergraduate classroom laboratory settings (primarily through the Course, Curriculum and Laboratory Improvement Program) and for faculty research (primarily through the Research at Undergraduate Institutions (RUI) and the Major Research Instrumentation (MRI) program). However, NSF has no program to fund the purchase of research-grade instruments for the primary purpose of undergraduate instruction or undergraduate research. NSF and the scientific community have emphasized the positive impact that undergraduate research appears to have on student performance as well as on student persistence through degree completion and the decision to pursue graduate education. Therefore, the Committee believes that all institutions that educate undergraduate students—including liberal arts institutions, comprehensive undergraduate institutions, and community colleges—ought to have access to sophisticated instruments to engage undergraduate students in meaningful research experiences.

The focus of the program described in section 7 is to provide instruments to those institutions that lack research infrastructure, defined under this section as institutions of higher education—including community colleges—that award fewer than ten total doctoral degrees per year in the natural and physical sciences, mathematics, engineering, and technology disciplines. The Committee also strongly encourages the Director to use funds established under this Section to provide supplemental funding to community

colleges funded under the Advanced Technological Education Act of 1992 to support the purchase of research-grade instruments.

The Committee believes that instruments purchased primarily for the purpose of undergraduate instruction and research may also be used for the purpose of faculty research as long as the faculty research does not interfere with use of the instrument by undergraduate students.

The Committee is concerned that NSF's Research at Undergraduate Institutions (RUI) program does not have a definitive program budget; rather, funds to support a request for instrumentation or research support made under an RUI solicitation must come from the general research budget. The Committee recognizes that research conducted at institutions focused more on undergraduate education than on research is often of high quality and importance and provides significant benefits for the undergraduate students involved in the work. However, because these institutions often lack access to high quality research facilities, graduate students, and post-doctoral fellows, their research output is typically lower than that of more research-oriented institutions. As such, undergraduate education-focused institutions typically face significant obstacles when competing against research-intensive institutions for limited instrumentation funding. The Committee believes that RUI funds should be set aside from core research funds and that awards made under the RUI program should be tracked and assessed as if the RUI program were a distinct program with designated funds.

Section 8—Undergraduate research experiences

The Research Experiences for Undergraduates (REU) program at NSF provides opportunities that are often "turning points" in the lives of many future scientists and engineers. The REU program is currently divided into two tracks: supplemental awards to existing research grants that support one or two students in a summer research experience, and site awards that provide formal research opportunities for ten or more students at a particular institution.

For REU site awards under section 8, the Committee charges the Director with ensuring that at least half of the students included in any given site come from institutions, that including community colleges, where research is limited or non-existent. The Committee intends that the term "limited" mean institutions where a few but not all faculty are engaged in research, where the research infrastructure is rudimentary, where scholarly research activity is not a primary factor in promotion and tenure decisions, or where faculty research does not result in the publication of scholarly papers.

The Committee recognizes the importance of mentoring in enriching a student's research activities, and believes it is most appropriate to engage faculty from the REU student participant's home institution to serve as a mentor during the academic year, in order to facilitate stronger connections between the students' home institution and the REU site. The Committee also encourages the Director to give priority to those proposals that engage faculty from a variety of institutions in the activities of the REU site.

The Committee is concerned that the NSF does not have mechanisms in place to fund large, multidisciplinary REU sites. As a result, institutions may be managing REU awards in different academic disciplines separately and opportunities for students to en-

gage in multidisciplinary research or to interact with students in other discipline areas may be lost. The Committee encourages the Director to establish funding mechanisms for larger, multi-disciplinary REU Sites to streamline the management of programs at awardee institutions and to provide expanded opportunities to students. In addition, given the ability to link geographically distant campuses and facilities, the Committee encourages the Director to allow 'virtual' collaborative efforts to be included in the portfolio of NSF-funded REU Sites. The Committee believes that virtual collaboration can be especially productive for students engaged in computer science-related research experiences. The Committee encourages the Director to allow professional societies and non-profit associations to act as facilitators of REU collaborative programs that involved a number of campuses. Professional societies can be instrumental in linking a number of campuses and in providing national outreach to students to inform them about REU opportunities.

Finally, in order to ensure that students in a wide variety of disciplines have access to research experiences, this section requires the Director to establish mechanisms to ensure that the REU Site portfolio reflects the diversity of academic disciplines supported by NSF funds. The Director is also required to evaluate the REU program to determine its impact on student persistence to degree completion and enrollment in graduate level programs in science, mathematics and engineering.

Section 9—Dissemination of project information

The Committee has found that it can be difficult to locate specific information about NSF-funded projects, such as the precise methodologies, activities, practices and materials being developed and implemented by awardees. Even harder to find can be information regarding positive and negative outcomes of the funded work beyond a few published articles in professional journals or from NSF-sponsored meetings for principal investigators. The Committee views NSF-funded work as being intrinsically valuable not only to the funded investigator, but to the community at large. Therefore, this Act requires the Director to ensure that all undergraduate science, mathematics, engineering or technology education projects disseminate complete information about the activities, progress outcomes and assessment of their projects via the Internet. The Committee expects that NSF will establish program-based web sites that will provide links to appropriate project-based or institutional web sites, and that information about undergraduate activities funded by the Research and Related Activities Directorates will also be included.

Section 10—Evaluation

The Committee believes that evaluation of the outcomes and impact of undergraduate education activities is as important as the development and implementation of the activities themselves. However, evaluation and assessment have historically received less attention and funding that other sponsored activities. In many of the programs sponsored by NSF's Education and Human Resources Directorate, the primary mechanism for review of projects is self-assessment, whereby the principal investigator for a grant, or a con-

sultant hired by that investigator, conducts the assessment of a project's progress and results.

Self-evaluation is an important part of the development and implementation process as it keeps the investigator's work aligned to the project goals and objectives and helps the investigator meet those goals, time deadlines, and budgetary constraints. On the other hand, self-evaluation or assessment can be narrow and biased toward positive results, is often times not a priority during the early development and implementation stages of the work, and frequently is given too little time and money. In addition, many superb educators and scientists lack any training in evaluation and assessment methodologies and may be poorly equipped to design and implement a comprehensive assessment plan or to interpret evaluative data.

Funds requested for evaluation are frequently reduced during the NSF budget negotiation process and the size and duration of typical awards make it impossible to conduct an informative evaluation. A three-year grant rarely provides time for the implemented work to be refined or for positive results to be realized in improved student performance. As a result of these difficulties, much of the current project evaluation and assessment is heavily reliant on subjective measures such as attitudinal surveys or on uninformative data such as numbers of teacher or student participants. Assessment rarely includes performance-based evaluation, largely because the short duration of grants precludes the involvement of adequate numbers of students necessary to make the assessment relevant or valid.

For these reasons, the Committee believes that it is very important for NSF to take a much more active role in project and program evaluation and to help investigators plan and execute valuable and informative assessments and evaluation. The Committee recognizes the expertise of NSF's Research, Evaluation, and Communication Division within the Education and Human Resources Directorate and calls on the Division to assist the Foundation in developing assessment benchmarks and tools that will enable sponsored investigators to improve their project-based assessment and evaluation activities and to provide data that is valuable to the Foundation for the purpose of comparative analysis and program evaluation. These benchmarks and tools should enable the Foundation to evaluate the effectiveness of all undergraduate education activities supported by all NSF directorates in increasing student enrollment and completion of science, mathematics, engineering and technology courses (for non-majors) and programs (for majors); student academic achievement; and placement in careers or advanced education following degree completion. Particularly promising projects should be subjected to extended evaluation, through supplemental funding or an award to an independent evaluative organization, to enable long-term evaluation of the project's activities and impact.

The Committee does not expect NSF to develop assessment instruments or tests that will be used to assess student performance. Rather, NSF should enable project managers to collect the data and implement the performance benchmarks and tools that will allow a retrospective determination of "what works" and provide a cumulative basis for best practices. The purpose of such assessment

and evaluation is to provide feedback that will improve the system and inform others of successful approaches, and to begin establishing causal relationships between practices and outcomes. The Committee expects the Director to make the results of such evaluations public.

Section 11—National Academy of Sciences study on undergraduate recruitment and retention

The Committee believes that while there is much speculation about the reasons for declining enrollments in some areas of science while graduation rates are soaring in others, these justifications are largely speculative and lack grounding in research, and it is time to look more carefully at successful models to determine "what works." Therefore, section 11 requires the Directors to enter into an arrangement with the National Research Council to perform a study on the factors that influence undergraduate students to enter, and persist to degree completion in science, mathematics, engineering and technology programs or to leave such programs and matriculate to other academic programs, or to leave college altogether. The Committee expects that student reported data regarding reasons for declaring an interest in, for persisting to degree completion, or for exiting a program in science, mathematics, engineering and technology be utilized in generating the report.

Section 12—Minority-serving institutions undergraduate program

The Committee recognizes that the size and quality of the scientific and engineering workforce could be expanded significantly if the largely untapped population of underrepresented minority students were engaged in high-quality science, mathematics, engineering or technology programs. Population projections indicate that the number of white males entering the higher education pipeline will decline after 2010 while the number of minority students and women will continue to increase. The program established under section 12 is specifically aimed at enhancing the quality of undergraduate science, mathematics, and engineering education at minority-serving institutions including Hispanic-Serving Institutions, Historically Black Colleges and Universities, Alaska Native-Serving Institutions, Native Hawaiian-Serving Institutions, and tribally controlled colleges and universities. The Committee expects that grants awarded under this program will be used: (1) to improve courses and curricular materials; (2) for faculty development including faculty sabbatical and exchange opportunities in research and technological advancement; (3) for professional development workshops on effective teaching practices and assessment; (4) to support visiting faculty including researchers from industry; (5) to allow faculty release time for the purpose of mentoring students or participation in curriculum reform or academic enhancement activities; and (6) for stipends for undergraduate students participating in academic or industry research activities.

Section 13—Advanced technological education program

The Committee recognizes the important contributions community colleges make toward training students in technical fields, in providing associate's degree programs in science, mathematics, engineering and technology, and in preparing students for transfer to

four-year colleges where they will earn baccalaureate degrees in science, mathematics, and engineering. In addition, many students who will become pre-K through 8th grade teachers start their education at a community college. The nation's 1,600 two-year institutions educate nearly 5.5 million students and award approximately 550,000 associates degrees annually, with only approximately 30,000 of those degrees awarded in the science and engineering areas. However, these statistics can be misleading, as many community colleges provide strong science and engineering education to students who transfer to four-year colleges and universities prior to completing the associate's degree. The Committee is concerned that little data exists on the role community colleges play in the undergraduate science, mathematics, engineering and technology enterprise, particularly with respect to community college students who ultimately earn baccalaureate degrees in science, mathematics, engineering or education. Therefore, the Committee encourages NSF to collect more information on community colleges as part of the National Survey of College Graduates.

NSF, in accordance with the Scientific and Advanced-Technology Act of 1992 (42 U.S.C. 1862i(a)), established a highly successful program, the ATE Program, that has facilitated the training of thousands of highly skilled technical workers through a variety of projects and 16 Centers of Excellence and Large-Scale Dissemination Projects. Given the success of the ATE program in increasing the number and quality of technical workers, the Committee believes that this program could make equal or greater contributions to the core science, mathematics, engineering and technology courses offered to students enrolled in associate's degree or transfer programs in these areas. Therefore, the Committee amended the 1992 Act to authorize activities for the improvement of core education courses in science and mathematics, including courses in engineering science and computer technology, which are required for students transferring to a four-year institution to pursue baccalaureate degrees. In addition, the Committee has explicitly authorized appropriations for instrumentation under the ATE program to encourage NSF to increase the allocation of resources allowed for the acquisition of state-of-the-art instrumentation through grants awarded under the ATE Program as an important contributor to improving science and technology courses. The Committee understands that these courses serve a wide variety of students including science, mathematics and engineering majors, non-majors, and teacher education majors. By improving the science and mathematics course work available to students at community colleges, the Committee feels that students who attend community colleges will have a higher degree of scientific and mathematics literacy, and will pursue and be successful in science, mathematics and engineering majors.

The Committee strongly favors the creation and strengthening of bridge programs that facilitate the transition of students from community college to four-year institutions, as supported by the Articulation Partnerships authorized by the Scientific and Advanced-Technology Act of 1992. Testimony from the Committee's March 7, 2002 hearing showed that including community college students in undergraduate research experiences at four-year institutions has an enormous impact on both the likelihood that the community col-

lege student would ultimately transfer to a four-year institution to earn a degree in science, and on the likelihood that the student would pursue higher education in science following completion of the baccalaureate degree. For this reason, the Articulation Partnerships section of the 1992 Act is amended to authorize support for students participating in research experiences at undergraduate institutions and support for faculty mentors involved in those research activities.

To ensure that the ATE Program is meeting the goals and objectives of the 1992 Act, the Committee instructs the Director to establish an advisory committee on science, mathematics, and technology education at community colleges composed of academic and industry representatives. The advisory committee may be constituted as a new committee or may be an extension of the Committee of Visitors already established for the ATE program as long as the membership and scope of work of the Committee of Visitors is consistent with section 13(c) of the bill. The role of the advisory committee is to review and assess the activities carried out under the ATE program including conformity of the program to the 1992 Act, the effectiveness of activities supported under the program in strengthening the science, mathematics and technical training capabilities of community colleges, the effectiveness of NSF and institutions supported under the program in disseminating information about activities carried out under the program, and the balance of resources allocated between national centers of excellence, individual projects, and articulation partnerships.

IX. Cost Estimate

A cost estimate and comparison prepared by the Director of the Congressional Budget Office under section 402 of the Congressional Budget Act of 1974 has been timely submitted to the Committee on Science prior to the filing of this report and is included in Section X of this report pursuant to House Rule XIII, clause 3(c)(3).

H.R. 3130 does not contain new budget authority, credit authority, or changes in revenues or tax expenditures. Assuming that the sums authorized under the bill are appropriated, H.R. 3130 does authorize additional discretionary spending, as described in the Congressional Budget Office report on the bill, which is contained in Section X of this report.

X. Congressional Budget Office Cost Estimate

U.S. Congress,
Congressional Budget Office,
Washington, DC, June 4, 2002.

Hon. Sherwood L. Boehlert,
Chairman, Committee on Science,
House of Representatives, Washington, DC.

Dear Mr. Chairman: The Congressional Budget Office has prepared the enclosed cost estimate for H.R. 3130, the Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is Kathleen Gramp.

Sincerely,

STEVEN LIEBERMAN
(For Dan L. Crippen, Director).

Enclosure.

H.R. 3130—Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act of 2002

Summary: H.R. 3130 would authorize various initiatives at the National Science Foundation (NSF) related to undergraduate education in science, math, engineering, and technology. The bill would authorize grants to academic institutions and nonprofit entities for programs that would increase the number of undergraduates pursuing scientific degrees, expand research opportunities for undergraduate students, develop faculty, implement certain institutional reforms, and improve access to research instrumentation at certain universities. In addition, H.R. 3130 would direct NSF to establish a special grant program for institutions that serve minority students, including Hispanic-Serving Institutions, Historically Black Colleges and Universities (HBCUs), and tribally controlled colleges and universities. Finally, NSF would be required to fund a study by the National Academy of Sciences (NAS) on students' perspectives on why they would or would not pursue an undergraduate degree in these fields.

Assuming appropriations of the necessary amounts, CBO estimates that implementing this bill would cost a total of $500 million over the 2003–2007 period. The bill would not affect direct spending or receipts, so pay-as-you-go procedures would not apply.

H.R. 3130 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, or tribal governments. The bill would benefit public universities and community colleges by authorizing grant programs to increase the number of U.S. students obtaining degrees in nonmedical science and technology. Any costs incurred by public investments and community colleges would be voluntary.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 3130 is shown in the following table. The costs of this legislation fall within budget function 250 (general science, space, and technology).

	By fiscal year, in millions of dollars—					
	2002	2003	2004	2005	2006	2007
CHANGES IN SPENDING SUBJECT TO APPROPRIATION						
Estimated Authorization Level	0	145	147	149	151	154
Estimated Outlays	0	17	81	123	136	142

Basis of estimate: For this estimate, CBO assumes that the necessary amounts would be appropriated near the beginning of each fiscal year and that outlays will follow the pattern of existing education programs at NSF. Unless otherwise specified in the bill, CBO assumes that funding levels would be adjusted annually for inflation.

H.R. 3130 would specify funding levels for some—but not all—of NSF's educational activities. The bill would direct NSF to establish at least 10 "talent expansion" centers that would focus on increasing the number of undergraduates in scientific fields and would authorize $25 million for 2003 and such sums as may be necessary thereafter for the centers. It also would authorize about $53 million for fiscal years 2003 through 2007 for grants for certain reforms at educational institutions, faculty development, instrumentation, undergraduate research opportunities, and certain existing programs focused on improving the quality of undergraduate education.

In addition, CBO estimates that H.R. 3130 would authorize an average of $70 million a year for grants to institutions serving minority students. NSF expects to spend a total of $27 million in 2002 for grants to HBCUs and tribally controlled colleges and universities, which includes institutions serving Alaska Natives and Native Hawaiians. CBO estimates that expanding this program to include Hispanic-Serving Institutions would cost another $40 million in 2003 if the level of support is similar to that provided to the other institutions. Finally, the estimated funding for 2003 includes $700,000 authorized by the bill for a NAS study.

Pay-as-you-go considerations: None.

Estimated impact on state, local, and tribal governments: H.R. 3130 contains no intergovernmental mandates as defined in UMRA and would impose no costs on state, local, or tribal governments. The bill would benefit public universities as well as community colleges by authorizing grant programs to increase the number of U.S. students obtaining degrees in nonmedical science and technology. Any costs incurred by public universities and community colleges would be voluntary.

Estimated impact on the private sector: This bill contains no new private-sector mandates as defined in UMRA.

Estimate prepared by: Federal Costs: Kathleen Gramp; Impact on State, Local, and Tribal Government: Elyse Goldman; and Impact on the Private Sector: Patrice Gordon.

Estimate approved by: Peter H. Fontaine, Deputy Assistant Director for Budget Analysis.

XI. Compliance With Public Law 104–4

H.R. 3130 contains no unfunded mandates.

XII. Committee Oversight Findings and Recommendations

The Committee on Science's oversight findings and recommendations are reflected in the body of this report.

XIII. Statement on General Performance Goals and Objectives

Pursuant to clause (3)(c) of House rule XIII, the goals of H.R. 3130 are to improve undergraduate science, mathematics, engineering and technology education for all students and to increase the number of graduates of programs in those areas.

The Committee requires that all of the programs authorized under the Undergraduate Science, Mathematics, Engineering and Technology Education Improvement Act be awarded on a competi-

tive, merit-review process. This process is expected to ensure that only those projects that hold the most promise for increasing the number and quality of graduates of science, mathematics, engineering or technology programs and for increasing the quality of undergraduate science, mathematics, engineering and technology education will receive funding. While increasing the number of science and engineering graduates is the primary goal of this Act, it is imperative that the rigor of the undergraduate program and quality of graduates not be compromised simply in the interest of increased numbers. Rather, all efforts to increase student enrollment should be supported with parallel efforts to improve the quality of each student's undergraduate science, mathematics, engineering and technology experience.

The decades-long engagement in undergraduate education reform has highlighted the need to engage undergraduate students in productive interactions with faculty through research experiences and mentoring programs, yet the mechanisms by which these activities are most effectively introduced remain largely unclear. The precise factors that lead to a student's decision to pursue or persist in a science or engineering degree program, or to transfer out of such a program are also not well understood. For those reasons, this Act requires that all of NSF-funded undergraduate science, mathematics, engineering, and technology education projects and programs be subjected to rigorous assessment and evaluation such that a national clearinghouse of best practices for increasing student enrollment, persistence and achievement evolves.

XIV. Constitutional Authority Statement

Article I, section 8 of the Constitution of the United States grants Congress the authority to enact H.R. 3130.

XV. Federal Advisory Committee Statement

The functions of the advisory committee established by H.R. 3130 are not currently being nor could they be performed by one or more agencies or by enlarging the mandate of another existing advisory committee.

XVI. Congressional Accountability Act

The Committee finds that H.R. 3130 does not relate to the terms and conditions of employment or access to public services or accommodations within the meaning of section 102(b)(3) of the Congressional Accountability Act (Public Law 104–1).

XVII. Statement on Preemption of State, Local, or Tribal Law

This bill is not intended to preempt any state, local, or tribal law.

XVIII. Changes in Existing Law Made by the Bill, as Reported

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

SECTION 3 OF THE SCIENTIFIC AND ADVANCED-TECHNOLOGY ACT OF 1992

SEC. 3. SCIENTIFIC AND TECHNICAL EDUCATION.

(a) NATIONAL ADVANCED SCIENTIFIC AND TECHNICAL EDUCATION PROGRAM.—The Director of the National Science Foundation (hereafter in this Act referred to as the "Director") shall award grants to associate-degree-granting colleges, and consortia thereof, to assist them in providing education in advanced-technology fields*, and to improve the quality of their core education courses in science and mathematics*. The grant program shall place emphasis on the needs of students who have been in the workforce (including work in the home), and shall be designed to strengthen and expand the scientific and technical education and training capabilities of associate-degree-granting colleges through such methods as—

(1) the development of model instructional programs in advanced-technology fields *and in core science and mathematics courses*;

(2) the professional development of faculty and instructors, both full- and part-time, [in advanced-technology fields] *who provide instruction in science, mathematics, and advanced-technology fields*;

* * * * * * *

(c) ARTICULATION PARTNERSHIPS.—

(1) PARTNERSHIP GRANTS.—(A) * * *

(B) Each eligible partnership receiving a grant under this paragraph shall, at a minimum—

(i) counsel students, including students who have been in the workforce (including work in the home), about the requirements and course offerings of the bachelor-degree-granting institution; [and]

(ii) conduct workshops and orientation sessions to ensure that students are familiar with programs, including laboratories and financial aid programs, at the bachelor-degree-granting institution[.]*;*

(iii) provide students with research experiences at bachelor-degree-granting institutions participating in the partnership, including stipend support for students participating in summer programs; and

(iv) provide faculty mentors for students participating in activities under clause (iii), including summer salary support for faculty mentors.

* * * * * * *

XIX. COMMITTEE RECOMMENDATIONS

On May 22, 2002, a quorum being present, the Committee on Science favorably reported the Undergraduate Science, Mathematics, Engineering and Technology Education Improvement Act, by a voice vote, and recommended its enactment.

XX. EXCHANGE OF COMMITTEE CORRESPONDENCE

COMMITTEE ON SCIENCE,
HOUSE OF REPRESENTATIVES,
Washington, DC, June 5, 2002.

Hon. JOHN BOEHNER,
Chairman, Committee on Education and the Workforce, Rayburn House Office Building, Washington, DC.

DEAR CHAIRMAN BOEHNER: Thank you for your letter of June 5, 2002, regarding H.R. 3130, the "Technology Talent Act of 2001," which was referred to the Committee on Science and in addition to the Committee on Education and the Workforce, and ordered favorably by this Committee on May 22, 2002. I appreciate your willingness to refrain from holding a hearing or markup on H.R. 3130 in order to have this legislation considered expeditiously by the House.

I agree that waiver of consideration by your Committee does not prejudice the Education and the Workforce Committee's jurisdictional interest and prerogatives on this or any similar legislation and it will not be considered as precedent for consideration of matters of jurisdictional interest to your Committee in the future. I will support your request to the Speaker for the appointment of conferees from your Committee with respect to matters within the jurisdiction of your Committee should a conference with the Senate be convened on this or similar legislation.

I will include our exchange of letters in the Science Committee's report to accompany H.R. 3130. Thank you for your cooperation on this issue.

Sincerely,

SHERWOOD L. BOEHLERT,
Chairman.

COMMITTEE ON EDUCATION AND THE WORKFORCE,
HOUSE OF REPRESENTATIVES,
Washington, DC, June 5, 2002.

Hon. SHERWOOD L. BOEHLERT,
Chairman, Committee on Science,
Rayburn House Office Building, Washington, DC.

DEAR CHAIRMAN BOEHLERT: Thank you for working with me regarding H.R. 3130, the "Technology Talent Act of 2001", which was referred to the Committee on Science and in addition the Committee on Education and the Workforce, and ordered favorably reported by your Committee on May 22, 2002. I understand your desire to have this legislation considered expeditiously by the House; hence, I do not intend to hold a hearing or markup on this legislation.

In agreeing to waive consideration by our Committee, I would expect you to agree that this procedural route should not be construed to prejudice the Committee on Education and the Workforce's jurisdictional interest and prerogatives on this or any similar legislation and will not be considered as precedent for consideration of matters of jurisdictional interest to my Committee in the future. I would also expect your support in my request to the Speaker for the appointment of conferees from my Committee with

respect to matters within the jurisdiction of my Committee should a conference with the Senate be convened on this or similar legislation.

I would appreciate your including our exchange of letters in your Committee's report to accompany H.R. 3130, which I understand you intend to file this week. Again, I thank you for working with me in developing this legislation and I look forward to working with you on these issues in the future.

Sincerely,

JOHN BOEHNER,
Chairman.

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