

## Appendix B

# Major Federal Science and Engineering Education Programs

The following information, in fiscal year 1988 obligations where possible, shows approximate Federal support of science and engineering education programs by agency and type of program. Obligations are the amount that an agency commits to spend out of its budget; the actual amount of funds spent may differ somewhat from the amount obligated. There may be large variations from year to year in agency budgets due to changes in congressional appropriations or legislation creating and eliminating programs. Changes in agency priorities also affect funding levels.

The estimates in this table are based on information provided to OTA by staff responsible for education, university relations, research and development (R&D), and/or personnel at each of the departments listed, supplemented by published sources. This table is not the result of an exhaustive survey, but does indicate the breadth and diversity of Federal support across the agencies for science and engineering education. Because of differences in recordkeeping, it is difficult to make precise statements on spending.

The programs listed are of several types: 1) the educational programs of the Department of Education and Veterans Administration that support all students and institutions, including but not specifically targeted to science and engineering; 2) agency support of university research, which indirectly funds students (as research assistants); and 3) special programs, usually much smaller in scope and budget, which have the support of science and engineering education as their primary goal. Faculty programs are not included. The left hand column lists the funding department and major programs, according to the educational level served (postgraduate, graduate, undergraduate, precollege, institutional). The two right hand columns list, respectively, estimated 1988 agency obligations and the number of science or engineering students (noted with an "s") or institutions (noted with an "i") that receive funds or participate in the program. The obligations and students listed are *only* those related to science and engineering (including social sciences). Our inability to estimate obligations or students is indicated by —.

Department and major programs	1988 budget (estimated, in millions of dollars, where noted)*	Number of students or institutions supported (science/engineering-related only)
<b>U.S. Department of Education</b>		
• Graduate and Professional Opportunities Program (about 1/2 are in science/engineering (s/e)) . . . . .	6 M	700 s
• Cooperative education (Title VIII, Higher Education Act) (1/3 to 1/2 is s/e) . . . . .	5-7 M	100,000 s 105 i
• Title II, Education for Economic Security Act		
—State grants (teacher training, supplies) . . . . .	109 M	—
—magnet schools (@30% of total \$72 M) . . . . .	22 M	—
• Discretionary programs (total \$11 M)		
—television, e.g., "3-2-1 Contact" . . . . .	3.25 M (1987)	—
—National Diffusion Network, miscellaneous . . . . .	—	—
programs, e.g., Physics Teach to Learn, CADPP (elementary mathematics)		
<i>Institutional</i>		
• Minority Institutions Science Improvement Program (MISIP), . . . . .	5 M	180 i

\* Based on OTA personal communications with Federal agency staff. Additional published sources are National Science Foundation, *A Directory of Federal Agencies' Programs to Attract Women, Minorities, and the Physically Handicapped to Careers in Science and Engineering*, NSF 85-51 (Washington, DC: 1985); and U.S. General Accounting Office, *Federal Funding Mechanisms in Support of University Research*, GAO/RCED-86-53 (Washington, DC: 1986).

The Department of Education spends billions of dollars on education, some of which goes to science and mathematics programs, teaching, education research, and computer technology. These include programs such as Chapter 1 and Chapter 2, student and institutional aid, and more likely sources of science/mathematics improvement or seed money such as the Office of Educational Research and Improvement (\$67 million) or the Fund for the Improvement of Postsecondary Education (\$11 million). Two centers dedicated to the study of mathematics and science teaching and learning were added in 1988 to the roster of 19 National Educational Research Centers; each of the 2 has a budget of \$500,000. One

of the ERIC clearinghouses of educational research and information is dedicated to science, mathematics, and environmental education. Together these large, broad support programs and other discretionary or general programs provide extensive funds for science and mathematics education. Discretionary funds may in particular be applied to seed programs. It is impossible to quantify the amount or directness of support for science and mathematics education from these large national programs, many of them formula programs. One approach is to estimate that 15 to 40 percent of funding is relevant to science and mathematics education.

**1988 budget (estimated,**  
in millions of dollars,      Number of students or  
where noted)<sup>1</sup>                  institutions supported  
(science/engineering-related only)

**Department and major programs**

**National Institutes of Health (NIH)**

*Postdoctorate*

- National Research Service Awards  
    Postdoctoral Fellowship Grants . . . . . 130 M                  5,800 s  
    (includes M.D.-Ph.D., about 50% of total)

*Graduate*

- National Research Service Awards  
    Predoctoral Training Grants . . . . . 100 M                  5,200 s
- Research assistants (RAs)  
    on research grants . . . . . 150-450 M                  7,000 s  
    (@ 5-15% of academic R&D)
- Minority Access to Research Careers (MARC)  
    Predoctoral fellowship . . . . . 665,000                  68 s

*Undergraduate*

- MARC Honors Undergraduate Research Training . . . . . 6.3 M                  385 s
- National Institutes of Mental Health  
    Minority Fellowships . . . . . 1.8 M                  150 s

*Precollege*

- NIH Minority High School Student  
    Research Apprenticeships . . . . . 1.5 M                  410 s

*Institutional*

- Minority Biomedical Research Support (MBRS) . . . . . 28 M                  100 i  
    —Regular MBRS program projects . . . . . —                  450 s  
    —Undergraduate Biomedical Research  
    Participation . . . . . —                  1,200 s  
    —Supplemental Awards for Improvement  
    of Animal Resources and Facilities . . . . . —                  —
- Research Centers for Minority Institutions . . . . . 5-M                  100 i

**National Science Foundation (NSF)**

*Postdoctorate*

- Presidential Young Investigators . . . . . 40 M                  **800** s
- Postdoctorates (six programs) . . . . . 58 M                  80 s
- NATO postdoctorates (NATO funds, . . . . . —                  50 s  
supplemented by NSF)

Department and major programs	1988 budget (estimated, in millions of dollars, where noted) <sup>1</sup>	Number of students or institutions supported (science/engineering-related only)
<i>Graduate</i>		
• Graduate RAs on research grants . . . . .	120 M	8,300 s
• Supplemental funding for minority/women RAs . . . . .	—	—
• Dissertation improvement . . . . .	1.2 M	190 s
• Graduate fellowships		
–Graduate fellowships . . . . .	25 M	700 s
–Minority graduate fellowships . . . . .	2.7 M	75 i
<i>Undergraduate</i>		
• Engineering Undergraduate Creativity Awards . . . . .	2 M	30 s
• Undergraduate research experience . . . . .	9 M	2,800 S
• Career access for women, minorities, and the disabled . . . . .	2 M	—
• College Science Instrumentation Program . . . . .	12 M	—
• Curriculum development . . . . .	7 M	—
<i>Precollege</i>		
• High school research experience		
—Young Scholars . . . . .	3.7 M	1,600 s
—RAs for minority high school students . . . . .	100,000	—
• Informal education . . . . .	13.5 M	—
• Materials development . . . . .	20 M	—
• Teacher preparation and enhancement . . . . .	45.5 M	—
• Research in teaching and learning . . . . .	4 M	—
<b>U.S. Department of Energy</b>		
<i>Graduate</i>		
• Graduate fellowships . . . . .	1.4 M	70 s
• Summer research support . . . . .	—	2,000 s
• RAs on research grants . . . . . (@5-15% of \$350-million university R&D)	15-50 M	3,500 s
<i>Undergraduate</i>		
• Science and Engineering Research Semester . . . . .	600,000	115 s
• Summer research internship . . . . .	3 M	1,000 s
• Co-op/Junior Fellows . . . . .	—	50-65 s
<i>Precollege</i>		
• Prefreshman Engineering Program (PREP) . . . . .	300,000	2,000 s
• High School Honors Research Program . . . . .	550,000	320 S
• Minority Student Research Apprenticeships . . . . .	120,000	200 s
• Precollege teacher training and research . . . . . (summer research experience at labs, short courses, materials)	250,000	50 teachers
<i>Institutional</i>		
• HBCU . . . . .	12 M	—

The Department of Energy has a University-Laboratory Cooperative Program, which includes faculty, research, and institutional development programs in addition to the undergraduate and graduate summer research programs noted above. Of a total budget of \$8.8 million, about \$2.5 million goes to science education centers be-

ing developed with the national laboratories, and about \$6.3 million to summer research programs and other science education programs. DOE and the national laboratories also have many volunteer outreach and technical assistance programs, such as Partnership in Education (adopt a high school).

Department and major programs	1988 budget (estimated, in millions of dollars, where noted)	Number of students or institutions supported (science/engineering-related only)
<b>Department of Defense (DoD)</b>		
<i>Graduate</i>		
• Graduate RAs on research grants . . . . . (@ 5-15% of academic research)	50-150 M	4,000-5,000 s
<i>Undergraduate</i>		
• Reserve Officers Training Corps (ROTC) (75% of Air Force and 80% of Navy ROTC funds are set aside for technical majors) . . . . .	—	21,000 s
• JETS/UNITE (Uninitiated Introduction to Engineering) . . . . .	—	—
• Co-op/Junior Fellows . . . . .	—	2,500-3,000 S
<i>Precollege</i>		
• Research and Engineering Apprenticeship (REAP) (at DoD laboratories) . . . . .	—	—
• Extensive informal outreach: career fairs, science fairs and awards, recruitment		
<i>Air Force/Air Force Office of Scientific Research</i>		
• Air Force laboratory postdoctoral . . . . . scholar programs	3 M	—
• Graduate fellowships . . . . .	1.5 M	75 s
• Graduate Student Summer Support Program . . . . . (laboratory employment for graduate students)	—	100s
• High school apprenticeship (summer jobs at laboratories; primarily minorities)		
<i>Army/Army Research Office (ARO)</i>		
• Army Graduate Fellowship Program . . . . . (no continuing funds appropriated)	7 M	36 s
• REAP . . . . .	275,000	140 s
• Introduction to Engineering (UNITE) . . . . . (6 residential programs for minorities)	100,000	150-180 S
• Junior Science and Humanities Program symposia (research talent search) . . . . .	750,000	7,000 s
• Computer-Related Science and Engineering Studies (CRES) (4 residential weeks . . . . . at universities)	50,000	60 S
• Science and Engineering Fair Program, International Mathematical Olympiad . . . . . (ARO contributes awards, judges)	50,000	500,000 s
<i>Navy/Office of Naval Research</i>		
• Young Investigator Program . . . . . (10-30 new multiyear awards each year)	2.5 M	50 s
• Graduate fellowships . . . . . (45-50 new multiyear awards each year)	25 M	150s
• High School Apprentice Program . . . . . (mentored summer work in labs; targets inner-city, minorities, disadvantaged)	120,000	130 s

Department and major programs	1988 budget (estimated, in millions of dollars, where noted) (science/engineering-related only)	Number of students or institutions supported
<ul style="list-style-type: none"> <li>• Historically Black College Council . . . . . (seeds research programs, graduate fellowships, summer faculty research, research instrumentation, high school apprenticeships)</li> </ul>	2.6 M	17 i
<i>Strategic Defense Initiative Office/ University Research Initiative</i>		
<ul style="list-style-type: none"> <li>• Graduate RAs on research grants. . . . . (@ 10-15% of \$50 M academic research)</li> </ul>	5-7.5 M	600 s
<i>Institutional</i>		
<ul style="list-style-type: none"> <li>• HBCUs . . . . .</li> </ul>	—	—
<i>Manpower/Education Research</i>		
<ul style="list-style-type: none"> <li>• Center for the Advancement of Science, Engineering and Technology (CASET) . . . . .</li> </ul>	1 M	—
<b>National Aeronautics and Space Administration (NASA)</b>		
<i>Postdoctorate</i>		
<ul style="list-style-type: none"> <li>• Postdoctoral research associateship , . . . . . (1 year of research at NASA)</li> </ul>	12 M	200 s
<i>Graduate</i>		
<ul style="list-style-type: none"> <li>• Graduate student researchers fellowships. . . . . (1 year thesis research support)</li> </ul>	4.8 M	240 S
<ul style="list-style-type: none"> <li>• Minority graduate fellowships . . . . .</li> </ul>	2 M	60-110 S
<ul style="list-style-type: none"> <li>• Graduate RAs on research grants. . . . . (@ 8% of academic R&amp;D)</li> </ul>	22M	—
<i>Undergraduate</i>		
<ul style="list-style-type: none"> <li>• Education and curriculum research . . . . .</li> </ul>	4.7 M	—
<ul style="list-style-type: none"> <li>• Co-op/Junior Fellows . . . . .</li> </ul>	—	1,100-1,200 s
<i>Precollege</i>		
<ul style="list-style-type: none"> <li>• Aerospace Education Services (Spacemobile) . . . . .</li> </ul>	2.1 M	—
<ul style="list-style-type: none"> <li>• Innovative programs . . . . . —NASA Education Workshops for Mathematics and Science Teachers (NEWMAST) —NASA Education Workshops for Elementary School Teachers (NEWEST) —Space Science Student Involvement Program (SSIP)</li> </ul>	1.3 M	—
<ul style="list-style-type: none"> <li>• Individual NASA laboratories have many local research apprenticeships, student employment, teacher resource centers, and outreach programs</li> </ul>		
<i>Institutional</i>		
<ul style="list-style-type: none"> <li>• University Advanced Design Program . . . . .</li> </ul>	1.5 M	25 i
<ul style="list-style-type: none"> <li>• Centers of Excellence . . . . .</li> </ul>	—	—
<ul style="list-style-type: none"> <li>• Space Engineering Research Centers . . . . .</li> </ul>	4M	10 i
<ul style="list-style-type: none"> <li>• HBCUs . . . . .</li> </ul>	9M	—
<b>U.S. Department of Agriculture</b>		
<i>Postdoctorate</i>		
<ul style="list-style-type: none"> <li>• Postdoctorates (Agricultural Research Service —ARS) . . . . .</li> </ul>	—	100 s

Department and major programs	1988 budget (estimated, in millions of dollars, where noted) (science/engineering-related only)	Number of students or institutions supported
<i>Graduate</i>		
• Graduate fellowships . . . . .	2.9 M	150s
• RAs on research grants (@ 10% of academic R&D) . . . . .	4.8 M	—
<i>Undergraduate</i>		
• Co-op/Junior Fellows . . . . .	—	500-650s
• Summer employment . . . . .	—	10,000s
<i>Precollege</i>		
—4H . . . . .	70-100M	5,100,000s
—Research Apprenticeship Program (ADS).... . . . .	250,000	200s
—Junior Fellowship . . . . .	—	200s
—Program in Agricultural and Lifesciences for Minority Students (PALMS) (career orientation) . . . . .	10,000	30s
—Beginning Agriculture Youth Opportunities (BAYOU), Southern University, LA		
—Summer Youth Enrichment, Delaware		
—Other programs include Stay In School, fairs, summer aides, D.C. Mayor's Youth Employment, high school visits, curriculum development; Forest Service teacher training and summer student programs		
<i>Institutional</i>		
• Cooperative State Research Service		
—Strengthening Grants for 1890s . . . . .	1.9M	—
—Merrill-Nelson(\$50,000 per State). . . . .	2.6M	—
—1890 Research Facilities . . . . .	9.6M	17i
—Evans Aliens . . . . .	21.5M	17i
<b>U.S. Environmental Protection Agency</b>		
<i>Graduate</i>		
• RAs on research grants (@5-15% of academic R&D). . . . .	4-10M	—
• Graduate fellowships/traineeships . . . . . (in past years, \$2-5 million for academic training, forecasting, and community colleges)	-0-	-0-
<i>Undergraduate</i>		
• Community college-based training (curriculum development, 2+2 programs) . . . . .	-0-	-0-
• Minority Student Fellowship Program . . . . . (summer jobs; part of Minority Institutions Assistance Program)	275,000	50-70 s
• Co-op/Junior Fellows . . . . .	—	800 S
<i>Precollege</i>		
• Summer internships. . . . .	—	—
<b>U.S. Department of Commerce/National Oceanic and Atmospheric Administration</b>		
<i>Undergraduate</i>		
• Sea Grant student assistance . . . . .	1.56M	—

Department and major programs	1988 budget (estimated, in millions of dollars, where noted) <sup>1</sup> (science/engineering-related only)	Number of students or institutions supported
• Co-op/Junior Fellows . . . . .	—	100-250 s
<i>Precollege</i>		
• D.C. Career Orientation . . . . . (summer work for girls and minorities)	30,000	24 s
<i>Institutional</i>		
• Sea Grant (entire program) . . . . .	40 M	—
<b>U.S. Department of Commerce/National Bureau of Standards</b>		
<i>Postdoctorate</i>		
• Postdoctoral research fellows . . . . .	—	20 s
<i>Graduate</i>		
• Summer program (graduate and undergraduate)		
• Graduate Engineering for Minorities (GEM) . . . . .	—	2 s
<i>Undergraduate</i>		
• Co-op/Junior Fellows . . . . .	—	100-200 s
<i>Precollege</i>		
• Volunteer outreach programs		
—Resource Education Awareness Program (REAP)		
—Montgomery County Science Fair		
—Career Awareness and Resource Education (CARE) . . . . .	—	30,000 s
—Adventures in Science (privately run) . . . . .	—	200 s
—Montgomery Education Connection		
There are also internal staff development programs, including graduate fellowships.		
<b>U.S. Department of the Interior/U.S. Geological Survey (USGS)</b>		
<i>Postdoctorate</i>		
• Resident Research Associateship Program, USGS . . . . .	—	—
<i>Undergraduate</i>		
• Co-op/Junior Fellows . . . . .	—	135 s
• Summer jobs for teachers (with National . . . . . Association of Geology Teachers) . . . . .	—	20-90 teachers
Ž Volunteer programs: science fairs, career seminars, classroom demonstrations and visits		
• HBCU (R&D, training, equipment, evaluation, . . . . . education, graduate research internships)	756,000	—
• Federal Equal Opportunity Recruitment Program (FEORP) (Programs for Minority Participation in the Earth Sciences—MPES) . . . . .	640,000	—
<b>U.S. Department of Transportation</b>		
<i>Graduate</i>		
• RAs on research grants . . . . . (@5-15% of academic R&D)	850,000-2.6 M	—
<i>Undergraduate</i>		
• Undergraduate/graduate research fellowships . . . . . (National Highway Institute)	250,000	15 s
• Co-op/Junior Fellows . . . . .	—	300-350 s

Department and major programs	1988 budget (estimated, in millions of dollars, where noted) (science/engineering-related only)	Number of students or institutions supported
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## Veterans Administration

### Undergraduate

(assume s/e as 35% of total trainees)

• G.I. Bill . . . . .	120 M	58,500 S
• New (Montgomery) G.I. Bill . . . . .	12 M	6,800 s
• Other programs:		
—Dependent's Education . . . . .	33 M	13,700 s
—Vocational Rehabilitation . . . . .	24 M	5,400 s
—Post Vietnam Education Assistance . . . . .	56 M	25,200 S
(DoD and trainee contributions)		

(College level trainees only; includes some graduate; does not include vocational/technical; includes part time.)

## Government-Wide Programs

**Cooperative education** (co-op). The Federal Government employs cooperative students at high school through graduate school levels, although the undergraduate level dominates. At the graduate level, co-op is a recruiting tool. Overall, the Federal Government employs about 16,000 co-op students in 54 agencies; about half of these are in s/e. Engineering is the largest occupation, with 28 percent of co-op students. Federal agencies consider co-op an excellent recruitment tool, but are having trouble competing with industry for good co-op students in high-technology areas. One problem is that the co-op budget fluctuates at agencies along with regular research budgets; some managers do not have money or job slots to spare. Co-op is particularly effective in providing career-related experience for minorities and women.

**Junior Fellowship.** Career-related summer employment for talented but needy students from high school graduation through college graduation. Junior fellowship is a recruitment tool; successful fellows are on the

fast track to career appointments. OPM delegates slots to agencies, which makes fellows attractive hires for managers. There are about 2,000 Junior Fellows in 5 Federal agencies, slightly *over* half of them in s/e.

**Stay in School. Part-time entry-level "routine"** jobs for at-risk youths to keep them in school. Many employees are clerical, some are technical aides; few are in s/e.

**College Work-Study Program.** The Department of Education awards grants to universities to create jobs. Federal agencies can also host students. First authorized by the Economic Opportunity Act, now under the Higher Education Act, Title IV, Part C.

**Federal Equal Opportunity Recruitment Program (FEORP) also known as the Affirmative Action Recruitment Program (part of the Civil Service Reform Act of 1978). Targets minorities and women. Assistance to HBCUs.**

**Resident (or Cooperative) Research Associateship. post-doctoral (administered by the National Research Council). Open to non-U.S. citizens.**

**Summer Employment.**