DOCUMENT RESUME

ED 327 008 EA 022 727

TITLE	By the Year 2000: First in the World. Report of the FCCSET Committee on Education and Human Resources. FY 1992.
INSTITUTION	Department of Energy, Washington, D.C.; Federal Coordinating Council for Science, Engineering and Technology, Washington, DC.
PUB DATE	Feb 91
NOTE	338p.; Prepared by the Committee on Education and Human Resources.
AVAILABLE FROM	Committee on Education and Human Resources, Department of Energy, 1000 Independence Ave., S.W., Washington, DC 20585.
PUB TYPE	Reports - Evaluative/Feasibility (142)
EDRS PRICE	MF01/PC14 Plus Postage.
DESCRIPTORS	Agency Cooperation; *Budgets; Educational Trends; Elementary Secondary Education; *Excellence in Education; Federal Government; *Federal Programs; *Futures (of Society); Government Publications; Government Role; Government School Relationship; Graduate Study; Higher Education; *Mathematics Education; Postdoctoral Education; Program Descriptions; Public Policy; *Science Education
IDENTIFIERS	Committee on Education and Human Resources; Federal Coor Council Sci Engineering Techn

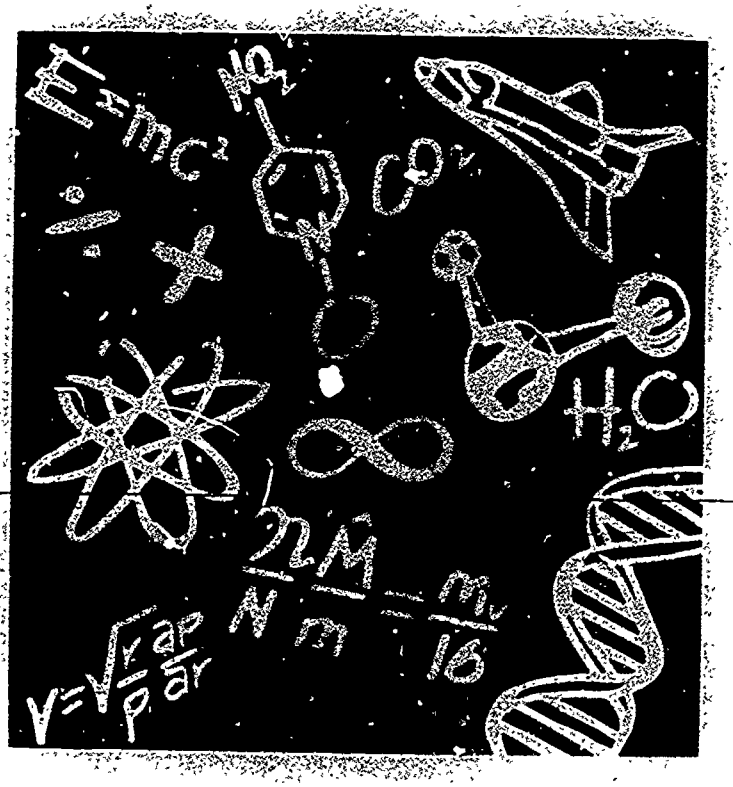
ABSTRACT

President Bush's budget for fiscal year (FY) 1992 includes $1.94 billion for mathematics, science, and engineering education at the precollege through postdoctoral levels. This is an increase of $225 million or 13 percent over FY 1991. This report from the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) outlines the federal role in mathematics, science, and technology education at the precollege through graduate levels; examines the underlying issues that affect this role; and discusses the elements of a strategy that can maximize the effectiveness of the federal contribution in these fields. For mathematics, science, engineering, and technology education specifically, this report: (1) defines the baseline of federal funding and programmatic activity; (2) outlines strategic objectives and budget priorities; (3) presents the first coordinated federal interagency budget; (4) lists criteria for evaluating federal programs; (5) highlights new initiatives and ongoing programs by education level and agency; and (6) provides contact information for each agency. The appendices display four matrices of fiscal year budgets for 1990, 1991, and 1992 and a 1990-1992 comparison. A copy of the 5-page press release announcing the report is appended. (MLF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

BY THE YEAR 2000:

FIRST IN THE WORLD



Report of the

FCCSET Committee on

Education and Human Resources

February 1991

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

MEMBERS OF CONGRESS:

I am pleased to forward with this letter "By the Year 2000: First in the World," a report by the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), to accompany the President's Fiscal Year 1992 Budget.

This report makes a unique contribution to our understanding of how the Federal Government can contribute to meeting the National Education Goals for mathematics and science education. The report presents, for the first time, a comprehensive baseline inventory of Federal funding and programs that affect mathematics and science education at all levels--precollege, undergraduate, and graduate. Of equal importance, it establishes a set of strategic objectives and budget priorities to guide future Federal actions in this critical area.

Through the FCCSET process, and in close cooperation with the Office of Management and Budget, the Committee on Education and Human Resources has prepared the first coordinated Federal interagency budget for mathematics and science education. Given the number of departments and independent agencies involved and the scope and diversity of their programs, this feat is a tremendous accomplishment. The report identifies precollege education as the first priority. At the same time, the report recognizes the need to strengthen undergraduate education and to preserve America's leadership in graduate education.

The Committee views this report as the first in a series that, building on the foundation thus far established, will provide not only a nationally much more complete overview of Federal activity in education than has ever been available previously but also a coherent, integrated program of activities directed toward achievement of the challenging goals articulated by the President and the Governors for the year 2000.

Intense effort on the part of highly dedicated senior government officials and unprecedented cooperation among the involved agencies is reflected in this report. Admiral James D. Watkins, Committee Chairman, together with Ted Sanders and Luther Williams, the Co-Vice Chairmen, and their interagency committee members, associates, and staff are to be commended on the outstanding work. Together they have made a substantial contribution to meeting one of the most important challenges that this nation faces.

D. Allan Bromley
Director

The Secretary of Energy
Washington, DC 20585

January 23, 1991

Dr. D. Allan Bromley
Assistant to the President
for Science and Technology
Office of Science and Technology Policy
Old Executive Office Building
Washington, D.C. 20506

Dear Dr. Bromley:

I am proud to transmit, *By the Year 2000: First in the World,* a report to accompany the President's FY 1992 Budget request, produced by the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering, and Technology.

This is a groundbreaking document. Never before has an Administration presented an interagency budget for mathematics, science, engineering and technology education. Along with this coordinated budget and priorities for future growth, this report includes another valuable resource for policy makers, educators and the public: a comprehensive inventory of mathematics and science education programs and activities across the entire Federal government—a snapshot of where the Federal government stands at the beginning of the decade.

I take great pride in what the Committee has achieved in only seven months. This report reaffirms the President's commitment to education and is an important step toward reaching the National Education Goals. I look forward to working with you to link our accomplishments to the important reform efforts underway in the States and the private sector to make this a truly national endeavor.

Sincerely,

James D. Watkins

James D. Watkins
Admiral, U.S. Navy (Retired)

Office of Science and Technology Policy
Federal Coordinating Council for Science, Engineering and Technology

Committee on Education and Human Resources

Chairman

James D. Watkins, Department of Energy

Vice Chairmen

Ted Sanders, Department of Education
Luther S. Williams, National Science Foundation

Members

Kyle Jane Coulter, Department of Agriculture
Nancy H. Mason, Department of Commerce
Ted Berlincourt, Department of Defense
Frederick Goodwin, Department of Health and Human Services
John C. Weicher, Department of Housing and Urban Development
John Schrote, Department of the Interior
William G. Myers, Department of Justice
Roberts Jones, Department of Labor
Kate L. Moore, Department of Transportation
D'Wayne Gray, Department of Veterans Affairs
Erich Bretthauer, Environmental Protection Agency
Margaret Finarelli, National Aeronautics and Space Administration
Ann I. Bay, Smithsonian Institution
J. Thomas Ratchford, Office of Science and Technology Policy
Charles E.M. Kolb, Office of Policy Development
Joseph S. Hezir, Office of Management and Budget
Barry White, Office of Management and Budget

Executive Director

Peggy Dufour, Department of Energy

FCCSET Directorate

Maryanne C. Bach, Executive Director
Charles H. Dickens, Senior Staff Associate

Committee on Education and Human Resources
Working Group Members

Department of Agriculture
Kyle Jane Coulter
Tina Buch
Larry Miller

Department of Commerce
Marc G. Stanley
Steven Needle
Carol Ann Mears

Department of Defense
Fred Smidt
Janet Johnston

Department of Education
Christopher Cross
David Florio
Conrad Katzenmeyer
Henrietta Moody
Thomas Corwin

Department of Energy
Richard Stephens
Peggy Dufour
Christopher Hanus
Maureen Towey

Department of Health and Human Services
Jay Moskowitz
Bonnie Kalberer
Michele Applegate
Joy Boyer

Department of Housing and Urban Development
Robert Knisely
James Stimpson
Ronald Morony

Department of the Interior
Cathy Hill
Phillip Kiko
Robert Lamb
William Sinclair
Steve Guertin

Department of Justice
Bill Myers

Department of Labor
David Duncan
David O. Williams

Department of Transportation
Jocelyn Stevenson

Department of Veterans Affairs
David Laprade

Environmental Protection Agency
Michael O'Reilly
Ed Hanley
Becky Daiss
Michael Baker

National Aeronautics and Space Administration
Frank C. Owens
Robert Brown

National Science Foundation
Luther S. Williams
Jean Vanski
Jim Dietz

Smithsonian Institution
Ann I. Bay

Office of Policy Development
Rae Nelson
Doreen Torgerson

Office of Management and Budget
Jack Fellows
Kathy Burchard
Norine Noonan

Office of Science and Technology Policy
Charles Dickens
Janice Howell

FY 92 Report Production

Department of Energy
Peggy Dufour
Nancy Kober
Maureen Towey
Christopher Hanus
Jamey Evans
Ruth Ann Verell
Judy Campbell
Paula Reano
Larry Woldt
Gai Pritchard
Brian Costlow
Ken Halvorsen
Bob Stiefel
Dallas Woodruff
Frank Townsend
Al Owens

National Science Foundation
Luther S. Williams
Jean Vanski
Jim Dietz

Office of Management and Budget
Jack Fellows

Office of Science and Technology Policy
Charles Dickens
Janice Howell
Jean Grace

TABLE OF CONTENTS

EXECUTIVE SUMMARY ____ 1

INTRODUCTION

The Quiet Crisis ____ 4
The Purposes of This Report ____ 4
Key Issues ____ 5
National Education Goals ____ 9
Objectives for Mathematics and Science Education Goals ____ 10

COORDINATING THE FEDERAL ROLE

FCCSET-CEHR ____ 11
CEHR Mission ____ 11
Phase I Work: Baseline Inventory ____ 12
Phase I Work: CEHR Program Categories ____ 13
Phase I Work: CEHR Budget Planning Priorities ____ 14
Phase II: The Year Ahead ____ 15
Phase II: Evaluating Federal Programs ____ 15
Benefits of a Coordinated Federal Strategy ____ 16

FY 1992 BUDGET OVERVIEW

FY 1992 Budget Request ____ 19
FY 1992 Budget Matrix ____ 20
FY 1990-1992 Growth ____ 21
Agency Roles ____ 21
CEHR Priorities ____ 23

FY 1992 PRECOLLEGE PROGRAMS

Precollege Concerns ____ 25
The Precollege Action Strategy/Budget Planning Priorities ____ 26
FY 1992 Budget Highlights ____ 27
FY 1992 Program Highlights ____ 29
Priority #1: Teacher Preparation and Enhancement ____ 29
Priority #2: Curriculum Development ____ 31
Priority #3: Comprehensive Programs/Organization and Systemic Reform ____ 35
Priority #4: Student Incentives and Opportunities ____ 37

FY 1992 UNDERGRADUATE PROGRAMS

Undergraduate Concerns ____ 39
The Undergraduate Action Strategy ____ 40
FY 1992 Budget Highlights ____ 41
FY 1992 Program Highlights ____ 43
Priority #5: Curriculum and Materials Development and Laboratory Improvement ____ 43
Priority #6: Faculty Development and Enhancement ____ 47
Priority #7: Student Support and Opportunities ____ 49
Additional Program Category Comprehensive and Systemic Reform ____ 54
Future Issues in Undergraduate Education ____ 55

FY 1992 GRADUATE PROGRAMS

Graduate Concerns ____ 57
FY 1992 Budget Highlights ____ 57
FY 1992 Program Highlights ____ 58

AGENCY PROGRAMS

Department of Agriculture ____ 67
Department of Commerce ____ 81
Department of Defense ____ 93
Department of Education ____ 111
Department of Energy ____ 125
Department of Health and Human Services ____ 147
Department of Housing and Urban Development ____ 163
Department of the Interior ____ 171
Department of Justice ____ 185
Department of Labor ____ 197
Department of Transportation ____ 219
Department of Veterans Affairs ____ 231
Environmental Protection Agency ____ 249
National Aeronautics and Space Administration ____ 261
National Science Foundation ____ 273
Smithsonian Institution ____ 289
Barry M. Goldwater Foundation ____ 299

APPENDIX

FY 1992 Matrix ____ 305
FY 1991 Matrix ____ 313
FY 1990 Matrix ____ 317
FY 1990-1992 Comparison ____ 321

LIST OF FIGURES

EXECUTIVE SUMMARY

Figure I: CEHR FY 1992 Strategic Objectives and Priorities ____ 3
Figure II: CEHR FY 1992 Budget Request ____ 3

INTRODUCTION

Figure 1. The Science Pipeline ____ 6
Figure 2. Engineering Degrees 1966-1989 ____ 7
Figure 3. The Changing Labor Force ____ 8

COORDINATING A FEDERAL ROLE

Figure 4. CEHR FY 1992 Strategic Objectives and Priorities ____ 13
Figure 5. CEHR FY 1992 Budget Planning Priorities ____ 14

FY 1992 BUDGET OVERVIEW

Figure 6. FY 1992 Budget Request Summary Table ____ 19
Figure 7. FY 1992 Budget Request ____ 19
Figure 8. FY 1992 Budget Matrix ____ 20
Figure 9. Math/Science Education Increases, FY 1990-1992 ____ 21
Figure 10. How Agencies Invest in Education ____ 21
Figure 11. Agency Roles ____ 22
Figure 12. FY 1992 Formal/Informal Program Split ____ 23
Figure 13. Growth in Budget Planning Priorities ____ 23
Figure 14. Underrepresented Groups ____ 23

FY 1992 PRECOLLEGE PROGRAMS

Figure 15. FY 1992 Precollege Request by Agency ____ 27
Figure 16. Precollege Growth: FY 1990-1992 ____ 27
Figure 17. FY 1992 Precollege Budget Request by Priority ____ 28
Figure 18. Precollege Formal/Informal Program Split ____ 28
Figure 19. Precollege Formal Education Budget ____ 28
Figure 20. Precollege Informal Education Budget ____ 28
Figure 21. Precollege Priority Growth: FY 1990-1992 ____ 29

FY 1992 UNDERGRADUATE PROGRAMS

Figure 22. Undergraduate FY 1992 Budget Request ____ 42
Figure 23. Undergraduate Education Growth: FY 1990-1992 ____ 42
Figure 24. Undergraduate Request: Two-Year/Four-Year ____ 42
Figure 25. Undergraduate Request by Agency ____ 43
Figure 26. Undergraduate Priority Growth: FY 1990-1992 ____ 43

FY 1992 GRADUATE PROGRAMS

Figure 27. Graduate FY 1992 Request by Agency ____ 57
Figure 28. Graduate FY 1992 Request by Program ____ 58
Figure 29. Graduate FY 1990-1992 Growth by Program ____ 58

EXECUTIVE SUMMARY

THE QUIET CRISIS

America is facing a significant challenge in science and mathematics education as evidenced by the following:

- Declines in American student performance relative to international peers.
- Inadequate preparation and lack of current scientific knowledge among many American teachers.
- Insufficient numbers of students pursuing education and training to fill critical scientific and technical jobs.
- Underrepresentation of women, minorities, and persons with disabilities in science courses and careers.
- Low levels of scientific literacy among the American public.

NATIONAL EDUCATION GOALS

Following the 1989 Education Summit, the President and the Governors established six national goals for improving education in the United States. Perhaps no goal is more critical to America's future international competitiveness than Goal #4: "By the year 2000, U.S. students will be first in the world in science and mathematics achievement."

THE FEDERAL ROLE

Education in America is a partnership effort involving Federal, State and local governments; educators and parents; business and industry; professional associations; and community-based organizations. The Federal government, as a user and patron of a large segment of the Nation's scientific and technical workforce, has a direct stake in the quality of mathematics and science education. Although only approximately 6% of the total spending for elementary and secondary education comes from Federal sources, the Federal government can play a leadership role by highlighting national problems, mobilizing national support, and funding programs that offer unique national solutions.

COORDINATING A FEDERAL STRATEGY

This report, *By the Year 2000*, describes the first-year progress of the Committee on Education and Human Resources (CEHR) of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) in developing a coordinated Federal budget strategy, consistent with the Goals, to improve science and mathematics education. With representation from 16 Federal agencies and institutions, and associated Federal programs that provide support for science and mathematics education, CEHR has:

- Established strategic objectives and priorities for funding Federal programs in mathematics, science, engineering and technology education to meet the National Education Goals [Figure I].

- Developed the first coordinated Federal budget for these programs [Figure II].
- Produced a comprehensive inventory of existing Federal programs and activities related to mathematics, science, engineering and technical education.
- Defined criteria for evaluating Federal programs and begun the evaluation process.

For maximum effectiveness in reaching the Goals by the year 2000, Federal mathematics and science education initiatives also must be coordinated with the work of the National Education Goals Panel and other bodies implementing U.S. education reform.

FY 1992 BUDGET SUMMARY

The President's FY 1992 budget proposes to invest $1.94 billion in mathematics and science education programs. This represents an increase of $225 million, or 13%, over the FY 1991 enacted funding level for these programs.

The requested FY 1992 increases are consistent with the priorities established by CEHR for FY 1992. The FY 1992 request is distributed as follows:

Precollege: *$660 million.* Increase over FY 1991: $146 million (+28%). Within this category, Teacher Preparation and Enhancement, CEHR's top priority, received the largest increase, $46.5 million (+15%).

Undergraduate: *$477 million.* Increase over FY 1991: $60 million (+14%). Student incentives and support received an additional $26.6 million (+13%).

Graduate: *$803 million.* Increase over FY 1991: $19 million (+2%). The FY 1992 request includes an additional $15 million (+18%) for predoctoral fellowships.

The overall FY 1992 increase follows the significant precollege program growth that occurred after the 1989 Education Summit, through agency reallocation and Congressional action.

UNIQUE FEDERAL RESOURCES

In addition to Federal dollars, other Federal resources are also being used to support educational improvement including the Nation's vast network of Federal scientific laboratories, technical facilities, and expert personnel, and the science- and mathematics-related information and materials they produce. These resources, along with the volunteer teaching outreach conducted by Federal employees and their contractors, have a previously unrecognized and underutilized potential for rapidly improving the basic science knowledge of American teachers and students.

Figure I
CEHR FY 1992 Strategic Objectives and Priorities

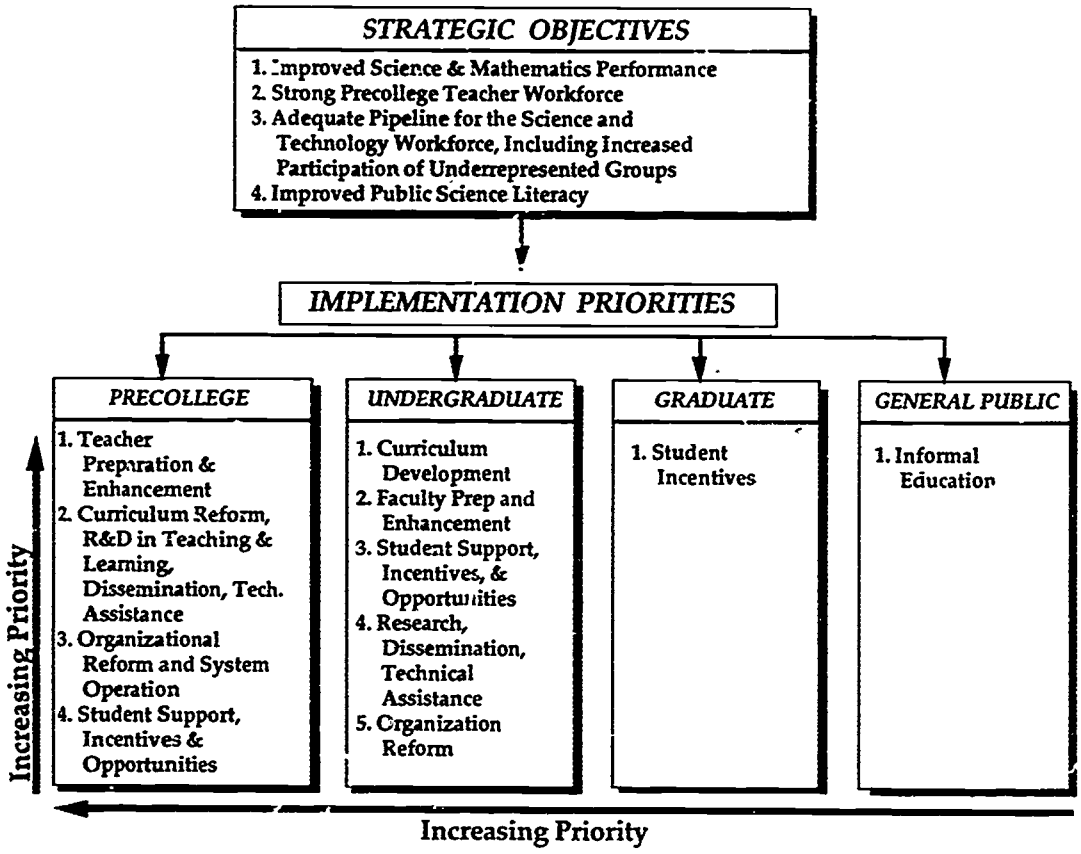


Figure II
FY 1992 Budget Request for Mathematics and Science Education

	FY 1991 Enacted	*FY 1992 Request*	*Requested Increase*	
Precollege	$ 514	$ 660	$146	28.4%
Undergraduate	$ 417	$ 477	$ 60	14.3%
Graduate	$ 784	$ 803	$ 19	2.4%
TOTAL	**$1715**	**$1940**	**$225**	**13.1%**

dollars in millions

INTRODUCTION

"By the year 2000, U.S. students will be first in the world in science and mathematics achievement."

National Education Goal #4

THE QUIET CRISIS

The link between American science and mathematics education and our international competitiveness in science and technology became an issue overnight in 1957 with the launch of the Soviet space satellite Sputnik. During the three ensuing decades, American higher education has retained its position of international preeminence. By contrast, however, U.S. standing in precollege (elementary and secondary) mathematics and science education achievement has eroded. This has occurred even as science and technology have become increasingly common in the American home and workplace. The problem has been acknowledged throughout the country with scores of reports, recommendations and plans. Yet, as a nation, we are only now beginning to respond with the sense of urgency appropriate to a problem of this magnitude.

The National Education Goals, established by the President and the Nation's Governors following the 1989 Education Summit, provide a policy framework through which the important issue of mathematics and science education can be examined. The creation of the Goals and the subsequent revitalization of national interest in mathematics and science education reform provide a unique opportunity for progress.

THE PURPOSES OF THIS REPORT

The purposes of this report are to outline the Federal role in mathematics, science and technology education at the precollege through graduate levels, examine the underlying issues that affect this role, and discuss the elements of a strategy that can maximize the effectiveness of the Federal contribution to American education in these fields.

For mathematics, science, engineering and technology education specifically, this report will:

1. Define the baseline of Federal funding and programmatic activity.
2. Outline strategic objectives and budget priorities.
3. Present the first coordinated Federal interagency budget.
4. List criteria for evaluating Federal programs.
5. Highlight new initiatives and ongoing programs by education level and agency.
6. Provide contact information for each agency so that the public can more easily participate in these programs.

Although a number of large Federal programs (such as block grants to States) yield considerable indirect benefits for mathematics and science education, this report will concentrate primarily on Federal resources specifically targeted on mathematics and science education at the precollege through university levels.

KEY ISSUES

Student Performance
America's Teachers
Workforce/Scientific Competitiveness
Underrepresented Groups
Public Science Literacy

Student Performance

The landmark 1983 study, *A Nation at Risk,* called for the reform of American mathematics and science education, citing alarming lags in American student achievement compared to that of other nations. In a recent international science achievement survey that compared students in the United States and 15 other nations, American high school seniors scored among the bottom fourth on calculus and algebra achievement tests. Among seniors studying "advanced placement" biology, Americans placed dead last out of 13 nations. Overall, American high school students performed below their counterparts in Japan, China, Mexico, Canada and Thailand.

In many of our high schools, science and mathematics courses are frequently ignored electives or, too often, are simply unavailable. Nearly 30% of our high schools offer no courses in physics, 17% offer none in chemistry, and 70% offer none in earth or space science. Textbooks for the courses that do exist are sometimes inadequate. In the midst of a scientific information explosion, it can still take several years to bring textbooks up to speed with current knowledge. Through its unique programs, facilities and expertise, the Federal government has the potential to bring students closer to the 21st century science they will live and work with as adults.

To promote interest in the study of mathematics and science, educators must begin to reach children at a younger age. The high school graduates of the year 2000 are in the third grade today. For many, it may already be too late. They may have already learned that "science is not for them," or that "mathematics is too hard." Their teachers may have never had a college-level course in the subjects they must teach. Many children will never do a science experiment in class, take a field trip to a museum, or use a computer during their entire precollege education. Yet, when they complete their 13 years of basic education, they will enter adult life in the most technically challenging living and work environment the world has ever known. The Nation must take steps now to prepare them for success.

America's Teachers

Teaching is a profession in crisis. In spite of their tremendous responsibilities, many teachers endure low salaries and low status, and recruiting teachers is becoming a great national challenge. In the United States today, there are 2.3 million public school teachers in grades K-12. The Department of Education estimates that over the next decade, we must hire 1.6 million new teachers, or an average of 160,000 teachers a year. Yet our primary source of new teachers, college students majoring in education, has fallen 55% since 1972. Today we are graduating only about half the teachers we will need to bridge the gap in the future. If it is becoming difficult to recruit teachers, it is even harder to retain them. Twenty percent of new teachers leave during their first year, and more than half leave before the sixth year. We are currently losing thirteen mathematics and science teachers for each one entering the profession.

Teacher preparation is also an issue. The American Association for the Advancement of Science concluded that few elementary school teachers have adequate preparation in science and mathematics before they begin to teach these subjects. Leading professional associations of mathematics and science educators have established standards for coursework preparation for teachers. By their estimates, only the following percentages of teachers meet these standards:

33% of elementary school teachers (science)
18% of elementary school teachers (math)

22% of middle school teachers (science)
14% of middle school teachers (math)

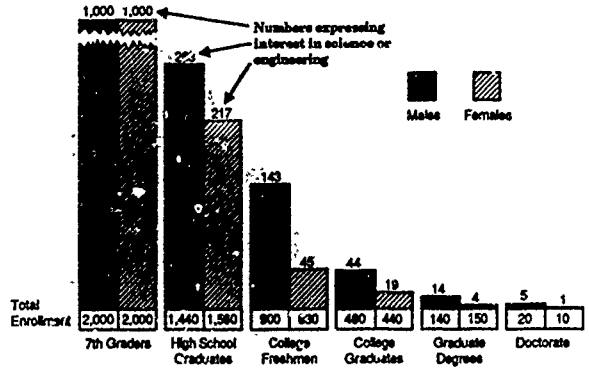
29% of high school teachers (biology)
31% of high school teachers (chemistry)
12% of high school teachers (physics)

This problem is compounded by the fact that too often, teachers are required to teach out of their fields and work with outdated or inadequate instructional materials in science and mathematics. Because teachers have little contact with the practicing scientific community, they are frequently unable to tie real-life applications to the basic scientific concepts they must teach. If we are going to improve student performance by the year 2000, we must significantly improve mathematics and science instruction well before the end of the decade. By bringing them closer to cutting-edge science, innovative curriculum and materials, Federal agencies can help prepare teachers so that they can communicate the excitement of science to their students.

Workforce/Scientific Competitiveness

A Nation at Risk and the many education reports that followed also warned that without a growth in student interest and ability in science and technology, America's world marketplace competitiveness in these fields would be in jeopardy. At similar risk would be the premier position of America in scientific research and development. As large numbers of those who entered the scientific workforce after World War II begin to retire, insufficient numbers of students are moving through the science pipeline to take their places.

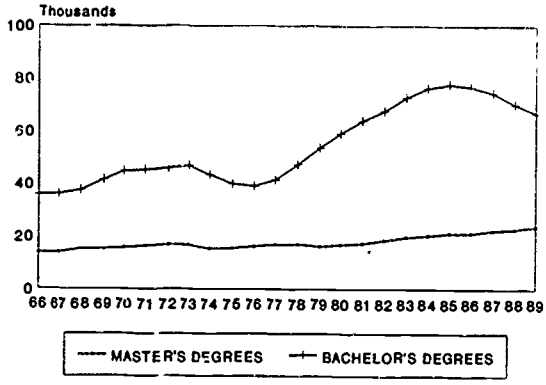
Figure 1
The Science Pipeline
Pool of Potential Scientists and Engineers Among U.S. Students



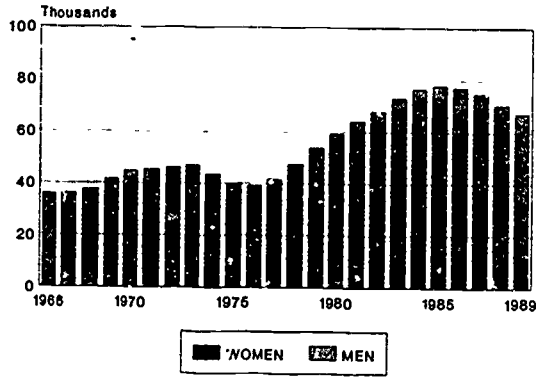
Source: National Science Foundation

If trends in American education continue on their present course, studies indicate that this country will not be able to produce enough scientists and engineers to meet its workforce needs. As Figure 1 illustrates, by the time children are in the seventh grade, fully half declare no interest in science. At the other end of the science pipeline, only six of every 4,000 seventh graders (five men and one woman) will ultimately receive a Ph.D. in science or engineering.

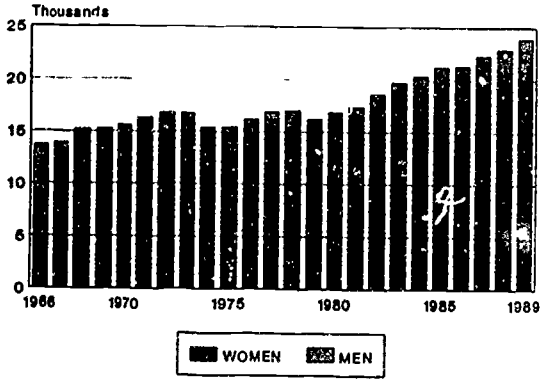
Figure 2
Engineering Degrees, 1966-1989



Engineering Bachelor's Degrees, 1966-1989



Engineering Master's Degrees, 1966-1989



Source: National Science Foundation

Figure 2 indicates a recent four-year decline in engineering bachelor's degree recipients, which is expected to be reflected at the master's level in the near future. Figure 2 also shows the low level of participation by women in these degree programs. In addition, the number of entering freshmen planning to major in engineering has dropped by 25% since 1982.

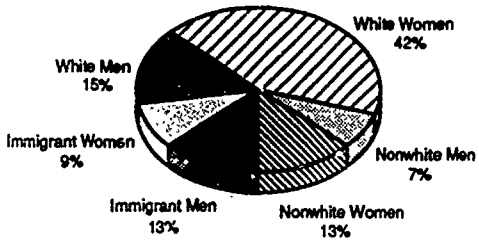
As a result of these and other factors, America's once-impressive lead in science and engineering personnel may begin to falter. Japan, for example, has doubled its technical workforce in the last two decades and, with half the population size of the United States, trains almost as many engineers as we do each year. Federal resources can help build a stronger technical workforce and maintain American inventiveness and discovery.

Underrepresented Groups

The problem of keeping students in the science pipeline is even greater for women, persons with disabilities and minorities underrepresented in science and technology, who, with foreign nationals, will comprise 85% of the net new entrants into the American workforce between now and the year 2000 (Figure 3). These individuals, who traditionally have not been part of the technical workforce, will be called upon to replace the decreasing percentage of white males seeking engineering and technical jobs. Today, only 8% of bachelor's degrees in science and engineering are awarded to blacks and Hispanics (20.2% of the total population combined); together, these minorities currently earn only 4% of all science and engineering Ph.D.s. At the turn of the century, minority students will account for more than 40% of our elementary and secondary school population. The Nation must take steps to

ensure greater participation by these groups in the scientific and technical workforce.

Figure 3
The Changing Labor Force
Net New Workers, 1985-2000



Source: U.S. Department of Labor

Public Science Literacy

A high quality basic science and mathematics education is a prerequisite for those who eventually choose careers in science and engineering fields, but it is equally necessary for the balance of our population if our citizens are to understand the scientific and technical issues that affect their lives: space policy, nuclear energy, AIDS research, or man's impact on the environment. Media coverage of important science and mathematics topics must increase and become better informed as well.

Although Americans have universal access to education and broad access to information, the state of American public scientific literacy is distressing. In one recent study, half the adults questioned did not know that it took one year for the Earth to orbit the Sun.

Science literacy will be critical to an increasingly wide range of jobs—from repairing heavy machinery to using a scanning electron microscope, from using computers in the office to operating an automated production line. In addition, science literacy is already an important job component in careers as diverse as food production, transportation, communications, forestry, water and environmental management, weather monitoring, national defense, and public health. It is increasingly likely that each individual will have several jobs during his or her lifetime, and must have the basic skills and flexibility necessary to change with the changing job market. In short, the quality of our basic science and mathematics education is an issue we must all face—as citizens, workers, educators and parents. Federal resources can play a role in broadening the base of American science literacy.

NATIONAL EDUCATION GOALS

In September of 1989, President Bush convened the historic Education Summit with the Nation's Governors in Charlottesville, Virginia. The National Education Goals developed following the Summit establish targets for American educational achievement by the year 2000 and serve as the framework for the national movement to improve education.

Three of the Goals, displayed in italics below, are directly related to mathematics and science education:

GOAL 1
By the year 2000, all children in America will start school ready to learn.

GOAL 2
By the year 2000, the high school graduation rate will increase to at least 90 percent.

GOAL 3
By the year 2000, American students will leave grades four, eight and twelve having demonstrated competency in challenging subject matter including English, mathematics, science, history, and geography; and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy.

GOAL 4
By the year 2000, U.S. students will be first in the world in science and mathematics achievement.

GOAL 5
By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.

GOAL 6
By the year 2000, every school in America will be free of drugs and violence and will offer a disciplined environment conducive to learning.

OBJECTIVES FOR MATHEMATICS AND SCIENCE EDUCATION GOALS

The President and the Governors provided additional policy guidance by developing specific objectives for each Goal. The following are the objectives for the three Goals related to mathematics and science education.

Objectives for Goal 3: Student Achievement and Citizenship

- The academic performance of elementary and secondary students will increase significantly in every quartile, and the distribution of minority students in each level will more closely reflect the student population as a whole.

- The percentage of students who demonstrate the ability to reason, solve problems, apply knowledge, and write and communicate effectively will increase substantially.

- All students will be involved in activities that promote and demonstrate good citizenship, community service, and personal responsibility.

- The percentage of students who are competent in more than one language will substantially increase.

- All students will be knowledgeable about the diverse cultural heritage of this Nation and about the world community.

Objectives for Goal 4: First in Science and Mathematics

- Mathematics and science education will be strengthened throughout the system, especially in the early grades.

- The number of teachers with a substantive background in mathematics and science will increase by 50%.

- The number of U.S. undergraduate and graduate students, especially women and minorities, who complete degrees in mathematics, science and engineering will increase significantly.

Objectives for Goal 5: Literacy and Lifelong Learning, Workforce Competitivencss

- Every major American business will be involved in strengthening the connection between education and work.

- All workers will have the opportunity to acquire the knowledge and skills, from basic to highly technical, to adapt to emerging new technologies, work methods, and markets through public and private educational, vocational, technical, workplace, or other programs.

- The number of quality programs, including those at libraries, that are designed to serve more effectively the needs of the growing number of part-time and mid-career students will increase substantially.

- The proportion of those qualified students, especially minorities, who enter college; who complete at least two years; and who complete their degree programs will increase substantially.

- The proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively, and solve problems will increase substantially.

COORDINATING THE FEDERAL ROLE

Improving mathematics, science, engineering and technology education within the time frame of the National Education Goals will entail high levels of commitment from the Federal government, State and local governments, the precollege through university education community, parents, professional associations, business and industry, community-based organizations, and organizations of individuals underrepresented in mathematics and science. Each has a stake in the quality and success of science, mathematics and engineering education, and each has a unique and critical role to play.

In America, education is a partnership effort. While Federal spending in precollege education is only 6% of the national total, with most of the remainder supplied through State and local governments, Federal leadership can focus attention on the need for improvement and can marshal support from a range of sources. At the graduate end of the education spectrum, Federal dollars are sometimes the only source of funds for student support, especially in critical areas relating to agency missions. The Federal government must leverage and make the most effective use of its resources to improve mathematics and science education.

FCCSET-CEHR

In May of 1990, Dr. D. Allan Bromley, Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy, convened a Committee on Education and Human Resources (CEHR) under the Federal Coordinating Council for Science, Engineering and Technology (FCCSET). FCCSET is an Executive Branch policy coordinating body for science, engineering and technology issues located within the White House Office of Science and Technology Policy. In 1989 and 1990, the FCCSET committee structure was consolidated and strengthened to improve coordination of Federal research and human resource development efforts. The Committee on Education and Human Resources is an outcome of this restructuring and revitalization.

CEHR Mission

Because of the large number of agencies and institutions participating, CEHR can serve as an important vehicle for coordinating the Federal portion of the National Education Goals effort. The ongoing purpose of CEHR is to guide Federal education and human resource development activities in three broad areas:

- Ensuring an adequate, well-trained scientific and technical work force;
- Maintaining U.S. leadership in world science and technology; and
- Producing a generation of well-informed and scientifically literate American students.

CEHR has five charges that relate explicitly to improving science, mathematics, engineering and technology education:

- To review Federal research and development and support programs in science, engineering and technology areas and identify the existing base of programs and resources;
- To improve interagency planning, coordination and communication;
- To identify and define priorities and strategic objectives, particularly those related to the

Federal workforce in the fields of science, mathematics and engineering;

- To develop and update long-range plans for the overall Federal effort, particularly plans for the Federal role in achieving National Education Goals #3, #4, and #5; and

- To support the efforts of the National Education Goals Panel and other bodies in implementing mathematics and science education reform.

Phase I Work: Baseline Inventory

The Committee's 16 member agencies and institutions began their work in 1990 by reviewing direct Federal support for mathematics, science, engineering and technology education, using the National Education Goals and the traditional mission orientation of the agencies as guidelines. The initial challenge before the Committee was to develop a systematic, comprehensive and accurate inventory of existing Federal programs and activities related to mathematics, science and technical education—a unique overview of where the Federal government stands in 1991. Using the National Education Goals as policy guidance, the Committee then established strategic objectives and funding priorities for FY 1992. Finally, using FY 1990—the year that began immediately after the September 1989 Education Summit—as a baseline, the Committee prepared a coordinated budget for FY 1992, and budget histories for FY 1990 and FY 1991.

The Committee's Phase I baseline efforts determined that:

- There was significant program growth in several Federal agencies, particularly in the precollege area, immediately following the Education Summit (FY 1990) through Secretary- and Administrator-directed intra-agency reallocations.

- Virtually every Federal agency relies on scientists, engineers, mathematicians and technicians to carry out its basic mission.

- All of these agencies conduct mathematics, science and technology education activities to some degree and can contribute to achieving the National Education Goals.

- The baseline level of science education effort in these agencies was far greater than had been previously recognized.

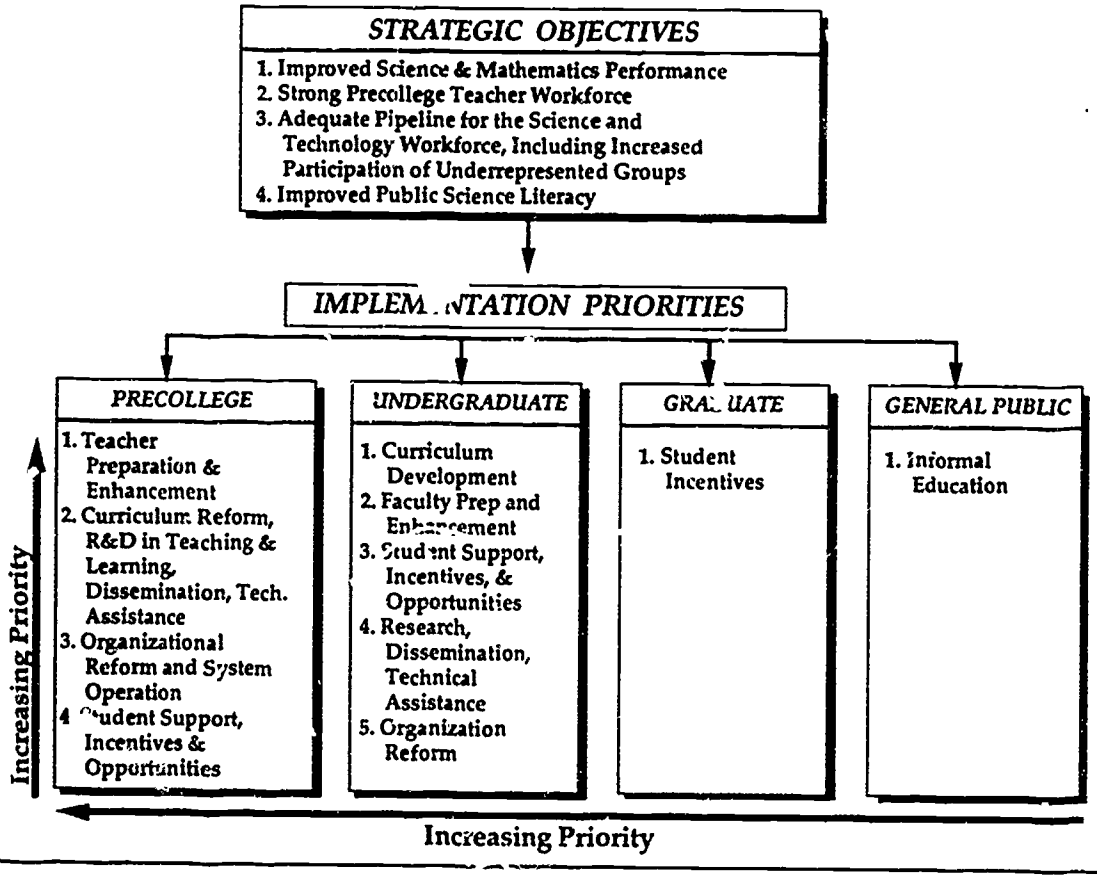
- All of these agencies have expert personnel who can be used in an expanded educational capacity.

- There is also considerable work being done on a volunteer basis by scientists and engineers in Federal facilities to help improve mathematics and science education.

- Informational and programmatic linkages within and between agencies could be improved and expanded, resulting in greater dissemination of successful programs.

- The Federal government's unparalleled collection of unique scientific and technical facilities, located in every State, the District of Columbia, Puerto Rico and the Territories, could be utilized more fully to serve mathematics and science education, resulting in increased benefit at low or no additional cost.

Figure 4
CEHR FY 1992 Strategic Objectives and Priorities



Phase I Work: CEHR Program Categories

The total FY 1992 request of $1.94 billion includes only those programs that have been designated by FCCSET-CEHR as "Category 1" programs. In conducting its inventory of existing Federal education programs, CEHR found it helpful to develop three categories that reflected the degree to which the programs were focused specifically on mathematics and science education.

Category 1 programs are those for which Congress appropriates funds expressly for science, mathematics, engineering and technology education. Category 1 also includes programs funded under other agency accounts that are expressly managed as science, mathematics and engineering education activities, such as educational materials developed by specific programs on their specific program topics.

Category 2 programs are those funded under agency research accounts that contribute to mathematics and science education, generally at the graduate level, but are managed as research programs. A typical example of Category 2

activities is the provision of graduate student support through a Federal research contract. Such support is provided when a principal investigator, awarded a research grant or contract, hires or provides tuition reimbursement to a graduate student to work on the project. Most Federal grants currently do not require annual reporting of the number of students supported or the amount of support they receive, making accurate tabulation difficult. However, the estimated number of students receiving such support is very large.

Category 3 programs are broad or general education programs that provide a level of support for science, mathematics, engineering and technology education. An example is the Department of Education's Chapter 1 formula grant program, which provides funds to local school districts that may be used for mathematics education, among other activities. The proportion of the spending devoted to mathematics and science, and how those funds are utilized is determined by States, local governments and school districts.

Because Category 1 programs are those over which CEHR member agencies have most immediate and direct control, they form the basis of this budget report.

Phase I Work: CEHR Budget Planning Priorities

CEHR established four strategic objectives for improving mathematics and science education in the near term, in concert with the National Education Goals. Using these as guides, the Committee also established the budget planning priorities reflected in this budget submission. The FY 1992 strategic objectives and budget planning priorities can be found in Figures 4 and 5.

Figure 5
CEHR FY 1992 Budget Planning Priorities*

PRECOLLEGE

1. Teacher Enhancement and Preparation
2. Curriculum; R&D in Teaching and Learning; Materials; Evaluation; Dissemination; Technical Assistance
3. Comprehensive Programs/Organization and Systemic Reform
4. Student Incentives and Opportunities

UNDERGRADUATE

5. Curriculum; R&D in Teaching and Learning; Materials; Evaluation; Dissemination; Technical Assistance
6. Faculty Enhancement and Preparation
7. Student Incentives and Opportunities

***Special Emphasis Throughout on Under-represented Groups**

To fully support the National Education Goals process, in this initial year, the Committee placed greatest emphasis on precollege education, followed by undergraduate and graduate education. Though not listed first, undergraduate and graduate programs are and will remain major components of the Federal education portfolio. The Committee's FY 1992 budget planning priorities indicate those areas in which it felt change should be implemented first to best assist the President and the Governors in achieving the Goals by the year 2000.

Throughout all of its budget planning priorities, CEHR has placed special emphasis on increasing the participation of groups currently underrepresented in mathematics and science fields. This emphasis cuts across all the priorities and all educational levels.

Phase II: The Year Ahead

Phase II, begun in January 1991, will review all Federal programs in mathematics and science education and broaden the scope of the Committee's efforts to include technical training and scientific literacy issues.

For Phase II, CEHR will stress the following priorities:

1. Assessing the effectiveness of the agency programs included in this report;
2. Examining undergraduate training, particularly at the two-year college level, and technical training programs in general;
3. Defining public science literacy and determining the extent of Federal effort;
4. Developing a fully formulated Federal program plan including all of these components; and
5. Establishing effective linkages with State, local, private sector and other non-Federal mathematics and science education reform efforts.

The Committee's 1991 Phase II findings and accomplishments will be presented in a subsequent report.

Phase II: Evaluating Federal Programs

The Committee has already begun the process of reviewing and evaluating the hundreds of programs included in this report. This involves measuring each program against a uniform set of criteria to determine its effectiveness. The CEHR evaluation criteria follow.

Program Evaluation Criteria

Relevance/Contribution
The program must contribute to the overall Committee on Education and Human Resources (CEHR) goals and one or more of the key objectives.

Merit/Readiness
The program must be the product of a well-documented planning and review process. It must also be based on sound knowledge of approaches effective in achieving CEHR goals and/or be likely to lead to fundamental and permanent advances in promoting these goals.

Impact
The program design must demonstrate both thoughtful assessment and dissemination plans and/or a strategy for promoting permanent and lasting change within the education delivery system for meeting CEHR goals. Existing programs must demonstrate significant progress toward achieving intended impacts.

Alliances
The program must work in collaboration with other Federal agencies and/or with State and local government, the academic sector, private industry, professional associations and other organizations. Collaboration will leverage resources, elicit involvement from the community and the educational establishment, and otherwise ensure the success of the program in achieving its objectives.

Costs
Program resources must be adequate for achieving objectives, be reasonable in relation to the benefits obtained, represent an appropriate share of total available resources, have been evaluated in terms of their long-term resource implications and adequately account for joint-funding opportunities.

Agency Approval
At a minimum, the program or activity concept must have policy-level approval within the submitting agency.

BENEFITS OF A COORDINATED FEDERAL STRATEGY

A coordinated Federal strategy for improving mathematics and science education will produce many benefits.

Baseline Information on Federal Activities
CEHR has produced a government-wide inventory that, for the first time, lists all Federal mathematics, science and engineering education programs and activities across agencies and categorizes them according to degree of focus on mathematics and science education. In addition, the inventory includes previously unavailable information for policymakers about mathematics and science education activities at levels below the traditional agency budget line items, as well as volunteer and outreach activities. The inventory can serve as a valuable guide for teachers, parents, school administrators and others on the front lines of educational reform who would like access to Federal expertise and resources.

An Integrated Federal Response
The problems addressed by the National Education Goals cut across the missions of many Federal agencies, and so should the solutions. The CEHR action strategy presented herein will enable member agencies and other policymakers to take a global view of the entire Federal response to mathematics and science achievement and to revise priorities or emphases to form a coordinated Federal strategy for meeting the National Goals.

Reductions in Overlap and Gaps
By learning more about missions and programs of different Federal agencies, the President and Congress can take action to reduce overlaps and fill gaps. Executive and legislative branch policymakers will become aware of promising programs and activities, including those that have not been highly visible in the past because they fall below budget line item level.

Cost Effectiveness
New knowledge about the range and purposes of Federal programs will result in more effective use of Federal resources. Since many programs in the inventory are cooperative ventures with other levels of government and the private sector, the plan can open up new avenues for cost sharing and greater leveraging of public and private dollars.

More Emphasis on Precollege Education
The Education Summit emphasized the need to begin as early as possible in the educational process. CEHR has made precollege education its highest priority, focusing resources and attention on the crucial elementary and secondary years.

A Stronger Teaching Force
Within precollege education, CEHR has placed first priority on enhancing the skills of teachers. Teachers will gain greater exposure to cutting-edge science, update their knowledge, and become better prepared to educate students. More students in the science pipeline will form a larger pool of future teachers in critical scientific and technical fields. The teaching force can also be expanded by offering encouragement and incentives for mid-career professionals from science and technical disciplines to enter teaching through innovative programs in alternative certification. In addition, scientific and technical experts can assist teachers by serving as classroom resource people.

Better Educated Students
Through the CEHR action strategy, Federal resources will be better utilized to motivate students to stay in the mathematics, science and engineering pipeline. CEHR coordination will increase student exposure to the latest scientific and technical developments through hands-on activities that link curriculum with the real world of science and through contact with Federal experts and facilities. Targeted Federal programs will help students complete high school with competency in mathematics and science and encourage them to enter college to receive further education in these subjects.

A More Scientifically Literate Public
Increased coordination will better enable Federal agencies to provide science and technology information to the public and increase public understanding. A more scientifically literate population will be better prepared to make well-informed risk assessment and policy evaluation decisions on difficult scientific and technical issues confronting the Nation.

A More Diverse Scientific and Technical Workforce
The multiple programs reaching groups underrepresented in science, such as women, minorities and the disabled, will improve career awareness and educational opportunities for these groups, integral to the future workforce of the Nation.

More Educational Facilities
Federal laboratories and other scientific facilities can become centers for student and teacher learning outside the classroom, offering hands-on opportunities and exposure not available in traditional school settings.

Replication of Successful Programs
Greater cooperation among Federal agencies will open new channels for disseminating information about exemplary programs and will expand opportunities for successful programs to be replicated.

Interagency Networks
Through its work, CEHR has established a network of mathematics and science education professionals across all Federal agencies who can serve as valuable sources of information and coordination. Participation in CEHR will enable member agencies to continuously evaluate their efforts against the whole. Opportunities are also increased for cooperative interagency efforts and joint funding of projects.

Better Evaluation
The inventory of Federal programs developed by CEHR shows how Federal funds are currently being spent. This inventory will allow CEHR to begin to evaluate individual agency programs and will provide a framework within which Federal

funds can be refocused as needed to achieve programmatic objectives.

Greater Public Support
A coordinated interagency budget and the program inventory are important public information documents about Federal programs, facilities, expertise and resources for mathematics and science education. Greater public awareness and access to Federal resources can translate into increased public commitment and community action.

Coordination with the States and Public Sector
By coordinating its own efforts in mathematics and science education, the Federal government can provide State and local governments and the private sector with easier and greater access to well organized and effectively run Federal programs and other resources, such as personnel, educational materials, facilities and equipment. By working together in this way, national progress toward achieving the National Education Goals by the year 2000 can be made most rapidly.

FY 1992 BUDGET OVERVIEW

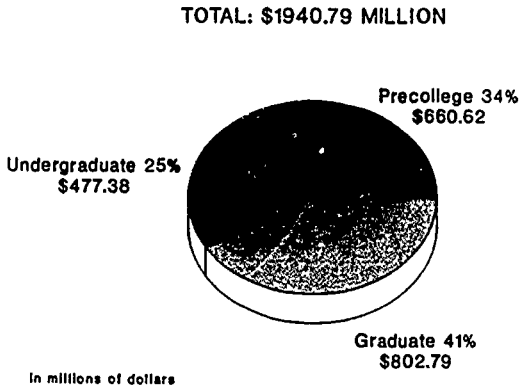
FY 1992 BUDGET REQUEST

The President's FY 1992 budget request for mathematics and science education programs is $1.94 billion dollars. This represents a $225 million or 13% increase over FY 1991. Figures 6, 7 and 8 detail the President's request by educational level, agency and program area.

In conformance with the policy guidance provided by the National Education Goals, the largest single increase in the FY 1992 budget request is in the precollege education area, which received a $146 million or 28% increase to $660 million. The next largest increase—$60 million or 14%—went to undergraduate education, with graduate education, the single largest component, receiving a 2% increase to $803 million.

Figure 8, on the following page, shows the President's FY 1992 mathematics and science education budget request (Category 1) in detail by agency, educational level and major purpose.

Figure 7
FY 1992 Budget Request



The matrix in Figure 8 represents the Committee's first inventory of Federal programs, to be expanded in the coming year. Ten agencies and institutions participated in this initial survey.

Figure 6
FY 1992 Budget Request for Mathematics and Science Education

	FY 1991 Enacted	*FY 1992 Request*	*Requested Increase*	
Precollege	$ 514	$ 660	$146	28.4%
Undergraduate	$ 417	$ 477	$ 60	14.3%
Graduate	$ 784	$ 803	$ 19	2.4%
TOTAL	**$1715**	**$1940**	**$225**	**13.1%**

dollars in millions

Figure 8
FY 1992 Budget Matrix

CEHR FY 1992 BUDGET BY AGENCY AND MAJOR PROGRAM AREA

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GRAND TOTAL	1940.79	456.09	329.90	74.43	415.85	7.60	67.15	41.71	513.09	13.37	21.60
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Teacher Preparation/Enhancement	358.53	97.30	239.00	6.20	0.63	0.25	5.57	2.06	5.15	2.37	0.00
Curriculum Development*	137.27	84.75	34.80	1.90	0.00	0.09	5.60	3.60	4.52	2.01	0.00
Comprehensive/Organizational Reform	57.57	47.55	0.00	6.40	0.00	0.00	0.28	0.50	0.60	2.04	0.20
Student Incentives	47.75	11.00	0.00	5.75	4.34	0.21	0.55	14.32	10.87	0.21	0.50
Other	59.50	12.45	40.00	1.40	0.00	0.09	2.10	1.49	0.62	1.44	0.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Faculty Preparation/Enhancement	42.36	27.55	0.00	2.40	0.00	0.00	9.65	1.84	0.02	0.90	0.00
Curriculum Development*	123.66	63.66	6.10	11.60	38.90	0.20	1.81	1.12	0.19	0.10	0.00
Comprehensive	47.65	14.95	0.00	3.85	6.80	0.00	1.68	0.53	6.34	1.00	12.50
Student Incentives	230.27	24.81	10.00	12.33	100.50	1.70	11.73	4.30	62.59	2.30	0.00
Other	33.44	1.35	0.00	0.00	29.88	0.00	0.16	1.05	1.00	0.00	0.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Predoctoral Fellowships	100.53	51.52	0.00	10.04	16.70	0.85	13.80	0.03	6.79	0.80	0.00
Predoctoral Traineeships	153.85	4.40	0.00	0.00	3.90	0.00	4.70	10.41	126.44	0.00	4.00
Postdoctoral Fellowships	100.08	9.85	0.00	10.05	10.50	3.35	9.10	0.48	52.15	0.20	4.40
Postdoctoral Traineeships	157.57	4.00	0.00	0.00	0.00	0.00	0.00	0.00	153.57	0.00	0.00
Other*	290.75	0.95	0.00	2.51	203.70	0.95	0.42	0.00	82.22	0.00	0.00

* includes program assessment and evaluation

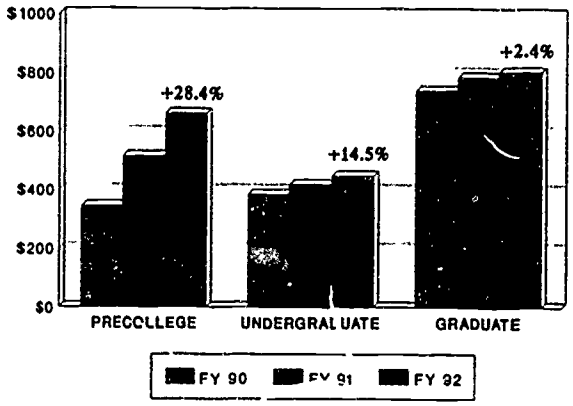
dollars in millions

FY 1990 - 1992 GROWTH

The total request for FY 1992 marks the second year of significant increases for Federal mathematics and science education programs. The FY 1992 request represents a 13% increase over FY 1991 and a 32% increase over FY 1990.

As Figure 9 shows, the most notable increase has been at the precollege level. The 92% growth in precollege funding between FY 1990 and FY 1992 is the direct result of heightened attention to elementary and secondary education brought about by the Education Summit in 1989.

Figure 9
Math/Science Education Increases, FY 1990-1992

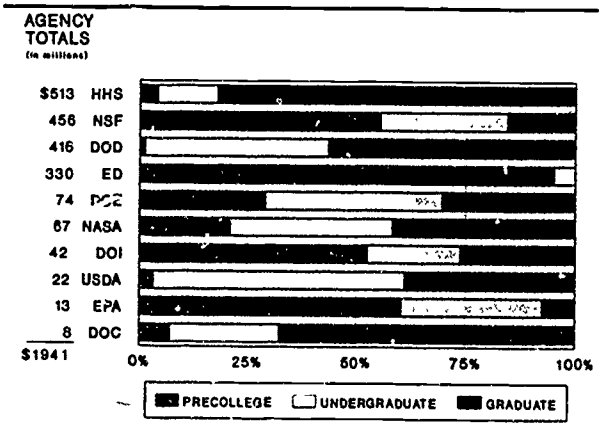


In millions of dollars

AGENCY ROLES

Several Federal agencies make substantial investments in mathematics, science and engineering education, and their roles vary by educational level.

Figure 10
How Agencies Invest in Math/Science Education, FY 1992 Budget Requests



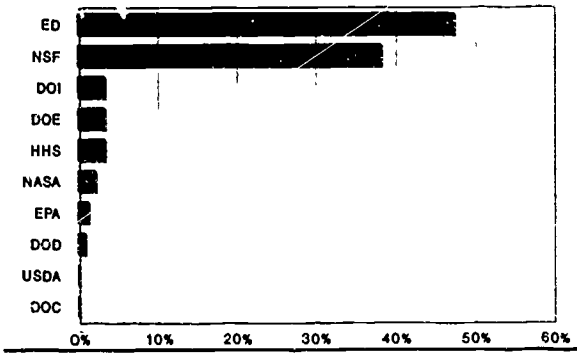
At the precollege level, the Department of Education and the National Science Foundation are the Federal agencies traditionally involved in mathematics and science education. Together their programs represent 86% of the total FY 1992 budget request for precollege programs. The mission agencies—those with primary missions in science and research and development and traditions of involvement in science and mathematics higher education—also have a modest precollege investment that they are proposing to expand in FY 1992.

At the undergraduate level, the Department of Defense provides the highest level of funding for mathematics and science education, followed by the National Science Foundation and the Department of Health and Human Services.

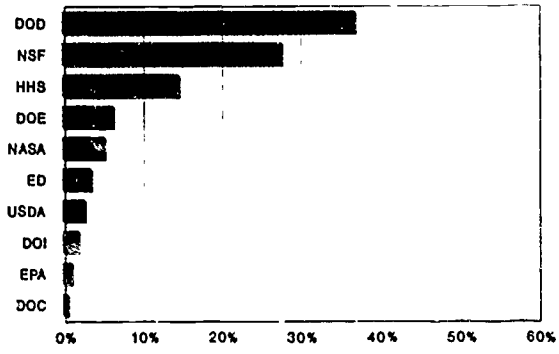
At the graduate level, the Department of Health and Human Services supports the largest number of graduate students. HHS is followed by DOD and NSF in terms of their budget requests for FY 1992 for graduate science and mathematics education.

Figure 11
Agency Roles, FY 1992 Budget Requests

Precollege: $660 million



Undergraduate: $477 million



Graduate: $803 million

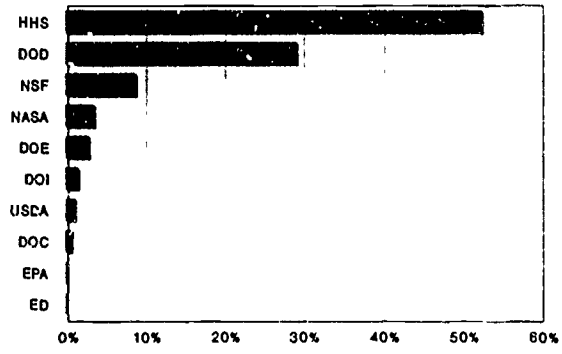


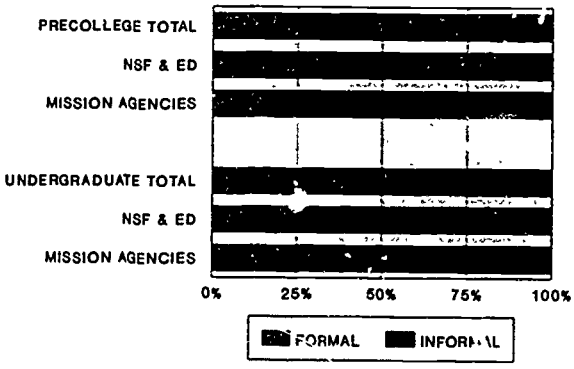
Figure 11 displays the principal funding agencies at the precollege, undergraduate and graduate levels and shows the relative percentages for each educational level by agency.

Agency Roles: "Formal" and "Informal"

CEHR also classifies agency education activities according to two divisions: "formal" and "informal." "Formal" or "in-classroom" activities are designed for classroom instruction and are integrated into formal curricula. "Informal" activities are generally conducted in non-classroom settings—for example, laboratories, museums and other facilities with unique capabilities for hands-on instruction—or involve support for the development of materials for hands-on activities instruction. "Informal" activities also include efforts to stimulate public interest in science through television and other media.

The Department of Education and the National Science Foundation conduct most of the Federal government's "formal" programs—about 90%. By contrast, the mission agencies carry out most of the "informal" Federal activities—approximately 80%. Figure 12 indicates the respective roles of ED, NSF and the science mission agencies in "formal" and "informal" activities.

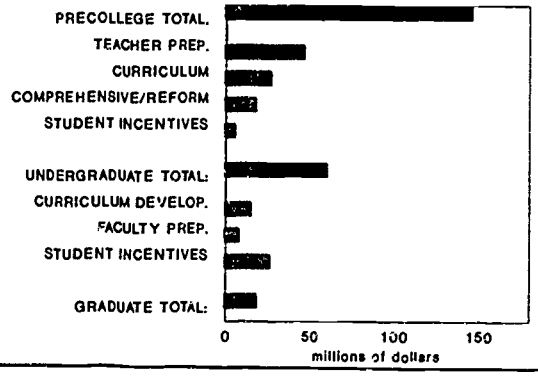
Figure 12
FY 1992 Formal/Informal Program Split



CEHR PRIORITIES

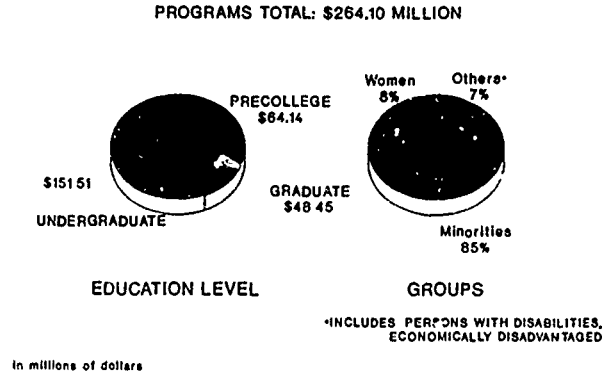
The President's FY 1992 requested increases generally track the CEHR budget planning priorities, as shown below in Figure 13. Of the total requested precollege and undergraduate increase, 88% is in areas identified as high priority by the Committee.

Figure 13
Growth in Budget Planning Priorities, Absolute Growth: FY 1991-1992



As noted earlier, CEHR has placed special emphasis on increasing the participation of groups currently underrepresented in mathematics and science fields. Figure 14 shows the distribution of funds requested for programs for underrepresented groups in FY 1992.

Figure 14
Underrepresented Groups



FY 1992 PRECOLLEGE PROGRAMS

Educators regard the precollege years, kindergarten through high school (K-12), as crucial in determining a child's lifetime understanding and performance in mathematics and science. Fully half of our children conclude by the seventh grade that these fields are not open to them as options for continued educational growth or potential employment, thereby reducing the science pipeline by 50%. Precollege science and mathematics learning is also the foundation of science literacy in our population, shaping both our electorate and our workforce. Instilling excellence in precollege science and mathematics education is, therefore, an important mission of the Federal government.

Federal dollars represent approximately 6% of total national funding for precollege education, with most of the balance derived from State and local sources. However, Federal funds can be used in a leadership capacity to stimulate, experiment, fund model programs, evaluate, disseminate and otherwise improve and expand our educational base as we approach the 21st century. As a result of the Education Summit, other Federal resources, such as laboratories, personnel and equipment, are being increasingly utilized in an expanded educational role, at no cost to student and teacher participants. The Federal precollege programs cited below are drawn from the FY 1992 budget request, and offer highlights of the CEHR action strategy.

PRECOLLEGE CONCERNS

Three general areas of concern have been identified in precollege mathematics and science education: (1) student learning; (2) teachers, instruction and curriculum materials; and (3) reforming the broader school system.

STUDENT LEARNING

Student learning concerns include both the achievement of students taking mathematics and science courses, and ensuring that adequate numbers of students will stay in the science pipeline and become the scientists, engineers and technicians the Nation will need in the future. One means of judging adequacy in achievement is the competitiveness of our students in international comparisons. In the most recent international science assessment, in comparison with students in 12 other countries, our high school students finished 9th in physics, 11th in chemistry, and last in biology. While our average students might not perform well, even the best of our students are less than competitive. In mathematics, our top 13% generally fell into the bottom 25% in comparison with other countries.

The picture is equally bleak regarding enrollments in high school mathematics and science courses, which are frequently electives. In 1987, less than 50% of our high school graduates took chemistry of any type, and only about 20% took physics.

Enrollments of women and minorities lag behind those of white males, yet the demographics of U.S.. school-age children clearly indicate that the pool of white males is shrinking. The pool of students entering the pipeline to careers in science and engineering must be expanded to include more of those who traditionally have been underrepresented.

TEACHERS, INSTRUCTION AND CURRICULUM MATERIALS

Again there is concern both for adequacy and numbers: adequacy of preparation of our mathematics and science teachers and the number of qualified teachers that our colleges and universities are graduating. Many of our current teachers, particularly elementary school teachers, have had inadequate preparation in the subject matter of mathematics and science. In many instances elementary school teachers had only one or two courses in mathematics and science, and almost 50% have had no additional college coursework in the past 10 years. Nor are the numbers of new mathematics and science teachers meeting the need. Over 60% of junior high and high school principals say they have difficulty hiring teachers for physics, chemistry and computer science classes. With decreasing enrollments in mathematics and science at the undergraduate level, the problem is likely to grow larger.

The lack of student interest in mathematics and science is partially attributable to poor instruction and inappropriate curriculum materials. Many mathematicians, scientists and educators have advocated the use of hands-on learning in elementary and secondary classrooms. Yet the amount of hands-on assignments and student experiments actually declined in recent years. Most instruction is done from the textbook, which in science is often a collection of out of date facts with little relevance to real-world applications.

THE BROADER SCHOOL SYSTEM

There is growing recognition that teachers and students individually cannot solve the difficulties encountered in mathematics and science education. Studies indicate that little hands-on science is taught at the elementary school level. In secondary schools, instruction in 50 minute periods makes it impossible to do many kinds of science experiments or to explore complex mathematical problems in detail. Restructuring efforts are underway in many parts of the Nation. The Federal government has recognized and will continue to support these State and local reform efforts.

THE PRECOLLEGE ACTION STRATEGY

The Precollege Action Strategy focuses on four critical priorities for emphasis in FY 1992. Each of these elements presents special opportunities for Federal involvement in precollege education.

PRECOLLEGE BUDGET PLANNING PRIORITIES

FY 1992 Priority #1: Precollege Teacher Enhancement and Preparation

- To strengthen qualifications and competence of inservice teachers.
- To attract and prepare new generations of teachers who can implement needed reforms.
- To raise the status of teachers and teaching by making them part of the scientific community.
- To provide teachers with hands-on experience in cutting-edge science and mathematics that can enhance their classroom instruction.

FY 1992 Priority #2: Precollege Curriculum Development, R&D in Teaching and Learning, Evaluation, Dissemination, and Technical Assistance

- To develop curriculum frameworks, education standards, and curriculum materials that will support educational reform.

- To conduct research, evaluation, dissemination, and technical assistance.
- To support educational technologies that will enhance student learning.

FY 1992 Priority #3: Comprehensive Programs/Organization and Systemic Reform

- To support systemic reform and restructuring of schools.
- To encourage the use of appropriate student assessments and other measurements of progress.
- To facilitate development of comprehensive programs, such as those affecting teachers and students of entire school systems.

FY 1992 Priority #4: Student Incentives and Opportunities

- To encourage innovative means of attracting students to science and technology careers.
- To provide research experiences for students.
- To provide scholarship support.

FY 1992 BUDGET HIGHLIGHTS

The total requested Federal investment in mathematics and science education at the precollege level for FY 1992 is $660 million. This represents a 28% increase over FY 1991 and a 92% increase over FY 1990. Of the total new funds requested by the President in FY 1992, 65% are in precollege mathematics and science education.

The major portion of the precollege request, 82%, is for formal activities that involve teachers, students and schools. Another 18% is aimed at informal activities that occur outside of the formal educational system or provide materials or learning experiences that enhance formal activities. The agencies that support the largest shares of precollege mathematics and science education are the Department of Education and the National Science Foundation. Together they

Figure 15
FY 1992 Precollege Request by Agency

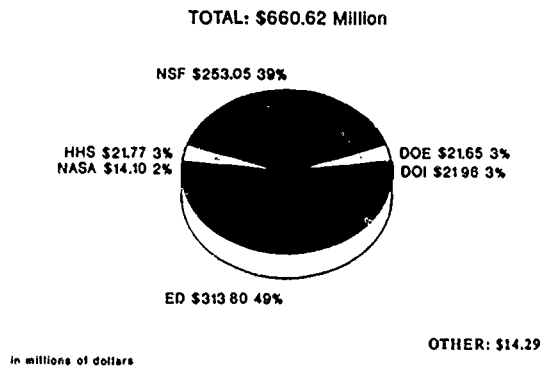


Figure 16
Precollege Growth: FY 1990-1992

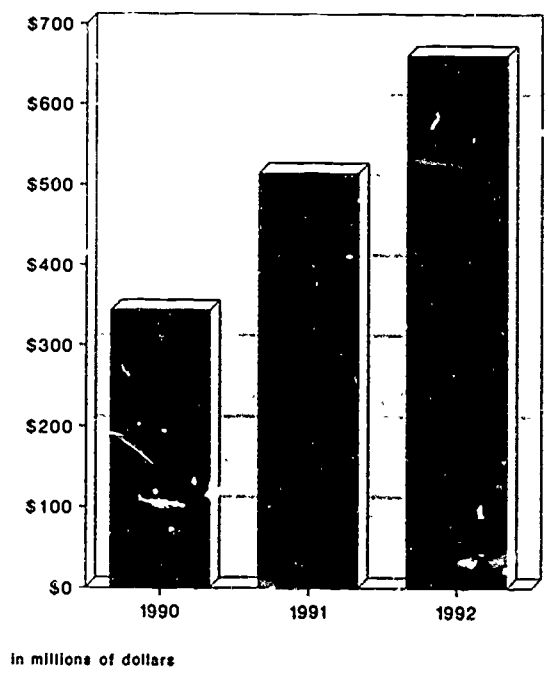
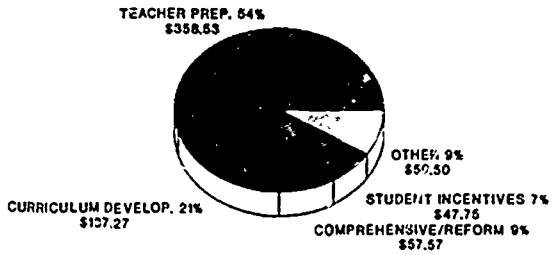


Figure 17
FY 1992 Precollege Budget Request by Priority

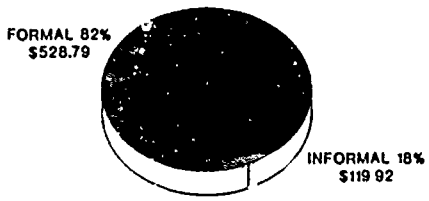


In millions of dollars

account for nearly 86% of the FY 1992 precollege request. Seventy-six percent of the Department of Education's precollege request is for formal programs in teacher development and enhancement, while NSF spreads its support over several categories, including informal education.

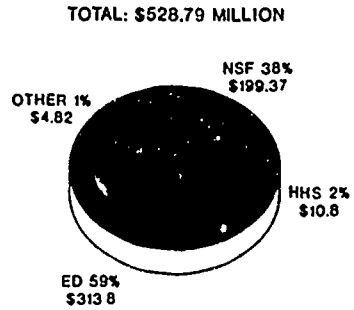
Other agencies have substantial commitments to precollege education. The Department of Energy, the National Aeronautics and Space Administration, and the Department of Interior together make up 55% of the informal precollege request, for example.

Figure 18
Precollege Formal/Informal Program Split



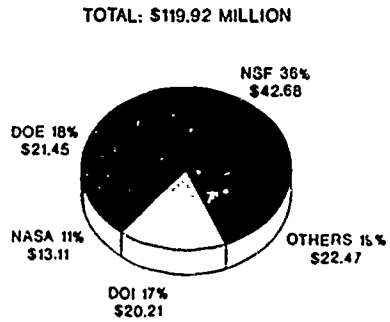
In millions of dollars

Figure 19
Precollege Formal Education Budget



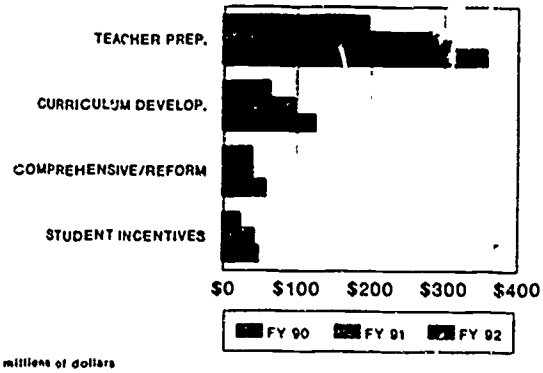
In millions of dollars

Figure 20
Precollege Informal Education Budget



In millions of dollars

Figure 21
Precollege Priority Growth: FY 1990-1992



In millions of dollars

Teacher preparation and enhancement is the highest CEHR priority for precollege programs. The FY 1992 budget request for mathematics- and science-related teacher programs is $358 million, which represents almost 54% of the total precollege request and an increase of $46.5 million or 15% over FY 1991.

Curriculum development is next in size of request, at $125 million, with a requested increase of 28%.

The comprehensive/reform priority receives the largest percentage increase, 46%, to a total of $57 million.

The precollege student incentives category increases by 13% for a total of $47 million.

FY 1992 PROGRAM HIGHLIGHTS

Following are summaries of some key Federal precollege programs making a difference in mathematics and science education.

FY 1992 PRIORITY #1: TEACHER PREPARATION AND ENHANCEMENT

Teacher preparation and enhancement is clearly a Federal priority. Federal programs provide an opportunity for rapid intervention in the educational system through leveraging of local funds for teacher improvements. The Federal programs are a balance of short-term and more intensive interventions aimed at upgrading teacher performance. These programs are clearly at the forefront of educational reform, providing a direct means of enhancing both content and skills that can have immediate payoffs in the classroom. Teacher enhancement programs also have the capability of reaching a substantial percentage of our Nation's teachers and providing the kinds of education that experts and school [illegible] identify as critical.

BUDGET IN BRIEF: PRIORITY #1: TEACHER PREPARATION AND ENHANCEMENT

PROGRAM TOTAL: *$358.5 Million*
FY 91-92 INCREASE: *$46.5 Million/+15%*

Department of Education

Eisenhower Mathematics and Science Education States Grants Program ($239 million)

The Eisenhower State Program provides formula grants to State and local educational agencies (SEAs and LEAs) and competitive grants to institutions of higher education to improve the skills of teachers and the quality of instruction in mathematics and science. SEAs and LEAs must use these funds to address the teacher training needs that they identified in statutorily required State and local needs assessment reports. States provide technical assistance and support to local

school districts; operate demonstration and exemplary programs; and ensure that local school districts are addressing identified needs and making progress toward achieving program goals.

The Eisenhower State Grant program provides recipients with an easily accessible and flexible means for addressing their teacher preparation and enhancement needs and implementing systemic educational reforms. This program has wide impact, since all States and approximately 85% of local school districts receive Eisenhower funds. In addition, Eisenhower funds are often used in conjunction with funds from other Federal, State and local sources. For example, Eisenhower program funds often enable recipients to participate in NSF-sponsored projects.

An evaluation of this program has found that the Eisenhower State Grants Program has produced an integration of efforts in mathematics and science at various levels in the participating school systems. It also provided over 600,000 teacher education experiences in the 1988-89 school year.

The President is requesting a $37 million increase in this program for FY 1992.

National Science Foundation

Teacher Preparation and Enhancement ($97.3 million)

The Teacher Enhancement Program supports innovative and cost-effective model projects for the inservice education of teachers and others involved in elementary and secondary school mathematics and science education. Participants attend courses, engage in research and structured leaves-of-absence, and attend workshops and conferences. Some projects are designed to improve technical qualifications and pedagogical techniques of individual teachers; other projects, with a regional or national focus, identify leaders who can carry experiences back to their home communities. These teacher-leaders promote and leverage change and are encouraged to become involved in research in teaching and learning and development of new curriculum materials.

The Teacher Preparation program supports innovative projects that include pre-service preparation of science and mathematics teachers; research on factors affecting teacher preparation; and development of creative materials to support teacher education. Program objectives include expanding content knowledge and pedagogical techniques of future teachers; facilitating linkages among scientists, educators, education specialists and school personnel; and attracting individuals of high ability in science and mathematics to the teaching profession.

These programs are expected to reach nearly 20,000 teachers directly. An estimated multiplier effect of ten implies that at least 200,000 science and mathematics teachers will be affected in FY 1992.

Department of Energy

Teacher Research Associates Program ($2.5 million)

The Teacher Research Associates (TRAC) Program provides science and mathematics teachers, selected from across the country, with eight-week, summer research assignments at 21 DOE National Laboratories.

Through research, the teachers not only learn about leading-edge technologies, but also recap-

ture the spirit and enthusiasm involved in scientific discovery. As part of the program, the teachers develop teaching materials and strategies to bring back to their classrooms, a vital link in reaching the next generation of scientists and engineers.

In addition to the research, TRAC teachers attend lectures, work one-on-one with scientists, make presentations before their colleagues summarizing their experiences, and maintain ongoing contact with DOE scientists during the school year. In 1990, over 200 teachers participated in this intensive program.

FY 1992 PRIORITY #2: CURRICULUM DEVELOPMENT

Curriculum development and related activities have far-reaching effects in the classrooms. By providing models of new approaches and means of implementing these innovations in classrooms, cutting edge ideas can be transferred at relatively low costs in a short period of time.

PRIORITY #2-A: Curriculum and Materials Development

Curriculum and materials development programs provide fundamental concepts in mathematics and science education that reflect current thinking in the disciplines and provide means for teachers to implement them readily in the classroom. The best thinking of specialists in both the disciplines and in mathematics and science student learning are captured in these programs.

The U.S. education system provides for State and local control of public elementary and secondary schools. The Federal role of encouraging and facilitating curriculum reform emphasizes the development of curricular frameworks for essential learning and education standards that can be used by State and local authorities as a basis for local curriculum design and performance measurement. Federal programs also support model curriculum development based on research findings of effectiveness, and dissemination and technical assistance to help implement curricular reform.

BUDGET IN BRIEF: PRIORITY #2-A: CURRICULUM AND MATERIALS DEVELOPMENT

PROGRAM TOTAL: $110.61 Million
FY 91-92 INCREASE: $24.41 Million/+28%

National Science Foundation

Instructional Materials Development
($41.2 million)

The Instructional Materials Program supports the development of many kinds of instructional materials in science and mathematics that promote the science and mathematics literacy of students at all grade levels and build a sound background for disciplinary learning in both high school and college. The varied projects range from those dealing with a few modules at a single grade level to those that prepare new model curricula covering as many as six school years.

The objective is to provide high-quality science and mathematics curricula at the elementary, middle and high school levels and to disseminate this material to over 16,000 school districts. Eleven major curricular projects involve triad partnerships of publishers, schools and school systems, and academic curriculum teams. Other projects draw on the resources of science and mathematics teacher networks and organizations.

Department of Education

The Eisenhower National Mathematics and Science Program ($15 million)

The Eisenhower National Program funds grants and cooperative agreements for projects of national significance in mathematics and science education. This program is a major component of the Department's efforts to ensure that U.S. students will be first in the world in science and mathematics achievement by the year 2000. Anticipated priorities for FY 1992 include projects designed to implement curricula that would introduce students to, and enable them to learn, higher order mathematics and science concepts at earlier ages; and programs to encourage and assist persons with training and experience in mathematical and scientific fields to enter teaching through alternate teacher certification routes.

In 1989, there were a total of 29 projects, with about half at the elementary school level. A wide range of projects have been funded, many with potential national impact, such as new curriculum standards in several States. There have also been projects supported jointly with NSF, including the American Association for the Advancement of Science's Project 2061.

National Aeronautics and Space Administration

Aerospace Education Services Program ($6.1 million)

The Aerospace Education Services Program (AESP), known as Spacemobile, is a vital outreach program to elementary and secondary schools. AESP specialists, all former teachers themselves, stimulate millions of students and teachers each year by using aeronautics and space as catalysts in the teaching of science, mathematics and technology. From September to June each year, AESP specialists visit classes, conducting student assemblies and teacher workshops. They are also involved in developing aerospace curriculum that is used to enhance science and mathematics classes. During the summer, AESP specialists conduct teacher workshops at the NASA field centers and various colleges and universities.

PRIORITY #2-B: Educational Technologies

The use of new educational technologies can expand and upgrade school mathematics and science instruction. Computers, laser disks and state-of-the-art laboratory equipment can provide students with experiences that will prepare them for more advanced scientific experiences and assist in making mathematics and science truly hands-on and problem-solving in nature.

BUDGET IN BRIEF: PRIORITY #2-B: EDUCATIONAL TECHNOLOGIES

PROGRAM TOTAL: $9.0 Million
FY 91-92 INCREASE: $2.25 Million/+35%

National Science Foundation

Applications of Advanced Technologies ($7.5 million)

The Application of Advanced Technologies Program is responsible for supporting research, development and demonstration in the use of state-of-the art computer and telecommunications technologies in education. The program seeks projects that will lay the research and conceptual foundation for technologies that will be available in 5 to 10 years. As an FY 1992 initia-

tive, a precollege engineering and technology education program will be launched with enhanced development, adoption and implementation of technology-based tools, curriculum materials and teaching methods. The objective is to increase the number of science and mathematics teachers capable of applying technological tools in their classroom practice.

National Aeronautics and Space Administration

Educational Technologies ($700,000)

NASA evaluates new technologies, whether developed inside or outside the agency, for potential use in education. Accomplishments include a computer network for students and educators, educational programs delivered to schools by satellite, and interactive laser videodisc programs.

Spacelink is an information access system that allows individuals to log on and receive news about current NASA programs and activities and other space-related information, including historical and astronaut data, lesson plans and classroom activities, and even entire publications.

Satellite videoconferences are a series of educational programs delivered by satellite to teachers across the country. The content of each videoconference varies, but all cover aeronautics or space science topics of interest to the educational community.

Laser Videodisc Technology is being used to develop interactive lesson plans on space-related topics. These interactive systems will be used to orient teachers in the use of resources available at the Teacher Resource Centers and how to make the best use of the resources when they return to the classroom.

PRIORITY #2-C: Dissemination and Technical Assistance

The key to achieving the most from research and development activities is to deliver these products and ideas in an accurate and timely manner. The Federal government is in a unique position to provide dissemination and technical assistance and has established mechanisms for doing these.

BUDGET IN BRIEF: PRIORITY #2-C: DISSEMINATION AND TECHNICAL ASSISTANCE

PROGRAM TOTAL: $5.76 Million
FY 91-92 INCREASE: $0.41 Million/+7%

Department of Education

National Diffusion Network (NDN)
($3.6 million)

The National Diffusion Network makes exemplary educational programs available for adoption by schools, colleges and other institutions. Mathematics and science programs are prominent in NDN. NDN program directors help local schools implement their programs to suit each school's unique needs. To do that, the director of the program provides training and follow-up assistance to staff members in the adopting school. Matching the needs of schools and available programs is the responsibility of State Facilitators.

Programs included in NDN are carefully screened for effectiveness by the Department's Program Effectiveness Panel. A program requesting a review must provide evaluation data

that prove that the program is effective in the school in which it was developed or field tested, and that it could be used successfully in other schools. As of 1990, approximately 500 programs had been approved and 88 of them were receiving Federal dissemination funds to help other schools adopt them. Twenty-five of these projects (28%) focus on mathematics and science.

Environmental Protection Agency

National Network for Environmental Education Centers ($100,000)

EPA, in cooperation with the Tennessee Valley Authority and the Alliance for Environmental Education, supports an expanding network of regional and environmental education centers for teacher training, research and community outreach. The network of environmental education centers disseminates environmental education materials and encourages information and technology transfer.

Department of Education

Education Resources Information Center (ERIC) ($400,000)

ERIC is the largest, most often-used information system serving the field of education and is the only national education information resource. It consists of 16 Clearinghouses, a central processing reference facility and ACCESS ERIC, a contact point for new users of the system. One Clearinghouse specifically focuses on mathematics, science and environmental education.

PRIORITY #2-D: Evaluation

Evaluation and assessment have clearly taken on even greater importance with the initiation of National Educational Goals and educational reform. Student assessments and school surveys provide means to determine the progress of educational reforms, and to provide a base for educational accountability.

BUDGET IN BRIEF:
PRIORITY #2-D: EVALUATION

PROGRAM TOTAL: $11.9 Million
FY 91-92 INCREASE: $2.41 Million/+25%

Department of Education

National Center for Education Statistics ($14 million)

The National Assessment of Educational Progress (NAEP), which is managed by the National Center for Education Statistics, is the only nationally representative assessment of what American students know and can do. It is an ongoing, Congressionally-mandated project created to survey the educational attainments of young Americans. Its primary goal is to determine and report the status and trends over time in educational achievement, subject by subject.

In 1990, NAEP began the collection of mathematics achievement data to provide State-by-State comparisons. Initial testing was done in the 8th grade. Efforts in 1992 will expand the assessment to 4th grade.

In addition to NAEP, the Center furnishes data on a variety of mathematics and science issues, such as course enrollments, demand for mathe-

matics and science teachers, and changes in high school graduation requirements. NSF and the Center often do joint funding of data collections that provides for stronger data bases while controlling costs in each agency.

National Science Foundation

Studies, Assessment, and Program Evaluation ($11 million)

Studies, Assessment, and Program Evaluation supports the collection and analysis of data on science and engineering education issues and supports related policy studies and development. Assessment studies assist the Foundation in a continuing effort to improve its own education activities and to provide information for planning to colleges, universities and government at all levels. Other components are devoted to assessments of NSF-funded programs and assessment of student performance (national and international) in science and mathematics.

FY 1992 PRIORITY #3: COMPREHENSIVE PROGRAMS/ ORGANIZATION AND SYSTEMIC REFORM

To meet the needs of students and teachers in mathematics and science education, it will be necessary to make dramatic changes in educational structures. The Federal role in organizational reform is to promote school-wide changes leading to active, engaging, student learning in science, mathematics, engineering, and technology. Reform activities include school restructuring; enhancing professional roles; and promoting the adoption of up-to-date curricula materials and equipment, as well as modern teaching and learning methods.

Many school districts are now in the process of restructuring, changing the nature of accountability and the roles of educational personnel and other participants in the educational process, including parents. Statewide changes are also occurring, spurred by the need for broad educational reform.

Because of their many relationships with States, local school districts, institutions of higher education, and their own facilities, Federal agencies have a crucial role to play in encouraging such reforms.

This category also includes comprehensive programs reaching both students and teachers in entire school districts, States, or regions.

BUDGET IN BRIEF:
PRIORITY #3: ORGANIZATION REFORM

PROGRAM TOTAL: $57.57 Million
FY 91-92 INCREASE: $18.06 Million/+46%

National Science Foundation

Statewide Systemic Initiatives ($31 million)

The Statewide Systemic Initiatives Program is designed to immediately broaden the impact, accelerate the pace, and increase the effectiveness of improvements in science, mathematics, engineering and technology education through comprehensive systemic changes in State education systems. Projects require collaboration of State executive, legislative, education, business and public leaders.

Each project reflects the unique needs, opportunities and resources of the submitting State and addresses relevant elements of K-12 or K-16 edu-

cation. State plans for education initiatives must integrate components of systemic change such as: organization structure and decision making; provision and allocation of resources; recruitment, preparation, retention and professional development of teachers and faculty; curriculum content and learning goals; delivery of instruction, including educational technologies; facilities and equipment; articulation within the system; and accountability systems.

NSF expects to make awards averaging $1.7 million per year for up to five years and has reached agreement with the Department of Education for use of its Eisenhower Act Science and Mathematics funds for collaborative support of the Program.

Environmental Protection Agency

Environmental Education Urban Initiative ($400,000)

Through the Environmental Education Urban Initiative, EPA will provide support for and participate in the development and implementation of programs for urban, inner city youth and teachers. The initiative will encourage environmental careers and enhance awareness of science through experiential, environmentally oriented projects and programs. Programs like Seattle's Earth Corps and the Natural Guard in New Haven, Connecticut and Baltimore are models of successful urban environmental education programs.

The Urban Initiative provides a vehicle to develop scientific and environmental literacy within urban, minority populations. The need to interest minority and women in scientific and environmental careers is critical to meeting current and future workforce needs.

EPA is already providing outreach in a number of major cities and plans to develop a coordinated, national outreach to urban populations to foster environmental careers and awareness. The Agency expects to invest $400,000 in FY 1992 to support this initiative.

EPA will work with other government programs, such as VISTA, and with existing urban environmental groups, Boy Scouts and Girl Scouts, the Association of Science and Technical Centers, and other organizations in order to capitalize effectively on existing networks and leverage resources

Department of Energy

Laboratory Partnerships with Rural and Urban Schools ($5.9 million)

Formal partnerships have been developed between DOE National Laboratories and rural and urban school systems. These partnerships provide a range of technical assistance from the laboratories to the school systems, including summer research appointments for teachers and students; mentoring of students by DOE scientists; assistance in the development of classroom and out-of-classroom science experiments; equipment loans; and short courses and institutes for teachers on energy-related topics. The overall purpose of these partnerships is to assist the participating school systems in implementing long-term structural improvements in the teaching of mathematics and science at the precollege level.

One laboratory partnership example is the Bay Area Science and Technology Education

Collaboration (BASTEC). Through BASTEC, the four DOE laboratories in the San Francisco Bay Area (Lawrence Berkeley, Lawrence Livermore and Sandia-Livermore National Laboratories and Stanford Linear Accelerator Center) work with six regional colleges and universities and the Oakland Unified School District (OUSD) to prepare all 2700 science and mathematics teachers in OUSD to implement the new California curriculum standards in science and mathematics.

Another example is the Chicago Academy for Mathematics and Science Teachers, a collaborative effort begun by Fermi and Argonne National Laboratories, and involving the State of Illinois, a consortium of universities, business and industry, and the scientific and teaching communities. Its goal is to prepare all new science and mathematics teachers coming into the Chicago school system, and enhance the skills of teachers already in the system. The Academy has the potential to reach 15,000 precollege teachers in Chicago who teach mathematics and science. The Academy has also received funding from the National Science Foundation and NASA.

FY 1992 PRIORITY #4: STUDENT INCENTIVES AND OPPORTUNITIES

Student interest in mathematics and science must be captured at the precollege level. Programs in this category do this by introducing students to new experiences, providing the opportunities for student participation in scientific research, and furnishing means for many students, particularly minorities and women, to become active in mathematics and science. It is of particular importance to provide incentives and opportunities at the critical points where students are changing levels and may be lost to mathematics and science.

Direct Student Support programs provide direct student financial assistance, e.g., fellowships, traineeships, scholarships, research assistantships, stipends, and cooperative education. Bridging programs attempt to provide enrichment experiences for students as they move from high school to college so that they will retain their interest in science and technology careers. All Federal agencies also provide support for summer and stay-in-school research and work experiences for high school students in Federal facilities and laboratories.

BUDGET IN BRIEF: PRIORITY #4: DIRECT STUDENT SUPPORT/BRIDGING PROGRAMS

PROGRAM TOTAL: $47.75 Million
FY 91-92 INCREASE: $5.57 Million/+13%

National Science Foundation

Young Scholars Program ($11 million)

The Young Scholars Program, targeted on grades 8-12, is designed to excite students about science and encourage them to investigate and pursue science and technology careers. The program strongly emphasizes student participation in the process of scientific discovery through interaction with practicing scientists in the laboratory and in the field. Projects combine instruction and problem solving activities with discussion of career preparation and science ethics.

These projects have a varied disciplinary focus covering mathematics, computer science, engineering, chemistry, life sciences, physics and the earth sciences. Projects are located at sites throughout the United States, including university and college campuses, research vessels, off-

shore island laboratories, museums and national parks.

Many students eliminate careers in science, mathematics and engineering as viable choices prior to high school by not pursuing courses. As a result, in FY 1990, the Early Alert Initiative was begun for students in grades 7-9. The discipline focus of these projects is limited to mathematics and physics because of continuing concerns over personnel shortages in these fields. The freshman year of college is another critical point at which students drop out of the educational pipeline leading to scientific careers. In FY 1992, a second initiative will focus on retaining students in scientific majors during the transition from high school to college.

Department of Health and Human Services

Minority High School Student Research Apprentice Program ($8.9 million)

Established in 1981, the Minority High School Student Research Apprentice program is the single largest program in the HHS precollege initiative. The program awards grants to eligible institutions so that they may bring minority students into their research projects as research apprentices. These apprenticeships provide students with meaningful experiences in various aspects of health-related research in order to stimulate their interest in careers in science.

In FY 1991, the program includes a high school science teacher initiative. This new program extension will allow teachers who are members of a minority group, or who teach a significant number of minority students, to participate in a summer research project in order to update their knowledge and skills in modern research tools and techniques. Such a "hands-on" research experience should strengthen teaching skills and provide the teachers the opportunity to bring back to the classroom a sense of the excitement of research. A longer range goal is to establish year round links between science teachers, secondary school students, and biomedical researchers.

This program will provide experiences for approximately 3560 students and more than 300 teachers.

Department of Education

The Mathematics and Science Achievement Awards ($40 million)

In addition to the above precollege priorities, the Department of Education has proposed a new program, The Mathematics and Science Achievement Awards, meant to stimulate schools in their attempt to better student achievement in mathematics and science. Its requested appropriation of $40 million would be used to reward school districts whose students have demonstrated the highest level of improvement in mathematics and science performance.

FY 1992 UNDERGRADUATE PROGRAMS

UNDERGRADUATE CONCERNS

National education reports have raised serious concerns that U.S. undergraduate education in science, mathematics and engineering is not adequately responding to the changing needs of our society. These concerns can be distilled into two basic questions.

> **QUANTITY:** Are we producing enough U.S. college graduates in science, mathematics and engineering to insure that our future economic and technological needs are met?

And, perhaps more importantly...

> **QUALITY:** Are undergraduate students, both majors and non-majors, receiving the education in science, mathematics and engineering that is necessary to meet those needs?

The answer to both of these questions is very likely "no." Experts predict that American higher education institutions will be producing considerably fewer science, mathematics and engineering bachelor's degrees than they once did, despite the increasing relevance of science and technology to the Nation as a whole and to our individual lives.

THE DEGREE PRODUCTION DILEMMA

Why are there fewer bachelor's degree recipients? The problem has roots in the fact that there are simply fewer 18-year-olds in the U.S. population today than there were in the late 1970s — about 3.6 million compared to an all time high of 4.3 million. The fraction of these students that will eventually graduate from college with bachelor's degrees in science, mathematics and engineering is about 4-5% based on a stable historical average. Unless we find a way of raising this average, we can expect to produce fewer bachelor's degrees in these fields between now and the year 2000, when the number of 18-year-olds is expected to partially rebound. This suggests the need for intervention to insure that the Nation's scientific and technological enterprise remains strong and healthy, now and in the future.

The decline in the 18-year-old population has made it necessary to seek an increased rate of entrance into science, mathematics and engineering bachelor degree programs. One potential source is those who have been traditionally underrepresented in these fields, including blacks, Hispanics, women and persons with disabilities. Black and Hispanic students, who comprised less than 20% of the 18-year-old population in the mid-1970s, are expected to represent 30% by the year 2000. But in the past these students have not, for a variety of reasons, studied the sciences in large numbers. Although blacks constitute about 12% of the U.S. population and Hispanics 8%, they earn only about 5% and 3% respectively of all degrees in science, mathematics and engineering. Similarly, women make up about half the population, yet earn about 30% of all science, mathematics and engineering degrees. The Nation has not been successful in stimulating interest in the sciences, mathematics and engineering, and educational institutions have not been able to retain students in these majors once the interest is there.

At the same time, degree preferences of college-bound high school seniors have been changing. In 1988 only 14% were interested in majoring in science, mathematics or engineering, compared to nearly 20% less than five years earlier. This is partially due to a recent downturn in interest in computer science following a surge in interest in

the early 1980s. To compound the problem, male students are three times more likely to be interested in science, mathematics or engineering majors than female students. Moreover, better than 50% of all students interested in pursuing science and engineering majors fail to complete degrees in these fields. And that is more than the Nation can afford to lose.

Many students do not have the proper high school preparation to pursue science, mathematics and engineering college studies. According to a national study conducted by the Department of Education, only 7% of the high school seniors tested were prepared for college level science courses. Nearly 30% of our high schools offer no courses in physics, 17% offer none in chemistry, and 70% offer none in earth or space science.

THE UNDERGRADUATE ACADEMIC EXPERIENCE

In addition to the aforementioned problems of degree production, many experts believe that undergraduate science, mathematics and engineering education has suffered from a lack of attention, which has left it stagnant, diminished its quality, and led to a dull and uninspiring student experience. As a result, there is increasing concern about the quality of the academic experience itself, particularly during for the first two years of the four-year undergraduate sequence.

In a number of critical fields, undergraduate course curricula are virtually the same today as they were 20 years ago. As a result, curricula are often narrowly focused, despite the fact that some of the most exciting research growth areas today are not within scientific disciplines but between them. Undergraduate course work needs to keep pace with changes in scientific research, both for science majors and non majors.

Quality curricula alone do not lead directly to quality instruction. Faculty need opportunities to upgrade their teaching skills and, in some instances, become more familiar with scientific developments in their fields. They also need to instill in students the enthusiasm that makes them true partners in learning. Many experts believe the best way to do this is by involving the students in genuine research and laboratory investigations. These types of hands-on experiences do not replace traditional classroom learning, but help students transform information they learn in the classroom into knowledge and insight. Unfortunately, many colleges and universities do not have the laboratory facilities and equipment to accommodate student needs.

An additional problem is the lack of monetary rewards and peer status for faculty who are committed to quality instruction. In the past several decades, the academic system has tended to stress research more than instruction. The American higher education system must now seek a new balance between these two important priorities.

THE UNDERGRADUATE ACTION STRATEGY

Academic reform programs targeted on the precollege level represent long-term investments in our Nation's future. Undergraduate program strategies have the potential for a much shorter-term impact. An investment made today in an undergraduate freshman may motivate that freshman to enter a doctoral program in the sciences only four years later. Without that investment, the student may choose a non-technical major. The undergraduate level therefore represents an important pivot point for science, mathematics and engineering career

choices. It is the last clear opportunity for students to opt in or out.

Recognizing the significance of these years, the Undergraduate Action Strategy offers four program elements, three of which are considered critical priorities for agency budget and program planning. These elements respond to current deficiencies in undergraduate education as discussed above. The strategy's objectives are:

UNDERGRADUATE BUDGET AND PROGRAM PLANNING PRIORITIES

FY 1992 Priority #5: Curriculum and Materials Development and Laboratory Improvement

- To keep education in pace with the progress of science, in order to meet the overall needs of a changing technological environment.
- To provide students with the best possible overall academic experience.
- To provide for strong links between classroom and laboratory.
- To ensure that all students are educated in the fundamentals of science, engineering and technology, regardless of major.

FY 1992 Priority #6: Faculty Development and Enhancement

- To provide faculty with opportunities to enhance their skills in teaching, new research technologies, information delivery and student interaction.
- To call attention to the balance between research and instruction in science, mathematics and engineering disciplines.

FY 1992 Priority #7: Student Support and Opportunities

- To attract and retain students in undergraduate programs in science, mathematics and engineering.
- To transform student interest into the receipt of bachelor's and advanced study degrees through multiple support mechanisms.
- To provide a non-threatening and positive learning environment.

Additional FY 1992 Program Category: Comprehensive and Systemic Reform

- To inject the undergraduate system with a new degree of vitality.
- To unite multiple elements of a sometimes fragmented system behind the achievement of specific goals.
- To take a comprehensive approach to a complete and intertwined set of problems.

FY 1992 BUDGET HIGHLIGHTS

The total Federal request for science, mathematics and engineering education at the undergraduate level is $477 million for FY 1992, which represents an increase of $60 million or 14% over the prior year. This is a substantial portion—24%—of the Federal program request for education and human resources.

As shown in Figure 24, the majority of the undergraduate request, nearly 70%, is for formal programs at four-year colleges and universities. The next largest share, 26%, is for informal activities that frequently take place outside of the classroom, such as research opportunities at Federal laboratories.

Support for formal and informal programs for two-year community and junior colleges represents only about 3.5% of the total undergraduate effort, although there is some overlap with four-year programs. Because of its near-term workforce significance, especially in technician

training, two-year college programs have been singled out for special attention by CEHR in the coming year.

Figure 22
Undergraduate FY 1992 Budget

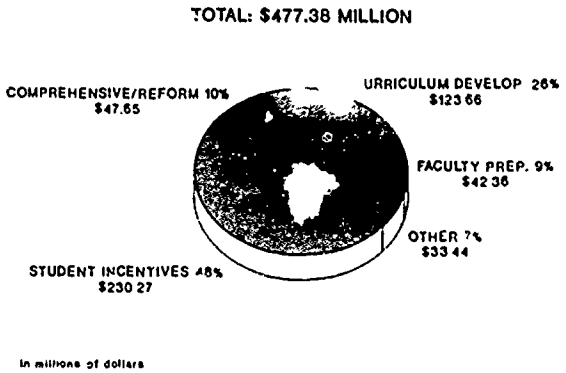
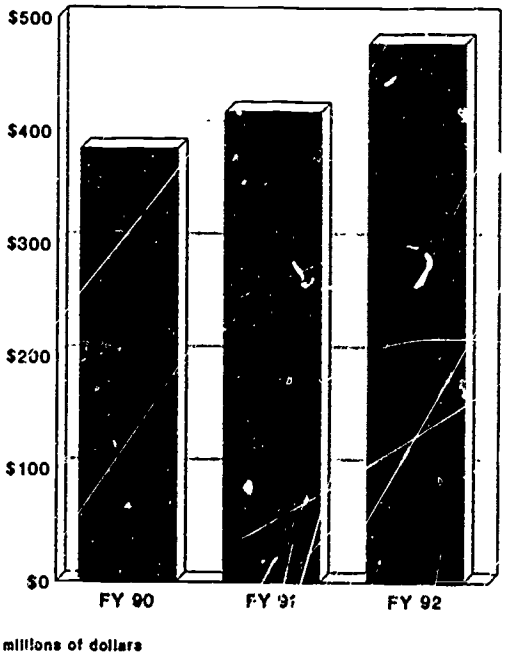
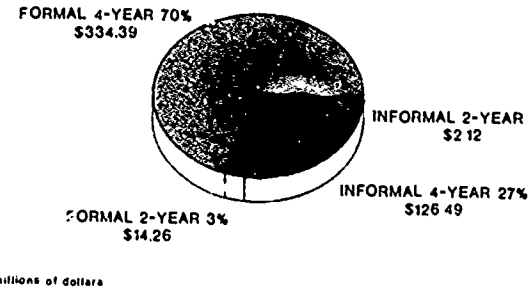


Figure 23
Undergraduate Education Growth: FY 1990-1992



The agencies that support the largest fraction of undergraduate education and human resources are the Department of Defense and the National Science Foundation. Together they account for nearly 65% of the undergraduate total budget request for FY 1992. While the Department of Defense concentrates largely on student support and informal curricula, the National Science Foundation focuses on formal curricula, laboratory development, faculty enhancement and systemic reform programs.

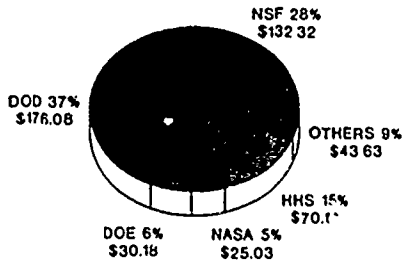
Figure 24
Undergraduate Request: Two-Year/Four Year



Other agencies make substantial investments in a variety of undergraduate programs. The Department of Health and Human Services, for example, has significant funding in direct student support for underrepresented groups. The Department of Energy and NASA together account for more than a third of the support for informal programs. Agencies such as the Department of Agriculture, the Department of the Interior, the Department of Commerce and the Environmental Protection Agency inhabit important, complementary programmatic niches that reflect their respective disciplinary missions.

Curriculum and Materials Development (including laboratory improvement programs) is the

Figure 25
Undergraduate Request by Agency

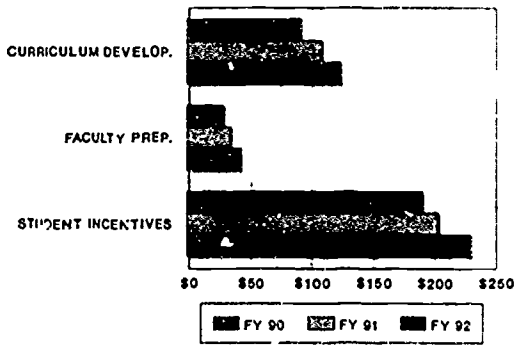


In millions of dollars

highest CEHR priority for increased funding. The FY 1992 budget request includes a 13.9% increase in this element of the budget, which would bring its total to approximately $124 million. Student support and opportunities constitutes the largest portion of the FY 1992 undergraduate request, about $230 million. Faculty preparation accounts for $42 million, an increase of 23%, while the comprehensive/organization reform category received a 27% increase to $47 million.

Programs that target involvement of groups underrepresented in the sciences, such as blacks,

Figure 26
Undergraduate Priority Growth: FY 1990-1992



IN MILLIONS OF DOLLARS

Hispanics, women and persons with disabilities, constitute a major effort at the undergraduate level. They amount to over $152 million, more than 57% of the total investment in underrepresented group programs at all educational levels and one-third of the total undergraduate effort as a whole.

The majority of the funds for underrepresented groups are for student support programs and comprehensive programs, both of which attempt to attract interest in the sciences and elevate the undergraduate degree participation rate. Ninety percent of the dollars spent on programs for underrepresented groups at the undergraduate level target minorities, 6% target women, and the remaining 4% target the disabled and economically and other disadvantaged groups.

FY 1992 PROGRAM HIGHLIGHTS

Following are summaries of some important Federal undergraduate programs making a difference in mathematics and science education.

FY 1992 PRIORITY #5: CURRICULUM AND MATERIALS DEVELOPMENT AND LABORATORY IMPROVEMENT

The Federal approach to undergraduate curriculum and materials development and laboratory improvement is composed of a series of complementary programs that create and disseminate model core scientific curricula and laboratories and produce learning and instructional materials, all with the objective of sparking movement toward stronger, more forward-looking coursework.

PRIORITY #5-A: Curriculum and Materials Development

The curriculum development programs in the plan are focused on teaching students basic and advanced scientific concepts, making them aware of applications of these concepts, and helping them develop the critical reasoning skills necessary to synthesize concepts and applications. Coupled with materials development programs in a variety of subjects, such as health, energy, the environment, natural resources and preservation, defense, space, and agriculture, curriculum and materials programs form a coherent package that reinforces the other components of the Undergraduate Plan.

Many times curriculum and materials development programs also contain opportunities for research into the processes of how students learn basic concepts of science, mathematics and engineering. How instructors can best teach these concepts is a valued aspect of the curriculum and materials development strategy.

Curriculum programs involve all types of undergraduate institutions, from four-year research universities to small liberal arts colleges and, to a much smaller extent, two-year junior or community colleges. In some instances, projects carried out by universities reach across institutional types, serving entry-level courses at two-year colleges as well.

BUDGET IN BRIEF: PRIORITY #5-A: CURRICULUM AND MATERIALS DEVELOPMENT

PROGRAM TOTAL:	*$98.49 Million*
FY 91-92 INCREASE:	*$17.1 Million/+21%*
TWO-YEAR PROGRAMS	*$0.25 Million*
FOUR-YEAR PROGRAMS	*$98.24 Million*

National Science Foundation

Undergraduate Curriculum and Course Development in Engineering, Mathematics and the Sciences ($39 million)

The Undergraduate Curriculum and Course Development Program emphasizes different aspects of curriculum development each year. For FY 1992, the program's focus is on introductory-level courses, curricula and laboratories for science, mathematics and engineering.

Grant proposals are accepted from all types of undergraduate institutions, research universities to community colleges. The program has two categories: Comprehensive Projects and Pilot Projects. Comprehensive Projects support a few major efforts involving broad-based, cohesive sets of activities meant to change undergraduate education significantly at the introductory level. Pilot Projects focus on individual courses, laboratories and other specific topic areas.

The program funds multidisciplinary and interdisciplinary projects, as well as those within more traditional fields of science. Some recent projects have targeted students majoring in engineering, mathematics and the sciences, while others have addressed students majoring in other technical and non-technical fields.

The Course and Curriculum Program stresses the need to incorporate into curricula new information delivery systems and technologies, new teaching processes and learning environments, and more engaging field experiences. The program also seeks to improve the instructional applications of communications and information technologies.

PROGRAM AT WORK

The National Science Foundation's Calculus Curriculum Development Program

The National Science Foundation has initiated a program meant to fundamentally restructure the approach to teaching calculus in colleges and universities across the Nation. Clear signs of progress have become evident from the 63 grants made to a geographically balanced set of institutions since 1988.

Although the projects include a diverse set of approaches to teaching calculus, several common themes are emerging. Emphasis is shifting from the instructor as the dispenser of knowledge to the student as an active participant in learning. Problem solving is replacing formula manipulation and the end-of-the-course exercises are being replaced by more realistic, open-ended problems that unify the important concepts learned throughout the term.

A project that embodies some of the best work is "Project Calc" at Duke University. The project is founded on the idea is that calculus is best taught as a laboratory course where problem solving, rather than lecture, holds the main focus in communicating the mathematic concepts being taught. Lecture is kept to a minimum giving students the opportunity to work through problems using computers in groups of two or three. Students are expected to turn in written laboratory reports that not only provide the numerical answers for the problems that have been assigned but also describe what these answers mean. For this reason a strong emphasis is placed on internalizing knowledge through intensive writing. To do this students combine the power of mathematics computer programs with the use of a technical word processing package.

The four-year grant also supports the active involvement of a nearby mathematics and science high school. The school is actively involved in every step of the project which is expected to produce a suitable course version for use at the high school level as well.

The project, which has been funded since 1989, is disseminating its product through grants to 12 test centers across the Nation. The test centers include a range of institutions, from small colleges to large universities, private and public institutions in all regions of the Nation. The final goal of the project is to produce a textbook and set of class materials for use at non-participating universities.

The Department of Energy

Academic Partnerships in Environmental Restoration and Waste Management
($11.5 million)

To address critical workforce shortages in the area of environmental restoration and waste management DOE has formed comprehensive academic partnerships at two- and four-year colleges. Focusing on curriculum development, these multi-year partnerships also include faculty and student development, stipends, graduate training, minority student recruitment and partnerships with DOE laboratories. University consortia have been formed with New Mexico universities (Waste Management Education and Research Center), universities in South Carolina (South Carolina Universities Research and Educational Foundation), and the universities in the Historically Black Colleges and Universities/Minority Institutions consortium.

National Aeronautics and Space Administration

The Advanced Design Program
($1.7 million)

The Advanced Design Program allows students to study advanced mission topics for NASA as part of courses taught at their universities. The program has two elements: Advanced Space Design and Advanced Aeronautics Design.

Conceived as a way to incorporate topics of engineering design into the undergraduate engineering curriculum, the program now enrolls students from other disciplines and often sponsors cross-disciplinary projects. Forty-five universities will collaborate with the NASA Centers in FY 1991, serving several hundred undergraduates. Over the last three to four years, the private sector has increased its involvement substantially, providing financial assistance and summer internships. Expanded after an extremely successful three-year pilot phase, the program has been in operation for six years.

Department of Defense

The Educational Technologies Program
($38.9 million)

The Educational Technologies Program provides computer-based instruction, and a variety of other educational and learning research to improve educational performance and teaching methods for Department personnel. Results of these programs are made available to the civilian educational system through two technology transfer centers. The center in Orlando, Florida is developing a database of curriculum content, hardware, software, portability, evaluation, costs and contact points for all Department training courses and education programs. The programs contribute to the state-of-the-art research and advanced technology training and provide valuable resources of software and learning technologies experience to the civilian education sector.

PRIORITY #5-B: Laboratory Improvement

The provision of laboratory opportunities is clearly among the most important elements in quality science-related instruction, even in mathematics. Laboratory improvement programs seek to upgrade laboratory equipment and strengthen the interaction between classroom learning and laboratory investigations in science, mathematics and engineering curricula. However, student research experience is not included in this pro-

gram element. That will be discussed later in the Student Support and Opportunities section.

Students need modern laboratories that provide them with knowledge about the role of rapidly progressing technologies in scientific research. This is particularly true of students who intend to enter the workforce after the undergraduate degree. Recent legislation has expanded the ability of several Federal agencies to lend and/or grant title to used or surplus laboratory equipment to educational institutions. It is expected that this will enhance the ability of recipient institutions to introduce new technologies into the student learning environment.

BUDGET IN BRIEF: PRIORITY #5-B: LABORATORY IMPROVEMENT

PROGRAM TOTAL: $25.06 Million
FY 91-92 CHANGE: -$2 Million/-7.4%

TWO-YEAR PROGRAMS: $2.30 Million
FOUR-YEAR PROGRAMS: $22.76 Million

National Science Foundation

The Instrumentation and Laboratory Improvement Program ($23 million)

This program seeks to improve laboratories and other investigational settings associated with undergraduate instruction in science, mathematics and engineering. It provides matching grants to universities and two- and four-year colleges—not for the purchase of ordinary equipment, but for the support of programs that will make significant new contributions to the way laboratories are taught.

The specific objectives of this program are:

- To introduce modern instruments that improve the education of undergraduate majors and non-majors in science, mathematics and engineering courses.
- To introduce current technology into the instrumentation for science instruction; for example, to interface computers with scientific instrumentation.
- To develop new ways of using instruments to extend instructional capabilities.
- To establish equipment sharing through consortia or centers.

Since these projects are meant to be models for other institutions to replicate, grantees are expected to disseminate their results through laboratory manuals, software, scholarly publications and presentations at scientific and professional meetings.

This program has funded projects that address introductory laboratory courses, courses that acquaint non-science majors with the principles and methods of science; laboratories for upper-level course majors; and undergraduate laboratories for future elementary and secondary school teachers.

FY 1992 PRIORITY #6: FACULTY DEVELOPMENT AND ENHANCEMENT

In some educational institutions, the rewards of faculty tenure, promotions and career advancement appear slow to come to those who devote substantial time in preparing classroom and laboratory experiences for undergraduate students.

Faculty are the only ones who can create a classroom environment where students and teachers are true partners in learning. To do this, comprehensive and diverse faculty development opportunities must be present.

Faculty need opportunities to learn new experimental methods and ways of incorporating them into undergraduate curricula. They need exposure to recent advancements in instrumentation technology and their suitability for classroom use. They need to be familiar with recent theoretical developments in their fields which bear on their undergraduate teaching. And, finally, they need opportunities to interact with experts in other fields—those that are both active researchers and teachers.

Because of the availability of scientific resources such as Federal laboratories and other facilities, the Federal government is in a unique position to provide these opportunities.

BUDGET IN BRIEF: PRIORITY #6: FACULTY DEVELOPMENT AND ENHANCEMENT

PROGRAM TOTAL: $42.36 Million
FY 91-92 INCREASE: $7.88 Million/+22.9%

TWO-YEAR PROGRAMS: $ 2.79 Million
FOUR-YEAR PROGRAMS: $39.57 Million

National Science Foundation

The Undergraduate Faculty Enhancement and Research in Undergraduate Institutions Programs ($6 million)

The purpose of this program is to enhance the disciplinary capabilities and teaching skills of faculty by exposing them to new techniques, technologies and approaches to teaching their courses. Projects are regional or national in scope and frequently make use of seminars, short courses, workshops and conferences or a combination of these activities. Sessions vary in length from a few days to a few weeks. The program encourages the participants to continue to interact after the project concludes and share newly gained knowledge and techniques with other non-participating faculty. Participants also work, in some cases, with industrial scientists to understand industrial applications of their new knowledge and ways to incorporate those applications into their courses.

National Aeronautics and Space Administration

Summer Faculty Fellowship Program
($4 million)

Initiated over 25 years ago, the NASA/American Society for Engineering Education Summer Faculty Fellowship Program provides an opportunity for approximately 250 college and university faculty to spend 10 weeks at a NASA laboratory center conducting research on problems of mutual interest to NASA and the fellows. The program is designed to further the professional knowledge of the participating faculty; stimulate an exchange of ideas between participants and NASA; and enrich the research and teaching activities of the participants' home institution. Traditionally, about half the participants represent the sciences and half represent various engineering disciplines. This program has successfully increased the capability of faculty to pursue studies in space and aeronautical sciences; nearly 40% of its participants go on to receive highly competitive NASA research grants within three years of their tenure.

Department of Energy

The Undergraduate Faculty Development Program ($2.4 million)

This program supports summer or academic year appointments, including sabbatical appointments, to enable faculty to participate in research at a Department of Energy facility. Faculty may participate with home campus students in team research projects at a number of Department of Energy laboratories or conduct instructional sessions and experiments with their students.

In addition, the program funds supplemental activities designed to complement and support special training needs and curriculum reinforcement in energy and related fields. These include one to four-week institutes on energy technology, environmental impacts, conservation and other related subjects; two to three-day workshops on special topics closely tied to laboratory research programs; and conferences on a broad range of topics associated with energy and developing technology.

As a result of this program, 80% of the participants translate their experiences into changes in course curriculum, lecture topics, or course offerings, and 90% encourage their students to apply for Department of Energy laboratory research appointments. The FY 1992 funding level is expected to result in a 30% increase in the number of participants, with a special emphasis on increasing the number female and minority participants.

Environmental Protection Agency

Research Support at Minority Institutions ($1.2 million)

This program has two general components: the Research Assistantship Program for Faculty and support for one or two Hazardous Substances Research Centers at Historically Black Colleges and Universities. The Faculty Assistantship program helps develop the teaching and research capabilities of faculty, which in turn strengthens academic departments. More competitive departments lead to higher quality instructional and research opportunities for undergraduates. This program supported about 15 faculty in FY 1991. The agency plans to expand this to a $1.2 million program in FY 1992.

Department of the Interior

The Undergraduate Faculty Development Program ($1.4 million)

Through the U.S. Geological Survey, the Department of the Interior provides opportunities for faculty members to work on research or investigative studies relating to the analysis of surface and ground water quality in the United States. Assignments provide scientists and researchers with enhanced personal knowledge and skills in hydrology for immediate application in the classroom. Improved understanding of this field by faculty leads to greater student learning and interest in hydrology-based careers. Approximately 100 faculty members will participate in the program in FY 1992.

FY 1992 PRIORITY #7: STUDENT SUPPORT AND OPPORTUNITIES

Recognizing the problems associated with a decline in student interest in science, mathematics and engineering and the historically low participation of women, minorities and the disabled, the undergraduate action strategy offers a broad

base of student support and opportunity programs. They range from scholarships to cooperative education to student research experiences. In fact, student support and opportunity programs constitute the largest share of Federal spending on science, mathematics and engineering education and human resources at the undergraduate level.

All CEHR agencies have made significant financial investments in student support and opportunity programs. Student support and opportunities programs have one or more of the following objectives:

ATTRACTION: Those that arouse the interest of students and encourage them to pursue studies and careers in science, mathematics and engineering;

RETENTION: Those that, through different support mechanisms, assist students in translating their study efforts in science, mathematics and engineering into a bachelor's degree; and

BRIDGE: Those that assist and encourage students with a bachelor's degree in science, mathematics or engineering to continue their studies toward masters, doctorate or other advanced degrees.

By far the largest player in student support and opportunity programs is the Department of Defense, followed by the Department of Health and Human Services and the National Science Foundation. Together these three agencies account for over $188 million in program support.

BUDGET IN BRIEF: PRIORITY #7: STUDENT SUPPORT AND OPPORTUNITIES

PROGRAM TOTAL:	*$230.27 Million*
FY 91-92 INCREASE:	*$26.67 Million/+13%*
TWO-YEAR PROGRAMS:	*$8.44 Million*
FOUR-YEAR PROGRAMS.	*$221.83 Million*

Department of Defense

Reserve Officer Training Corps (ROTC) ($100.5 million)

This program provides direct support for undergraduate students majoring in science, mathematics and engineering. After receiving their undergraduate degree, students are required to serve four years of active military duty or service in the Reserves. This program is particularly beneficial in assisting students with high abilities but limited financial resources. Scholarships awarded to science, mathematics and engineering majors represent approximately 60% of the total $168 million ROTC scholarship program. In 1990 about 13,000 scholarships were awarded to science, mathematics and engineering majors at approximately 800 universities. Scholarships support tuition, books, fees and a $100 per month stipend during the school year.

Department of Health and Human Services

Minority Access to Research Careers ($15 million)

The goal of this program is to expand and strengthen undergraduate education in the life sciences and promote related careers. This goal is accomplished through a variety of activities that

recruit talented undergraduate students by providing direct financial support in the form of grants, traineeships and awards to individuals and institutions. These awards are used to:

- support undergraduate students pursuing life science careers;
- enhance science faculty preparation; and
- increase the number and quality of research experiences available to students.

Under this program, highly qualified minority institutions receive support to provide science courses and research training for honors students in their third or fourth year of college. Eligible students are selected on the basis of their academic achievements and their commitment to obtaining a doctoral degree in an area of biomedical science. Grants cover tuition, fees and a stipend of $6,500 a year.

Most students participate in one summer research project at a major research institution. This off-campus research experience is a valuable part of the program, since it enables students to broaden their research activities, co-author scientific papers, and present their work at scientific meetings. The program also allows students to demonstrate their competence to institutions that may then invite them to pursue graduate studies. This program has been so successful that it served as a model for the National Science Foundation's Research Careers for Minority Scholars Program, which funds similar projects for many fields of science, mathematics and engineering.

PROGRAM AT WORK

Department of Health and Human Services

Minority Access to Research Careers:
Undergraduate Scholars Program

One of the most outstanding MARC Scholars Projects was initiated in 1977 at Jackson State University, Mississippi. The goal of the project, as with other MARC Scholars projects, is to engage talented minority undergraduate students in research and prepare them for graduate studies in biomedical research.

The program covers two academic years and two summers. The Jackson State program, in addition to arranging a special honors course sequence, includes courses in the use of research instrumentation and computers, special seminars, and mathematics and communication skills course segments. Each scholar participates extensively in ongoing research projects at the university and spends two 10-week summer segments at other outstanding research institutions where nationally recognized research in the scholar's area of interest is being performed. Financial support is ensured for all scholars upon completion of the Bachelor's degree and acceptance by graduate schools.

In addition to receiving an annual stipend and full payment of tuition, the scholars receive a travel allowance of $700 for attendance at national scientific meetings and conferences.

The fact that 90% of all scholars have gone on to attend graduate school, with nearly 60% pursuing Ph.D.s, demonstrates the overwhelming success of the Jackson State University MARC program. Prior to the initiation of the MARC program, less than one-quarter of similar students pursued a Ph.D.

Department of Energy

Research Partnerships Programs
($6.5 million)

The Research Partnership Programs provide undergraduate junior and senior science and engineering students with summer research opportunities at over 20 Department of Energy facilities. Students are carefully paired with a laboratory scientist and participate as team members in an ongoing research project. In some cases, projects also involve the participation of their university faculty.

A national competitive program also provides juniors and seniors with a full semester at one of six Department of Energy laboratories, where they participate in research at the cutting edge of science, receive training in the operation of state-of-the-art equipment, and receive instruction in their chosen fields of study.

These experiences give students meaningful opportunities to use the knowledge from their university training in research. They also encourage students to continue their education through graduate school. In fact, over 40% of past program participants have received or expect to receive a Ph.D. in science, mathematics or engineering.

Department of Education

The National Science Scholars Program
($10 million)

The National Science Scholars program, one of President Bush's original Educational Excellence Act initiatives begun in 1991, will encourage achievement in the sciences by providing scholarships to graduating high school students who have excelled in the sciences, mathematics and engineering. Each State will nominate at least four individuals from each Congressional district in the State. Selection is to be based on National Science Foundation-developed criteria. Nominations are to be submitted to the President, who will select two students from each Congressional district after consulting with the Secretary of Education and the Director of NSF.

Scholarships will be given directly to the institutions that the scholars will attend and will be available for between four and five years, providing up to $5,000 per year for the support of educational expenses.

To receive a scholarship, the student must have demonstrated outstanding academic achievement in high school in the sciences, mathematics or engineering, and have been accepted as a full-time major in science, mathematics and engineering. A student must maintain a high level of academic achievement in one of the approved majors as a full-time student in order to receive additional scholarships.

Departments of Commerce, Interior, and Defense and the Environmental Protection Agency

Federal Cooperative Education Programs

Four Federal science mission agencies have cooperative education, or co-op, programs: the Departments of Commerce, Interior, and Defense and the Environmental Protection Agency.

The Environmental Protection Agency has cooperative education agreements with 64 colleges and universities, including many with predominantly minority enrollments. As part of their degree programs, up to 200 students per year work at EPA, primarily in regional offices and laboratories. In addition to contributing to the educational progress of participating students, the Co-op program is an integral part of EPA's strategy to attract the best science and engineering students.

The Department of Commerce runs a similar program through the National Institutes of Standards and Technology (NIST). Here, the Co-op program offers employment to college students through formal work-study arrangements between NIST and participating academic institutions. The program also offers a part-time employment option for students who wish to pursue their studies on a part-time basis and earn an income at the same time.

The Department of the Interior's effort is a progressive, career-related student employment program that aims to prepare students, through education and work experience, to qualify for employment with the Fish and Wildlife Service in a variety of science-related positions. It also pro-

vides students with guidance and support to seek advanced educational degrees in the biological sciences. The Service's goal for FY 1992 is to increase overall student participation by 15%.

The Department of Defense runs a cluster of career development programs. Their purpose is to encourage interest in science and engineering careers and to provide mechanisms that bridge the transition from undergraduate study to graduate education programs or work. Special emphasis is placed on reaching underrepresented groups, including minorities, women and the disabled. The programs offer internships and co-op programs in Department of Defense laboratories and excepted service for students. Approximately 8,800 students will be reached by these programs in FY 1992.

ADDITIONAL FY 1992 PROGRAM CATEGORY: COMPREHENSIVE AND SYSTEMIC REFORM

The final part of the undergraduate portfolio involves programs that are multifaceted: they may address curricula reform, faculty enhancement, laboratory improvement, student opportunities, or all of these. These programs either strive to accomplish multiple goals in a single institution (comprehensive) or to bring together various entities to achieve one or two fundamental objectives, sometimes across institutions, sometimes across educational levels (systemic reform).

While comprehensive programs have been a part of the Federal effort for some time, systemic reform programs represent a new direction. These programs are meant to spark new thinking and inject vitality into approaches that have sometimes grown rigid over time. They are meant to galvanize action and complement the more traditional programs described above and help the Nation move forward with a sense of urgency and resolve.

Although comprehensive and systemic reform has not been designated a CEHR priority for FY 1992, these programs are an important part of the Federal effort to improve undergraduate education.

BUDGET IN BRIEF: COMPREHENSIVE AND SYSTEMIC REFORM

PROGRAM TOTAL:	*$47.65 Million*
FY 91-92 INCREASE:	*$10.19 Million/+27.2%*
TWO-YEAR PROGRAMS:	*$ 1.98 Million*
FOUR-YEAR PROGRAM:	*$45.67 Million*

National Science Foundation

Alliances for Minority Participation
($10 million)

This program is designed to effect permanent, fundamental changes to remedy the underrepresentation of minorities in science and engineering. Focused on the undergraduate level, this program promotes the creation of regional alliances of K-12 school districts, community or other two-year colleges, four-year colleges, universities and local businesses and industries.

NSF's funding will support the design and implementation of innovative strategies to enhance the quality of science, mathematics and engineering instruction and to attract and retain undergraduate minority students in science and engineering undergraduate majors. To do this the project will:

- Establish partnerships among colleges and universities, school systems, Federal, State and local government agencies, major national science and engineering laboratories and centers, industry, private foundations, and science, mathematics and professional organizations.

- Develop an infrastructure and management plan that will ensure a long-term continuation of the program beyond the term of Foundation financial support.

- Develop specific evaluation plans and procedures for assessing quantitative and qualitative changes resulting from the project.

Although most activities will focus on the undergraduate level, the program will also address minority student participation in at least one other critical transition point along the science, mathematics and engineering pipeline (high school to college; two-year college to four-year; undergraduate to graduate school). Alliances must be based on sound and successful understanding of programmatic approaches, must be cost effective, and must involve students in faculty research.

In FY 1992, up to 10 awards of $1 million each are planned. The ultimate goal of the program is to ensure that 50,000 bachelor's degrees and 2,000 Ph.D.s are earned by underrepresented minorities each year.

Department of Energy

Laboratory Alliances with Historically Black Colleges and Universities ($3 million)

This program supports formal alliances between Department of Energy National Laboratories and participating Historically Black Colleges and Universities (HBCUs). These alliances provide comprehensive and long-term technical assistance to upgrade the teaching and research capabilities of the HBCUs and to attract and retain additional minority students in scientific and technical careers.

Activities include faculty summer, sabbatical and collaborative research opportunities at a Department of Energy facility, student research participation, visiting scientist programs, academic support systems for minority students, seminars, assistance in development of new courses, and equipment loans. Examples of alliances supported by this program include the Lawrence Berkeley Laboratory partnership with Jackson State University; and the partnership between Sandia, Los Alamos and Oak Ridge National Laboratories and North Carolina A&T State University, New Mexico Highlands University and the Mendez Education Foundation in Puerto Rico. Other alliances are under development.

The development of close research and education partnerships between the Laboratories and HBCUs will have significant impacts on the capabilities of the HBCUs to participate in frontier research and related education programs.

FUTURE ISSUES IN UNDERGRADUATE EDUCATION

CURRICULA COST-EFFECTIVENESS:
When course curricula go largely unchanged for decades, the result is a costly and time consuming effort to return them to the current state of scientific research and development. The more cost-effective approach is to insure that curricula

improvement is not a periodic activity, but a continual process; that it does not fall behind, but moves concurrently with science. Through the Undergraduate Program Plan the Federal Government has begun to recognize its share. But in order to succeed in this strategy, all members of the educational community take active roles.

DEGREE EFFICIENCY: For every student that is reached by Federal undergraduate programs, many more are lost. Programs that use strategies known to produce a 'high yield' of degrees relative to their cost will be pursued with increased vigor. To do this will require more emphasis on the evaluation of the effectiveness of various program strategies.

PARTICIPATION OF UNDERREPRESENTED GROUPS: The recruitment and retention of women, minorities and persons with disabilities in science, mathematics and engineering majors must be continued until an acceptable level of participation is reached. Programs with this objective will receive continued and sustained support. Due to their high minority enrollments, community and junior colleges represent one possible avenue toward achieving this goal.

LABORATORY TECHNOLOGIES: Emphasis will be placed on the comprehensive improvement of laboratory settings through the introduction of new research technologies. An exciting future possibility is the introduction of computers that simulate research experimentation. When research equipment is too costly, computer simulations can be substituted, achieving desirable results at a fraction of the cost. Computers can bring state-of-the-art experimentation to the classroom, for institutions that can afford to buy expensive research equipment and for those that cannot. These technologies will not and should not serve as a replacement for actual laboratory research experiences, but can certainly serve to augment them.

FY 1992 GRADUATE PROGRAMS

The contribution of graduate training to developing productive researchers and advancing science is widely recognized as essential to the country's scientific, strategic and economic growth. Continued progress is ensured only if adequate numbers of well-trained individuals pursue careers in scientific research.

GRADUATE CONCERNS

The Nation's graduate education system is not producing adequate numbers of scientists, engineers and technicians to carry out current levels of operation, let alone meet new scientific and economic challenges. Increases in graduate science and engineering enrollments in doctorate-granting universities slowed from a 2% average annual rate from 1980 to 1987, to a 1% rate from 1987 to 1988. In the life sciences, a decline in 1986 baccalaureate awards (Science & Engineering Indicators, 1989, the National Science Foundation) further threatens the outlook for graduate enrollments and for an adequate supply of future researchers in this field.

FY 1992 BUDGET HIGHLIGHTS

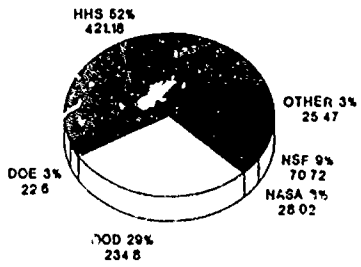
The FY 1992 graduate training programs of the agencies participating on the FCCSET-CEHR offer the opportunity to ensure that adequate numbers of well-trained individuals pursue careers in scientific research and achieve the highest levels of expertise in their fields.

Graduate education accounts for 41% of all money the Federal government spends on science education. At $802.79 million requested for FY 1992, graduate education receives the largest share of Federal funds for science education.

In addition, the Federal government is the largest single source of graduate science education funding. Graduate education is the traditional focus of mission-oriented agencies, and Federal money is often the only source of funds for direct student support in specialized fields such as nuclear engineering and human genome research. Mission-oriented Federal agencies—including the Department of Health and Human Services (DHHS), the Department of Defense (DOD), the Department of Energy (DOE), and the National Aeronautics and Space Administration (NASA)—provide 88% of all Federal graduate funding (Figure 27). Graduate training is an integral part of their stated, congressionally approved missions and is considered a necessary part of the national science education effort.

In FY 1990 graduate funding was $738.5 million. It reached $784 million in FY 1991, with $802.79 million requested for FY 1992.

Figure 27
Graduate FY 1992 Request by Agency



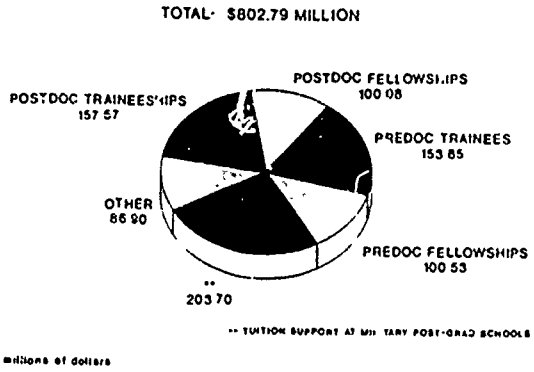
In millions of dollars

On the FCCSET-CEHR matrix, graduate education is broken into five basic categories: predoctoral traineeships, postdoctoral traineeships, predoctoral fellowships, postdoctoral fellowships and "other" programs.

Fellowships are awards to individuals to pursue supervised pre- and postdoctoral research training in specified areas of scientific inquiry. Traineeships are awards to institutions to support individuals selected by the institution to participate in pre- and postdoctoral research training.

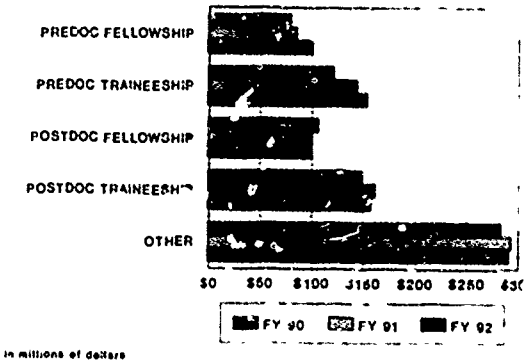
As shown in Figure 28, traineeships make up the largest portion of graduate education funding, with fellowships a close second. The largest portion of the "other" category—about $203.7 million—is devoted to Department of Defense student support and tuition waiver programs for military and civilian personnel pursuing advanced degrees in science and engineering. The remaining $87 million is spread across a variety of programs, ranging from the DHHS Minority Biomedical Research Supplement and Intramural Appointments to National Science Foundation cross-directorate programs—those funded out of an NSF Research Directorate but focusing on science education.

Figure 28
Graduate FY 1992 Request by Program



As part of the overall National Education Goals effort, a new relationship is evolving between the elementary and secondary education communities and the college and university science communities. The scientific community and its graduate faculties and research apprentices are beginning to assume a leadership role in forging alliances with the precollege education community. Several of the mission agencies are encouraging these relationships through mentor and apprentice programs with junior and senior high schools.

Figure 29
Graduate FY 1990-1992 Growth by Program



The FCCSET priorities target precollege education because this is where major reform and improvement are needed. However, graduate education, which has been a major Federal responsibility for many years and continues to be an essential priority of the mission agencies, has proved highly successful in producing quality research scientists. Support of such education is vitally important to ensuring the flow of talented, well-trained individuals into scientific careers.

FY 1992 PROGRAM HIGHLIGHTS

Following are summaries of some major graduate programs making a difference in science, engineering and technical education. The programs include pre- and postdoctoral fellowships and pre- and postdoctoral traineeships supported by the four FCCSET mission-oriented agencies--

the Department of Health and Human Services, the Department of Defense, the Department of Energy and the National Aeronautics and Space Administration. Though not a mission agency, the National Science Foundation has a substantial investment in graduate education and is included here.

Other agencies, whose graduate funding represents 3% or $25.5 million of total Federal graduate funding, are the Department of Commerce, the Department of Interior, the Environmental Protection Agency and the Department of Agriculture. Descriptions of some of their major programs also follow.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

The National Research Service Awards - Pre- and Postdoctoral Traineeships and Fellowships ($345 million)

The primary emphasis in DHHS science education programs has been support for graduate training for the next generation of biomedical and behavioral scientists. These programs have been highly successful, and in fact, many of the new disciplines in biomedical sciences today, e.g., biotechnology, human genome research and the neurosciences, were nurtured by the research training programs of the National Institutes of Health (NIH) and the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA). Such training has been an integral part of the DHHS mission for over 40 years, and is a stated requirement in section 487 of the Public Health Service Act.

The National Research Service Award (NRSA) program, established in 1974, was mandated by Congress to codify the requirement for the support of biomedical and behavioral research training. It provides both institutional training grants and individual fellowship awards to help support students as they pursue research training. The NRSA is the largest DHHS program and accounts for 82% of the Department's graduate education expenditure.

Within the NRSA program, special efforts are made to recruit women and minorities; every applicant must have an acceptable plan for recruitment of such trainees before the application will be accepted for review. Also, some special NRSA programs focus on minorities, such as the ADAMHA Minority Fellowship Program and the NIH and ADAMHA graduate Minority Access to Research Careers (MARC) program.

Other Graduate Research Training and Enhancement Programs

In addition to the NRSA, DHHS has a number of programs devoted to increasing the number and enhancing the expertise of research scientists. A range of awards seek to improve the research capabilities of those in the life sciences pipeline and workforce, with emphasis on recruiting and supporting minorities. Intramural Appointments make up almost 6% of the DHHS graduate training budget. These awards and appointments bring students into Public Health Service intramural laboratories for training in research methodologies. The Minority Biomedical Research Support program accounts for about $14 million (or 30% of the DHHS graduate education budget) and provides supplements to support training of minority students for research careers. The Center for Disease Control Training Grant Program for Occupational Health and Safety Research

Training is funded at about $10 million (or 2% of the DHHS graduate education budget) and supports the development of occupational safety and health expertise.

DHHS estimates that about 14,000 graduate awards will be made in FY 1992. More than $423 million has been requested for graduate education in 1992, about 90% of the total DHHS effort in science education.

DEPARTMENT OF DEFENSE

Predoctoral Fellowships and Traineeships, Postdoctoral Fellowships ($31.1 million)

DOD has a variety of fellowship and traineeship programs that support graduate and postdoctoral education. Agencies that administer these programs are the Army Research Office, the Office of Naval Research, the Air Force Office of Scientific Research, the Defense Advanced Research Projects Agency, and the Office of the Secretary of Defense. Programs also exist for military personnel pursuing advanced degrees at the Naval Postgraduate School and the Air Force Institute of Technology, military personnel pursuing advanced degrees at civilian colleges and universities, and civilian personnel pursuing postgraduate education in science and engineering. Support includes DOD fellowships, traineeships, postdoctoral associateships and support provided under military and Federal civilian education training programs. By the end of FY 1991, about 3,530 students will receive full-time support for graduate studies, and 360 will receive support for postdoctoral studies. Another 20,000 will participate in part-time graduate education programs.

Graduate Schools

The DOD Military Postgraduate Schools program operates the science and engineering departments at the U.S. Naval Postgraduate (NPG) School and the Air Force Institute of Technology (AFIT). Both institutions award master's and doctoral degrees in science and engineering disciplines important to DOD, particularly in specialties seldom offered by civilian universities. AFIT provides administrative support for military personnel who attend civilian universities and establishes criteria for transferring credits among cooperating universities. Science and engineering majors represent about 67% of NPG students and 40% of AFIT students. The program will allow 1,800 students to pursue full-time science and engineering graduate education in FY 1992.

NATIONAL SCIENCE FOUNDATION

Predoctoral Fellowships ($51.5 million)

The NSF Graduate and Minority Graduate Fellowship Programs are designed to enhance the Nation's research base by giving students, including minorities, a chance to work toward master's and doctoral degrees in mathematics, physics, biology, engineering, social sciences and the history and philosophy of science. Awards also support study toward a research-based Ph.D. in science education. Fellowships are awarded for three years, to be used over a maximum of five years. Since the program's inception, NSF has awarded more than 25,000 fellowships. In FY 1992 about 1,100 fellowship awards will be made. In FY 1992 this program represents nearly one-quarter of the overall NSF graduate education effort.

DEPARTMENT OF ENERGY

Graduate Study ($1.66 million)

The DOE Research Experiences program provides opportunities for first- or second-year graduate students to conduct research at a DOE facility and to use DOE facilities and instruments for short-term research (a few days to several weeks). In addition, full-time graduate students enrolled in accredited universities are eligible to receive appointments of up to one year, renewable to a maximum of three years for the Ph.D., to carry out thesis research in residence at a DOE facility. In FY 1992 the number of participants will increase by 30% to about 350.

Predoctoral and Postdoctoral Fellowships ($20 million)

DOE Predoctoral and Postdoctoral Fellowships support advanced study in nuclear energy, fusion research, high energy physics, high performance computing, human genome research, global climate research, basic energy sciences, environmental restoration, civilian radioactive waste management, medical physics, computational sciences and engineering, among other specialized fields. Fellowship recipients study at universities or conduct postdoctoral research at DOE National Laboratories or industrial labs conducting DOE-sponsored research. DOE has supported such research fellowships since 1977.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Predoctoral Fellowships ($13.8 million)

NASA's National Space Grant College and Fellowship Program aims to increase the understanding, assessment, development and use of space resources by developing a network of universities with interests and capabilities in aeronautics, space and related fields. The program also seeks to encourage cooperation among universities, aerospace industries and State and local governments; encourage interdisciplinary training, research and public service programs related to aerospace; recruit professionals, especially women and underrepresented minorities, for careers in aerospace sciences, technology and allied fields; and strengthen science, math and technology education from the elementary through university levels. The program designates Space Grant Colleges and consortia that will provide leadership for a national network of universities and colleges, and also awards support programs and Space Grant fellowships. It is designed to promote institutional cooperation and extend capabilities rather than directly support technical research. More than 100 universities are involved in space-related research, education and public service programs.

NASA's Graduate Student Researchers Program provides graduate fellowships nationwide to post-baccalaureate U.S. citizens to conduct thesis research at a NASA center or carry out a program of study or research at their home institutions. This program supports about 400 students each year at $22,000 each (stipend $16,000; university and student allowance $6,000).

Postdoctoral Fellowships ($9.1 million)

NASA's Resident Research Associateships Program, managed by the National Research Council, gives postdoctoral scientists and engineers the opportunity to perform research at a NASA field center. Regular one-year research associateships go to those who have held a doc-

torate for fewer than five years. Senior research associateships, awarded for one year, go to those who have held a doctorate for more than five years. About 245 awards are made annually.

OTHER AGENCIES

Department of Commerce

Two divisions within the Department of Commerce offer graduate education programs: the National Oceanic and Atmospheric Administration (NOAA) and the National Institute of Standards and Technology (NIST). NOAA programs include Graduate Cooperative Research programs; Graduate Predoctoral Fellowships-Affirmative Action Programs; and Graduate Curriculum and Materials Development-Predoctoral Fellowships.

NIST programs include Graduate Postdoctoral Fellowships; Predoctoral Fellowships; and the Graduate Student-Q Program, which offers employment to predoctoral graduate students outside NIST's organized fellowships. Highlighted for FY 1992 is the Postdoctoral Fellowship program administered in cooperation with the National Academy of Sciences National Research Council; a 10% increase is requested for this program.

Department of Interior

The Bureau of Indian Affairs, Office of Indian Education Programs supports a contract to provide administrative and financial help and student support services to American Indian and Alaskan Native graduate students.

U.S. Geological Survey Graduate Fellowships provide opportunities for graduate students and recent doctoral degree recipients to conduct research or investigative studies relating to analysis of the quality and quantity of U.S. surface and ground waters. More than 150 graduate students will participate in the program in FY 1992.

The Fish and Wildlife Service, Office of Training and Education, supports the Graduate Cooperative Research Program to help educate natural research biologists in fisheries, wildlife and related disciplines for employment as researchers and managers of fish and wildlife resources. This program is slated for a 8% increase in FY 1992.

Environmental Protection Agency

Environmental Protection Agency (EPA) Predoctoral Fellowships and Traineeships encourage students attending minority institutions to pursue careers in environmental research by offering advanced training in the environmental sciences, biological sciences, physical sciences, computer sciences, engineering and mathematics. EPA also offers a Postdoctoral Fellowships program which is administered by the American Association for the Advancement of Science.

Department of Agriculture

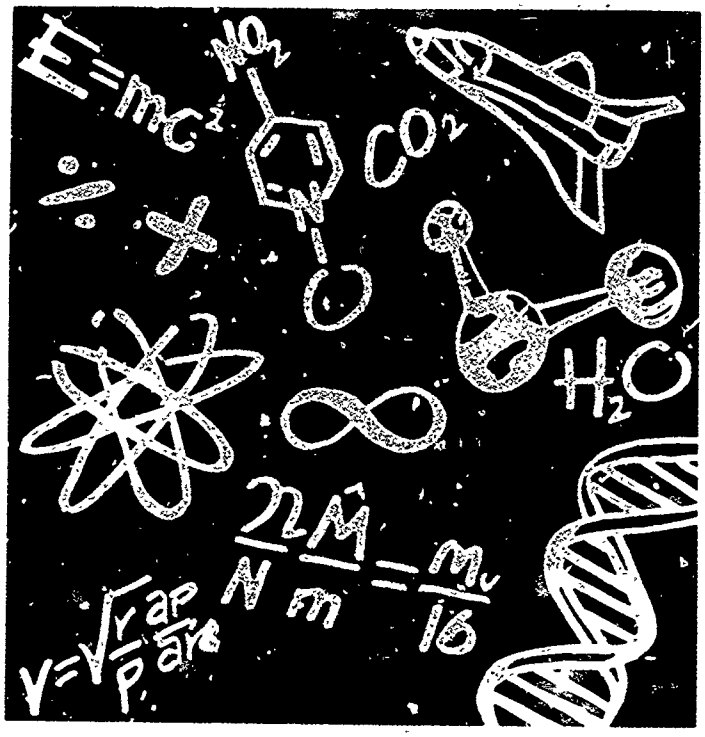
The U.S. Department of Agriculture (USDA) National Needs Graduate Training Grants Program is the only Federal program directed at developing food and agricultural scientific and professional expertise. The program supports colleges and universities with nationally recognized teaching and research capabilities in the food and agricultural sciences: especially in water science; food, forest products and agribusiness marketing; plant and animal biotechnology; food science and human nutrition; and biopro-

cessing or food and agricultural engineering. In FY 1992 the program is a priority, with a 14% increase.

The Postdoctoral Research Associates Program, administered by the Agricultural Research Service, gives new Ph.D.s the chance to receive advanced training and experience in the public sector and conduct critical basic research with prominent scientists in their fields. In FY 1992 the program will support 320 to 350 postdoctoral research associates.

BY THE YEAR 2000

AGENCY PROGRAMS

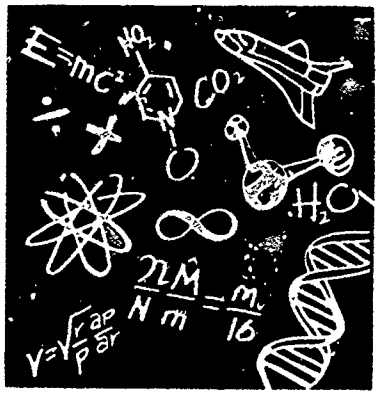


Department of Agriculture
Department of Commerce
Department of Defense
Department of Education
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
Department of Veterans Affairs
Environmental Protection Agency
National Aeronautics and Space Administration
National Science Foundation
Smithsonian Institution
Barry M. Goldwater Foundation

FY 1992

"American agriculture is being challenged as never before to operate in a way that is both internationally competitive and environmentally sensitive. Our success is dependent on the people whose ingenuity and creativity will be the foundation of the agricultural expertise of the future. The USDA's concern for human resource issues is reflected in the continuing sponsorship of programs designed to strengthen science education at all levels."

Charles E. Hess
Assistant Secretary for Science and Education



MISSION AND STRUCTURE

The birth of the Department of Agriculture was one of three events that mark the May-July period of 1862 as arguably the greatest epoch in the history of world agriculture. On May 15, Lincoln signed the act creating the Department of Agriculture. That institution, which he called "the people's Department," has reached into every county and out to every farm and ranch. Working with farmers, agricultural industries and consumers, the Department of Agriculture has helped make American agriculture the most productive in the world and has helped give the American people the most varied and wholesome food supply from the smallest share of disposable income of any people in the world.

On July 2, 1862, President Lincoln signed the Morrill Land-Grant College Act that established land-grant colleges in each State to educate the sons and daughters of farmers and merchants and which for the first time lifted agricultural training to the level of scientific endeavor and brought college training within reach of the youth of working families and "ordinary citizens."

Much of the subsequent vigor of America, its rising productivity on farms and in industry, its enlightened and educated consumers, its growing affluence, its beneficence in a hungry world, its strength, and its leadership among world nations are rooted in these developments.

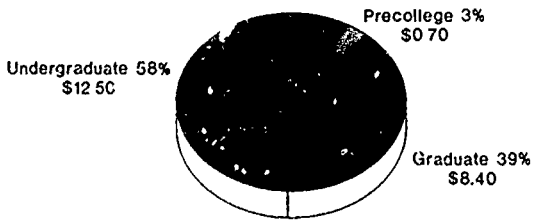
America's food and agricultural system is one of its greatest success stories. Including production, processing and marketing, the agriculture and forestry sectors account for more than 20% of the gross national product and employment in the United States. Everyone uses the products of the U.S. science-based food and agricultural industry.

The need for more cost-efficient production and the demand for agricultural products will grow in the years ahead as societal requirements for food and fiber increase and as production resources diminish. But these needs cannot be met without highly qualified scientists and professionals working to advance the frontiers of knowledge and technology. One of the most crucial variables in the food equation of the future is scientific and professional human capital.

Therefore, education has long been a concern of the U.S. Department of Agriculture (USDA). The Department's education efforts have produced scientists and professionals who have helped make American agriculture the greatest in the world. Through the related function of cooperative extension, USDA has also engaged in helping agricultural producers and the public become more competent in applying new technologies and scientific knowledge.

The Department's education mission is carried out in strong alliance with States, universities and the private sector. Recognizing the significance of this alliance, the Food and Agriculture Act of 1977 designated USDA as the lead Federal agency for higher education in the food and agricultural sciences. Through its Office of Higher

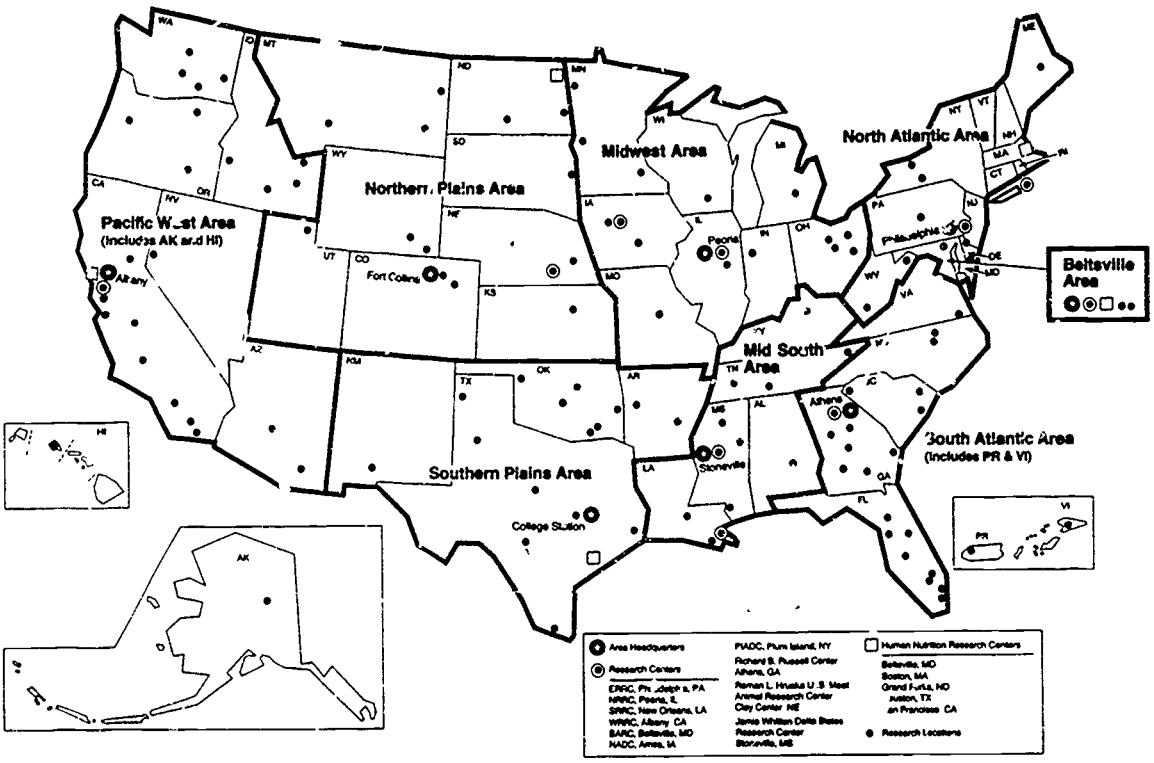
TOTAL: $21.60 MILLION



in millions of dollars

USDA Education Budget FY 1992

HIGHLIGHT The FY 1992 budget will enable USDA to offer a comprehensive and integrated array of education initiatives aimed at assuring the Nation of an adequate supply of agriscience and business professionals for the 21st century.



Agriculture Research Service - Area Organization

Education Programs, USDA has implemented that charge with a broad array of initiatives to link teaching, research and extension and improve the training of food and agricultural scientists and professionals. Most of these efforts were informal until 1984, when the Department initiated the National Needs Graduate Training Grants Program to develop expertise in areas with scientific shortages.

With modest support, the USDA programs have catalyzed substantial State and private sector support and resulted in improved college and university curriculum and faculty, better career information, and enhanced opportunities for hands-on experiences in science for American youth. These accomplishments have strengthened food and agricultural sciences education, but much more needs to be done to confront new challenges and achieve the National Education Goals for math and science education emerging from the President's 1989 Education Summit.

U.S. agriculture has entered an era characterized by global competitiveness, food distribution inequities, environmental concerns, and promising technologies. Grappling with these issues will require a reliable supply of food and agricultural scientists and professionals—a supply that is unlikely to be forthcoming without prompt and bold intervention. Even today's food and agricultural system is threatened by shortages of quali-

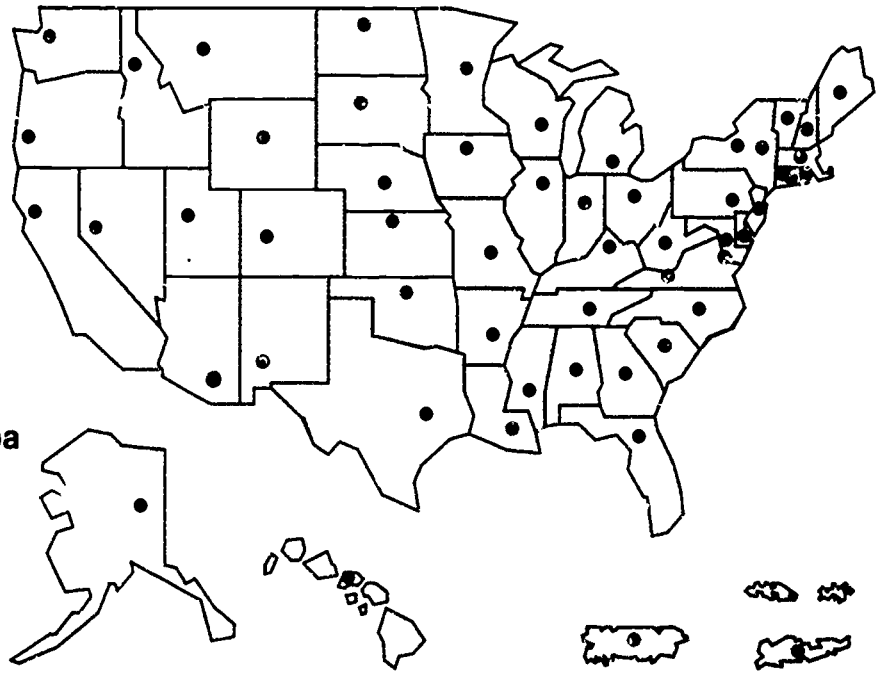
fied scientists, engineers, managers, and technical specialists. Moreover, the higher education institutions that graduate food and agricultural scientists and professionals are increasingly confronted with serious issues:

- Colleges and universities are finding it increasingly difficult to recruit students with strong science backgrounds into food and agricultural disciplines.

- Enrollments have been declining precipitously at the baccalaureate and graduate levels and minority enrollments have remained minimal at all degree levels.

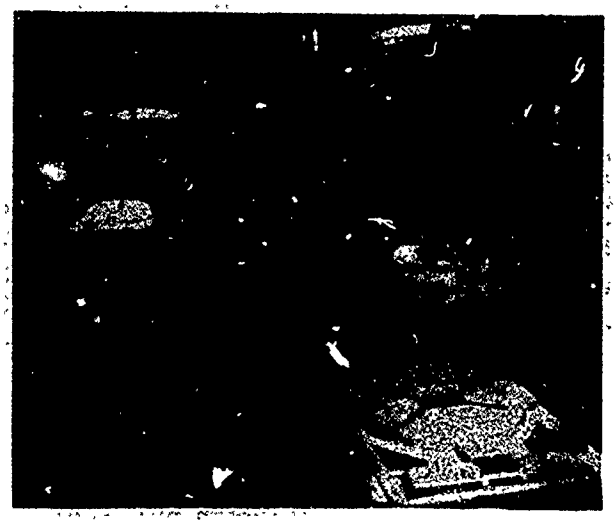
- The U.S. food and agricultural higher education system is facing numerous challenges to maintain state-of-the-art curricula, faculty and scientific instrumentation.

The U.S. Department of Agriculture is authorized to provide the leadership, oversight and management necessary to assure that the Nation is provided with adequate supplies of high-quality food and fiber. In fulfilling its science and education mission, the Department supports and conducts a wide range of research, development, extension and education activities. The USDA Joint Council on Food and Agricultural Sciences was established by Congress almost a decade ago to encourage and coordinate research, extension and higher education activities in the food and agricultural sciences throughout the United States. Its members, who are from both the public and private sectors, represent producers, industry and State and Federal agencies and institutions. In its annual report to the Secretary and the Congress, the Joint Council has repeatedly, over the past eight years, identified the development and nurturance of scientific



State Agricultural Experiment Stations

expertise as one of the top five national priorities for the food and agricultural science and education system.

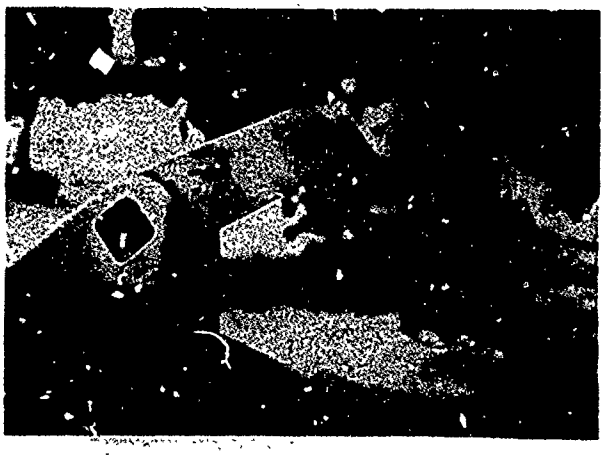


Scientists are needed to discover ways to produce food in space. Depicted is a prototype moon farm for food production.

Major responsibility for assuring that national food and agricultural research needs are being met rests with the Department of Agriculture's research arm—the **Agricultural Research Service (ARS)**. The mission of ARS is to plan, develop, and implement research designed to produce new knowledge and technologies required to assure the continuing vitality of the Nation's food and agriculture enterprise. As a Federal research agency, ARS operates 127 Federal laboratories and research centers, specializing in soil and water conservation, plant productivity, animal productivity, commodity conversion and delivery, human nutrition, and integration of systems. Federal scientists and professionals in these laboratories and centers are an invaluable resource for science enrichment initiatives at the precollege and college levels.

The more than 200 land-grant and other institutions with food and agricultural sciences programs enjoy a special relationship with USDA's **Cooperative State Research Service (CSRS)**. This agency is responsible for advancing science and technology in support of agriculture, forestry, people and communities in partnership with the State Agricultural Experiment Station System, colleges, universities, and other research organizations. Thus, CSRS has abundant opportunities to link elementary and secondary students and teachers with ongoing science programs. Of paramount importance is the fact that CSRS is actively involved with a network of 15,000 university scientists and administers Federal support for research through which approximately 6,000 graduate students receive assistantships.

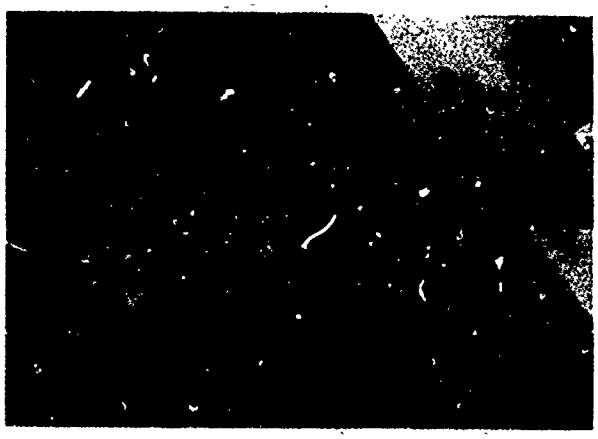
The world renowned extension system, a three-way partnership, includes the USDA **Extension Service (ES)**, the Cooperative Extension Service in each State and territory at the land-grant universities, and the local Extension office in virtually all of the Nation's 3,150 counties. In addition to support from Federal, State, and local governments, the extension system calls on the private



Agrobot harvesting fruit designed by agricultural engineers at a State Agricultural Experiment Station.

sector as an active partner, with a record 2.9 million volunteers contributing to technology transfer and information delivery programs. This unique structure is a highly effective mechanism for helping educators quickly address national and local problems by delivering new knowledge and technology for immediate use by people. In fact, one in every four American families takes advantage of extension programs.

Furthermore, the 4-H Youth Development programs under USDA's Extension System offer unparalleled opportunities for kindling interest in math and science among American youth. Almost three million youth, ages 10 through 20, participate in 4-H school enrichment activities.



Collection and transmittal of agricultural information moves into the satellite age.

The National Agricultural Library (NAL), with a collection of almost two million volumes, is the largest agricultural library in the free world. It collects technical information on agriculture and related subjects from all over the world and makes it available with the use of computer databases to scientists, educators, and agricultural producers. The library is the coordinator and primary resource for a national network of State land-grant and field libraries. It serves as the U.S. center for the international agricultural information system. Key services provided by NAL include:

- Specialized Information Centers in 13 subject areas which provide a wide range of customized services ranging from responding to reference requests and developing focused publications to coordinating outreach activities and establishing dissemination networks.

- Agricola Database of 2.8 million agricultural literature citations, which is commercially available online or on compact disk.

- Publications, including directories, bibliographies, reference briefs and fact sheets, which provide the latest references and sources of information on key issues in agriculture are available through NAL.

Many other USDA agencies have research and education programs. These include the **Forest Service, Agricultural Cooperative Service, Animal and Plant Health Inspection Service, Agricultural Marketing Service, Human Nutrition Information Service, Office of International Cooperation and Development, Soil Conservation Service,** and the **National Agricultural Statistics Service**. The different research and education programs of the Department are complementary and mutually supportive in providing new knowledge, technology and information on food, agriculture and forestry issues vital to producers, marketing firms, consumers and action agencies. The results of these efforts affect the total economy of the United States and millions of consumers here and abroad.

For example, the **Forest Service (FS)** research program is responsible for developing scientific and technical knowledge to enhance the economic and environmental values of America's 1.6 billion acres of forest and associated rangelands. Research is generally long range and high risk, covering a wide spectrum of biological, economic, engineering and social disciplines. Research is conducted through eight regional forest and range experiment stations and the Forest Products Laboratory in Wisconsin. More than 2,000 studies are in progress. Approximately 800 scientists are stationed at 74 locations throughout the States, Puerto Rico, and the Pacific Trust Islands.

The **Human Nutrition Information Service (HNIS)** develops, through applied research, information required to improve public understanding of the nutritive value of foods, the nutritional adequacy of food supplies and diets, and the selection of nutritious and healthful diets. The Agency compiles food composition information, monitors food and nutrient consumption by U.S. households and individuals through national surveys, and develops materials and techniques to help Americans improve their nutrition and reduce risk of disease through better diets.

The mission of the **Office of International Cooperation and Development (OICD)** is to coordinate and conduct the Department's international programs in agriculture and related fields. International research and education programs include scientific and technical exchanges, administration of collaborative research, representation of USDA and U.S. Government research and educational interests in international organizations, and training and facilitating private sector involvement in agricultural development and cooperation. Programs are conducted cooperatively with other USDA and U.S. Government agencies, universities and the private sector.

The **Economic Research Service (ERS)** produces economic and other social science information as a service to the general public and to aid the Congress and the Executive Branch in developing, administering and evaluating agricultural and rural policies and programs. ERS monitors, analyzes and forecasts U.S. and world agricultural production and demand for production resources, agricultural commodities and food and fiber products. ERS also measures the costs of and returns to agricultural production and marketing; evaluates the economic performance of U.S. agricultural production and marketing; and estimates the effects of government policies and programs on farmers, rural residents and communities, natural resources and the American public in general. In addition, ERS produces economic and other social science information about the organization and institutions of the U.S. and world agricultural production and marketing systems, natural resources and rural communities. This information is widely available to the general public through research monographs, situation and outlook reports, professional and trade journals, radio, television and newspapers.

USDA's strategy for improving math and science education in the Nation involves marshaling these various facilities and expertise to promote excellence in education through a broad range of initiatives. This commitment is reflected in the Department's FY 1992 budget request.

AGENCY PRIORITIES

In its FY 1992 budget, USDA is proposing an "education investment portfolio" with the goal of

educating a talented cadre of food and agricultural scientists and professionals. The portfolio includes increased support for three existing programs. USDA's FY 1992 priorities track the priorities identified by OTHR.

Many of the programs are at the undergraduate and graduate levels, where USDA has had notable experience and success. An important theme of the strategy is the redoubled emphasis on full participation of students from underrepresented groups. Specifically, USDA is proposing to:

- Enhance faculty preparation and student learning by maintaining support for the Higher Education Challenge Grants Program.

- Reform postsecondary curriculum by continuing the excellent work begun in FY 1990 through the 1890 Institution Grants Capacity Building Program and increasing funds for the Higher Education Challenge Grants Program.

- Provide greater incentives and opportunities for students, especially those from underrepresented groups, to pursue advanced training and careers in food and agricultural sciences. This will be accomplished by increasing funds for the National Needs Graduate Training Grants Program and the 1890 Institution Capacity Building Grants Program, as well as maintaining support for the Postdoctoral Research Associate Program.

In addition, the FY 1992 priorities acknowledge the need to address the precollege level, consistent with the National Education Goals for math and science. Specifically, the Department is supporting initiatives to:

- Strengthen the higher education institutions that prepare precollege teachers in food and agricultural sciences, especially minority teachers.

- Improve scientific literacy among students in grades K-12 and boost public awareness by increasing support for the Ag in the Classroom Program and sustaining support for the Research Apprenticeship Program and 4-H Youth Development's School Enrichment Program.

The remainder of this chapter discusses these initiatives in detail.

Scientist serves as national role model for attracting women and minorities into agriculture.

ONGOING PROGRAMS

Precollege

Ag in the Classroom
This is a grassroots program coordinated by USDA and administered by the Cooperative State Research Service. The program helps students in grades K-12 gain a greater understanding of the role of agriculture in the economy and society, as well as informing students about career opportunities in the food and agricultural sciences. Each State develops its own program, in cooperation with farm organizations, agribusiness, education and government. The program, in existence since 1981, reaches some 15,000 teachers per month.
(Precollege Formal - $208,000)

Research Apprenticeship Program
This program provides summer employment in university and Federal research laboratories for high school students with strong math and science aptitude. Since the 1980s the program has involved more than 8,000 students, one fourth of whom were supported on Federal funds. The remaining students were supported on State and private funds leveraged by the Federal partner. Research apprentices, many of whom are minority and female students, interact with scientists and gain hands-on experience in exciting food and agricultural scientific developments. In addition, the program seeks to encourage students to attain college degrees in science.
(Precollege Informal - $500,000)

4-H Youth Development's School Enrichment Program
4-H complements the education students receive in formal K-12 classrooms by providing informal, experiential education in community settings. Extension staff and thousands of volunteer leaders provide hands-on learning through real experiences. Approximately 54% of the students enrolled in 4-H—or about 2.8 million youth—participate in school enrichment. Programs may include in-school 4-H clubs, environmental labs, one-day events, educational TV, programs in rehabilitation centers, national observances, and special interest groups. Many programs use innovative teaching methods and are run in cooperation with public schools.
(Precollege - $42.5 million)

Teachers Research Fellowship Program
Funded by ARS out of general overhead, this program provides summer employment in Federal research facilities for almost 200 junior and senior high school teachers. The objective is to broaden teachers' knowledge about food and agricultural research and to encourage teachers to inspire greater student interest in science.

ARS Youth Enrichment Program
Administered through ARS from general operating funds, this program annually provides hands-on science experiences for more than 100 high school students in the mid-Atlantic region alone who are interested in attending college and pursuing science careers. The program familiarizes students with career options and develops leadership skills through summer learning experiences. Students participate in lectures, tours and career seminars.

Undergraduate

1890 Institution Capacity Building Grants Program
This program is administered through the Office of Higher Education Programs of the Cooperative State Research Service and seeks to attract more minority students to food and agricultural sciences. The 1890 land-grant institutions and Tuskegee University, which are historically black institutions, receive competitive grants to strengthen their programs in food and agricultural sciences in targeted areas and build linkages with each other and with other colleges and universities. Programs are carried out in cooperation with USDA agencies and other non-Federal partners and encourage dollar-for-dollar matching. Funds are used for curriculum design and development, faculty preparation and enhancement, instruction delivery systems, student experiential learning opportunities, equipment, and student recruitment and retention. The program began in FY 1990 during which 29 grants were made to launch capacity-building projects at each of the 17 eligible institutions.
(Undergraduate Comprehensive - $11 million)

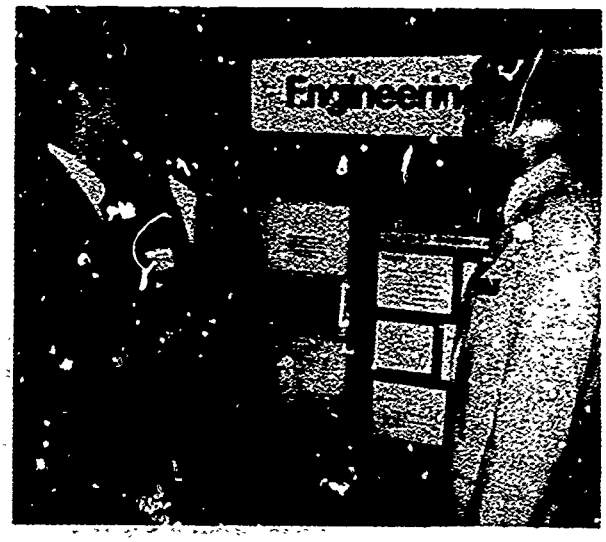
Higher Education Challenge Grants
This program is also administered through the Office of Higher Education Programs of the Cooperative State Research Service and strives to augment the capacity of colleges and universities to produce scientists and agricultural professionals at the forefront of knowledge. Colleges and universities compete for grants to strengthen their teaching programs in the food and agricultural sciences. Funds may be used for curriculum development, faculty preparation and enhancement, instruction delivery systems and student experiential learning. Matching support from state or private funds is required. Projects must be of regional or national significance; involve creative solutions to problems that can serve as models; encourage better working relationships in the university science and education community and with the private sector; and/or produce benefits that will transcend USDA support. Twenty-four challenge grants were made in FY 1990, the first year of the program, with an appropriation of one million dollars.
(Undergraduate Comprehensive - $1.5 million)

Morrill-Nelson Formula Grants
Funds appropriated under the Morrill-Nelson Act are distributed to land-grant institutions to advance the quality of instruction programs in food and agricultural sciences. Funds ($50,000 per state) are used to support faculty salaries, curriculum development and other instructional costs. **(Undergraduate Comprehensive - $2.8 million)**

Graduate

USDA National Needs Graduate Training Grants Program
Initiated in 1984, this program supports colleges and universities with nationally recognized teaching and research capabilities in food and agricultural sciences to help them recruit and educate scientists and professionals in designated fields in which there are national shortages of expertise. Fellows are graduate students who demonstrate academic excellence and a commitment to a future career in the food and agricultural sciences. Participation of women and minority students is also emphasized. This program is planned in conjunction with other key Federal agencies, universities and the private sector.

HIGHLIGHT Funding in FY 1992 will support about 25 model projects aimed at strengthening curriculum, faculty, student experiential learning, and instruction delivery systems, thereby enhancing the quality of education available to more than 60,000 college and university students majoring in the food and agricultural sciences.



USDA doctoral fellows exchange ideas with renowned educator during national conference on future opportunities and challenges unique to the food and agricultural sciences.

To date the program has recruited almost 500 doctoral students into critical shortage areas. Funds proposed for FY 1992 will support recruitment and training for 72 new doctoral students. **(Predoctoral Traineeships - $4 million)**

Postdoctoral Research Associate Program
This program is administered by the Agricultural Research Service and provides employment opportunities in ARS facilities for new Ph.Ds. Research associates engage in mentor relationships with some of the most prominent scientists in their fields. Associates conduct critical basic research and receive advanced and specialized training and experience that are often unavailable elsewhere. The research associates in turn introduce ARS scientists to new concepts. The private and university sectors assist ARS in recruiting new appointees, which number about 100 annually, and placing them in careers upon completion of the postdoctoral training.
(Postdoctoral Fellowships - almost $5 million)

SCIENCE LITERACY/OUTREACH

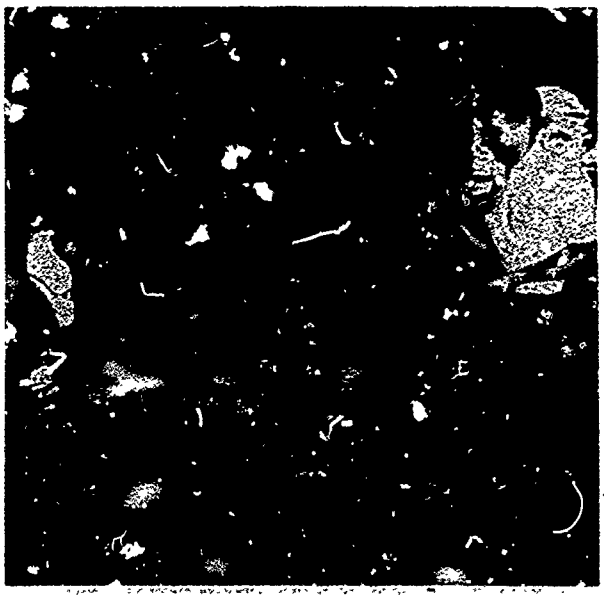
Food and Agricultural Careers of Tomorrow (FACT) Working with universities, the Department has established FACT, a national career information center. The center prepares and disseminates popular career information publications, videos, news releases and exhibits. FACT's first publication, *Energize the Green Machine*, is available in three versions, including one tailored for predominantly minority audiences and another published in Spanish. The booklets are being distributed to the public via "The Land" exhibit at Disney World's EPCOT Center.

National Agriscience Ambassador
The National Agriscience Ambassador, a former agriscience teacher and Future Farmers of America adviser, was one of the top 20 candidates in NASA's Teacher in Space Program. The Ambassador makes presentations to students, parents, teachers, school administrators, State and local government representatives, businesses and industries and civic groups. The presentations are intended to enhance public awareness of agriculture; improve the image of agricultural science and business; motivate young people to consider further education and careers in food and agricultural fields; and represent agriscience at business, trade, government and education meetings. Through participation in three interactive satellite programs, the Ambassador has reached several million students in grades K-12.

HIGHLIGHT Increased funding in FY 1992 will recruit and train approximately 72 graduate students for careers as food and agricultural scientists in such areas as plant or animal biotechnology, water science, nutrition, bioprocessing or engineering, and international marketing.

Interactive Video

A nationwide interactive video teleconference for grades 6 through 12, entitled *Food for the Future*, was staged in February 1989. The program featured the current and future world of agriscience with special highlights in the areas of biotechnology, space agriculture, hydroponics and aquaculture. Hosted by the USDA Higher Education Programs Office, the University of Florida, Kraft, Inc., and the Louisiana Educational Satellite Network (LESN), the show was broadcast live simultaneously from "The Land" in Walt Disney World's EPCOT Center and LESN. Participants included Mickey Mouse and Susan Forte, USDA's National Agriscience Ambassador. The teleconference included a question and answer period in which students throughout the United States called in with questions.



Aquaculture, an emerging area of food production for the future.

Two subsequent programs focused on *Get Hooked on Aquaculture* and *Food Science - Technology with Tas* An estimated 15 million student viewers were reached through these three programs. Similar programs are being prepared to air in 1991.

National Challenge Forums

In October 1990, USDA held a national forum in conjunction with the Hispanic Association of Colleges and Universities. More than 100 participants discussed ways to attract talented Hispanic individuals to careers in agriscience and agribusiness. This is but one example of the challenge forums the Department has hosted in an ongoing effort to stimulate public discussion about nurturing scientific talent and promoting excellence in education.

USDA has also supported a variety of other special projects to advance food and agricultural science education. These have included a national curriculum revitalization project for higher education institutions; a major study conducted by the National Academy of Sciences on competencies needed by future food and agricultural scientists and professionals; a study on improving secondary level agricultural education; and a national forestry education summit.

Additionally, the Department disseminates special publications to teachers and students, including study materials, student projects, science workbooks, and career information. A computerized information system provides online access to a comprehensive array of national data essential to higher education planning and evaluation.

Finally, specific agencies of USDA have adopted and work directly with high schools and middle schools by advising on their educational pro-

grams and providing career information and counseling. Examples include the programs at Saul High School in Philadelphia and Chicago High School for Agricultural Sciences.

In conclusion, the U.S. Department of Agriculture firmly contends that the advancement of science and technology is essential to the health of every nation—essential to quality of life, economic stability and national security. It recognizes that human resources are key to advancing science and technology, and is concerned that the U.S. seems to be losing its edge in the cultivation of scientific and professional personnel.

The foregoing highlights the expanding array of education-related activities undertaken by many USDA agencies. Despite rather modest funding for such education initiatives, the Department is playing a significantly increasing role as a catalyst in advancing the quality of American education. It is earnestly striving to provide national leadership by availing school systems, teachers and students across the Nation with enhanced opportunities that will strengthen their interest in and knowledge of science. In pursuit of educational excellence, USDA offers an unparalleled national network for advancing science and education through its Federal laboratories; State Agricultural Experiment Station system; university scientist- and educator- cooperators; professional staff; and volunteer lay-leaders.

CONTACT INFORMATION

Federal Laboratories:
Administrator, Agricultural Research Service, USDA
Room 302-A, Administration Building
14th & Independence Avenue, S.W.
Washington, D.C. 20250

State Agricultural Experiment Stations:
Administrator, Cooperative State Research Service, USDA
Room 305-A, Administration Building
14th & Independence Avenue, S.W.
Washington, D.C. 20250

Cooperative Extension or 4-H Programs:
Administrator, Extension Service, USDA
Room 338-A, Administration Building
14th & Independence Avenue, S.W.
Washington, D.C. 20250

College and University Teaching Programs:
Deputy Administrator, Higher Education Programs Cooperative State Research Service, USDA
Room 350-A, Administration Building
14th & Independence Avenue, S.W.
Washington, D.C. 20250

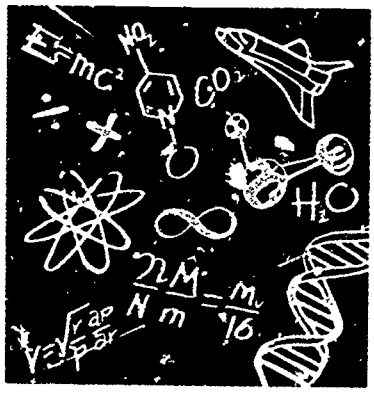
Library Services and Programs:
Director, National Agricultural Library
Room 200, NAL
Beltsville, Maryland 20705

Other:
Director, Office of Public Affairs
Room 201-A, Administration Building
14th & Independence Avenue, S.W.
Washington, D.C. 20250

"America's hope for the future lies in the education of its children. When today's kindergartners become tomorrow's business leaders, America's international competitiveness will depend on the skills we impart to them during their academic journey.

In the rapidly changing global economy, the greatest resource we can develop is a nation of leaders. The technology revolution continues to shape our lives and change the ways we do things. We need a work force that can adapt to swift changes and leaders who manage the opportunities offered by technology."

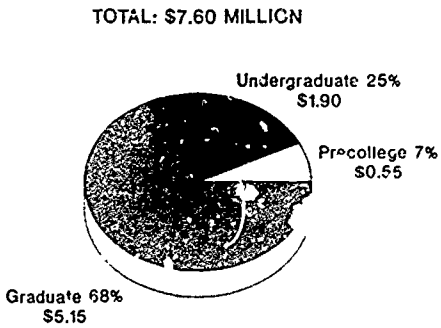
Robert A. Mosbacher
Secretary of Commerce



OVERVIEW

The Department of Commerce was established by Congress in 1913, reorganizing the Department of Commerce and Labor which was created in 1903. The Department of Commerce now has 34,000 employees positioned around the world, and operates with a current budget of $2.6 billion. Today Commerce has 13 agencies headed by Robert A. Mosbacher, the 28th Commerce Secretary.

The Department of Commerce encourages, serves, and promotes the Nation's international trade, economic growth, and technological advancement. Within this framework and together with a policy of promoting the national interest through the encouragement of the competitive free enterprise system, the Department provides a wide variety of programs. It offers assistance and information to increase America's competitiveness in the world economy; administers programs to prevent unfair foreign trade competition; provides social and economic statistics and analyses for business and government planners; provides research and support for the increased use of scientific, engineering, and technological development; works to improve our understanding and benefits of the Earth's physical environment and oceanic resources; grants patents and registers trademarks; develops policies and conducts research on telecommunications; provides assistance to promote domestic economic development; promotes travel to the United States by residents of foreign countries; and assists in the growth of minority businesses.



in millions of dollars

DOC Education Budget FY 1992

This chapter reviews the education and human resource programs for two of the largest agencies within Commerce: the National Institute of Standards and Technology headed by Dr. John W. Lyons, and the National Oceanic and Atmospheric Administration headed by Dr. John A. Knauss.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Mission and Structure

A principal agency of the Commerce Department's Technology Administration, the National Institute of Standards and Technology (NIST) has as its missions to aid U.S. industry through research and services, to contribute to public health and safety, and to support the U.S. scientific and engineering research communities.

To achieve these goals, NIST conducts basic and applied research in the physical sciences and engineering, developing measurement techniques, test methods, standards, and related services. The Institute does generic research and development work on new advanced technologies.

The research and technical programs of NIST are carried out by 3,000 scientists, engineers, technicians, and support personnel, supplemented by some 1,000 visiting scientists each year. These activities are conducted in two sites:

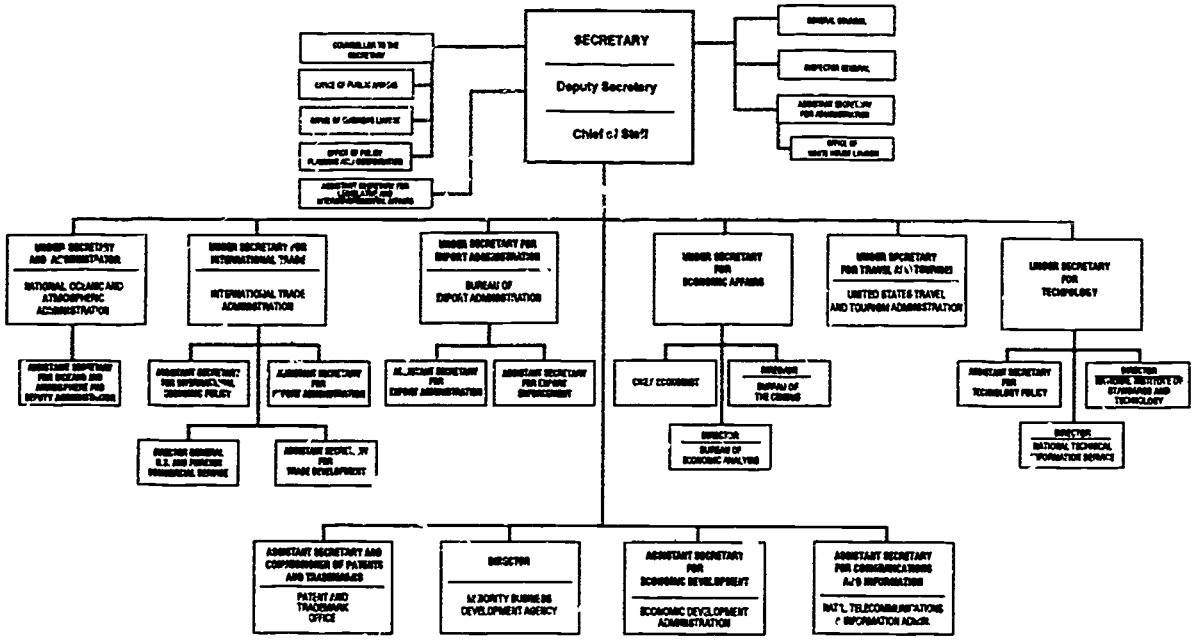


Table of Organization - Department of Commerce

Gaithersburg, Maryland, the headquarters laboratory, and Boulder, Colorado.

The Institute's core programs include significant scientific and engineering work in ten major research areas: chemical science and technology, electronics and electrical engineering physics, manufacturing engineering, materials science and engineering, building technology, computing and applied mathematics, fire safety, computer systems and technology services.

Education Programs

The professional staff at NIST maintains a cooperative association with many universities and a continuing interest in developments in education in mathematics, science, and engineering. Many of the senior staff have extensive experience as university professors, and a substantial group of NIST staff maintains adjunct appointments in colleges and universities near the laboratory sites in Boulder and Gaithersburg.

As the national laboratory for measurement science and engineering, with emphasis on state-of-the-art research, it has been natural for the Institute to maintain a strong program of post-doctoral education. Since 1954 the Institute has sponsored a substantial number of postdoctoral research fellowships in collaboration with the National Research Council of the National Academy of Sciences.

At both the graduate and undergraduate level, the Institute has developed a program of cooperative education to provide work-related educational opportunities to students from a large number of participating colleges and universities. A somewhat larger program (Student "Q"

Program) of work-related studies, primarily in the summer, involves undergraduate and graduate college students, as well as high school students.

Conscious of the vital necessity to encourage more participation by women and underrepresented minorities in science and engineering programs, the Institute has in recent years enhanced its outreach to these groups.

The Institute provides a limited number of fellowships to support outstanding graduate students who have been associated with laboratory programs. It participates in the activities of several national consortia providing fellowship support for minorities and women and has carried out intensive collaboration and recruiting activities with a number of the Historically Black Colleges and Universities. On a volunteer basis, the Institute staff has actively supported precollege education for many years. Typically, the Institute staff provides lectures, visits, workshops and tours for precollege students and teachers near the laboratory sites. In addition, NIST volunteers maintain a number of special programs to excite the interest of all students in science, mathematics, and engineering.

ONGOING PROGRAMS

Graduate

Postdoctoral Fellowships
(FY 1992 budget: $3.35 million)
The NIST/NRC Postdoctoral Research Associateships Program provides two-year fellowship appointments for outstanding scientists and engineers chosen through a national competition administered by the National Research Council of the National Academy of Sciences. The appointments provide an opportunity for the nation's best young scientists, mathematicians, and engineers to engage in state-of-the-art research in association with senior research specialists on the Institute's staff, utilizing the excellent and often unique research facilities of NIST. The Institute expects to maintain this program at approximately 45 research associates.

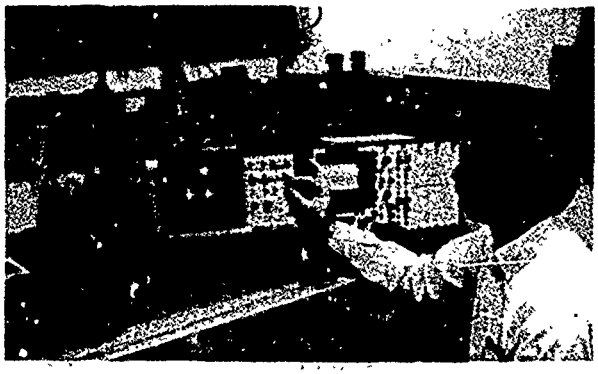
Graduate Research Fellowships - Predoctoral
(FY 1992 budget: $100,000)
The NIST Authorization Act of 1987 provides broad authority to the Institute to award fellowships to outstanding students showing promise of contribution to Institute programs.

The Institute now awards a number of fellowships directly to graduate students who have been identified through their outstanding performance at NIST and their excellent academic records.

Undergraduate

Student Cooperative Program
(FY 1992 budget: $370,000)
NIST supports a program of cooperative work study activities arranged on a formal basis with a large number of colleges throughout the country. These students are primarily in physical science, engineering, mathematics, and computer science, and have completed at least two years of their undergraduate program.

Student "Q" Program
(FY 1992 budget: $1.10 million)
The Institute supports some 150 students each year in a work study program carried out primarily in the summer and other vacation periods. Two-thirds of these appointments are at the undergraduate level and a smaller number at the graduate and precollege level.



NRC Postdoc developing ultrasonic transducer arrays for measuring material properties of composites

Volunteer Activities

Literally hundreds of NIST staff have participated for years in volunteer educational activities, primarily at the precollege level. The wide spectrum of activities includes science fairs, lectures, demonstrations, workshops and laboratory visits for students and teachers in grades K-12; volunteer curriculum efforts with local schools; and extensive participation by NIST staff as adjunct faculty in local university courses.

Illustrative examples of NIST volunteer activities are the following.

Connection Resource Bank - Montgomery Education Connection
Many NIST staff participate in activities of the Montgomery Education Connection, a private, nonprofit organization formed specifically to link Montgomery County Public Schools and county employers.

One of these activities is the Connection Resource Bank, a highly computerized, user-friendly database which provides information on available speakers, tutors, mentors, consultants, materials, laboratory tours, and other information helpful to local school systems. Over the last two years, the Resource Bank has responded to more than 1,000 requests from teachers to provide activities reaching more than 40,000 students.

NIST Resources Educational Awareness Partnership (REAP)
The REAP program is a NIST-based program to bring the excitement of the world of science directly into the lives of young students. The program provides demonstration experiences, lectures, science kits, and special laboratory visits by NIST staff. In the average year, more than 120 presentations are made by some 100 NIST employees, impacting more than 5,000 students.

A similar program, Career Awareness and Resources Education (CARE), is conducted at the NIST Boulder, Colorado laboratory. The Boulder program involves about 150 employees, and their activities have touched 35,000 students and teachers in more than 20 school districts.

Adventure in Science
NIST is one of the host campuses for Adventure in Science, a nonprofit, all volunteer group with hands-on classes in physics, chemistry, computer science, biology, astronomy, and other subjects. More than 100 children, ages 8-15, meet for classes on Saturdays from November through March.

NIST CONTACT

For further information about education programs, the NIST contact is Dr. Burton H. Colvin, Director for Academic Affairs, (301) 975-3067.

THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

Overview

Created in 1970 within the Department of Commerce, NOAA conducts research and gathers data about the global oceans, atmosphere, space and sun, and applies this knowledge to science and service. In addition to weather forecasting, NOAA warns of dangerous weather, charts the seas and skies, guides the use and protection of ocean and coastal resources and conducts fundamental environmental research.

NOAA's research and services are carried out by its five major units: the National Weather Service, the National Ocean Service, the National Marine Fisheries Service, the National Environmental Satellite, Data, and Information Service, and the Office of Oceanic and Atmospheric Research. Currently, NOAA's educational efforts reflect the diversity of these units' activities. One of the challenges for FY 1992 is to foster a climate that advances NOAA's contribution to education while embracing those energetic programs already underway.

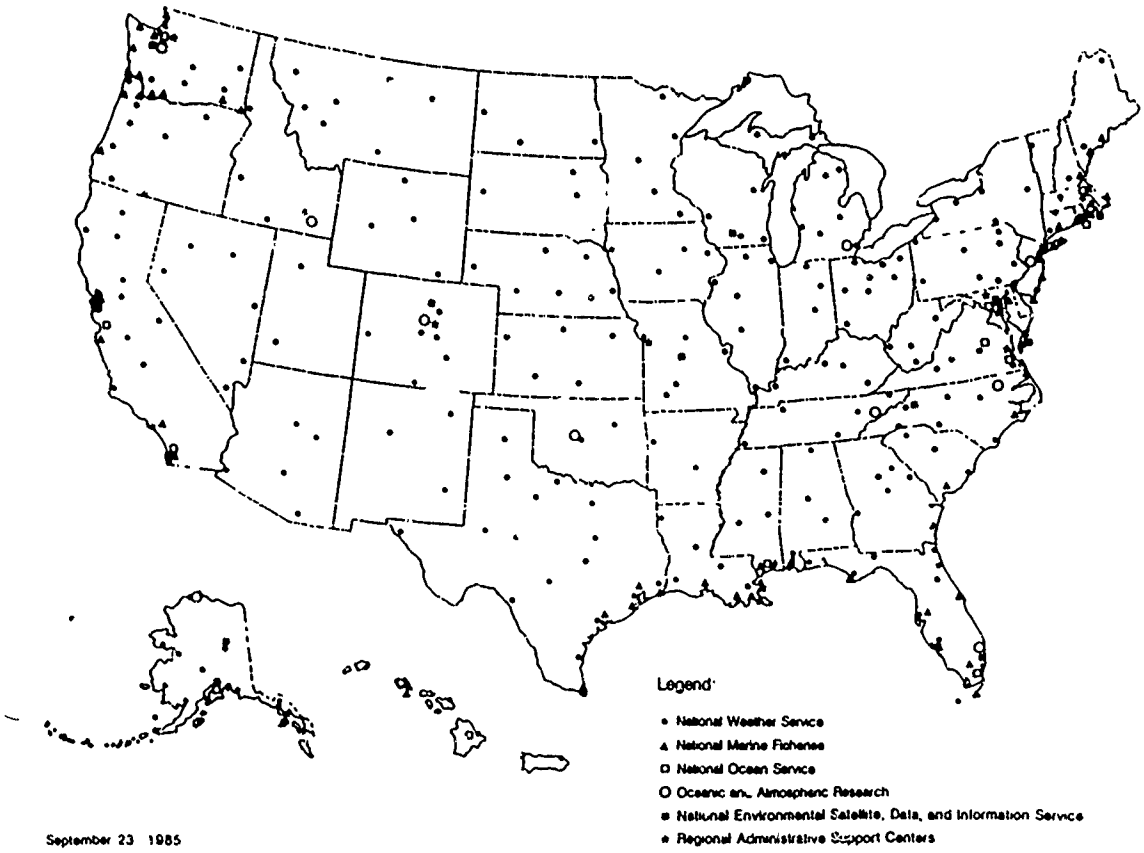
Mission and Structure

NOAA's basic mission is to analyze and predict changes in the earth's environment, using scientific and technical expertise. In addition, the agency has national responsibility for conserving marine living resources and protected species, and providing associated services to the fishing industry; overseeing atmospheric and hydrological resources; assessing, managing, and monitoring the marine environment and resources, management and resource restoration; producing comprehensive environmental science data; and providing leadership in research and education in the earth sciences.

NOAA's strategic plan for 1991-2000 succinctly explained the importance of this last function: "Research and education in the Earth sciences will be important to NOAA in the 1990s for several reasons. First, increased investments in scientific research are an urgent National priority because of the overall relationship of R & D to economic competitiveness. Second, advances in the Earth sciences directly translate into opportunities for NOAA to fulfill its mission. Third, NOAA can, in turn, stimulate progress in the Earth science community through NOAA's collection of data, development of models and publication of research findings. Fourth, research and advanced education go hand in hand in the academic community, and NOAA depends upon a continuing supply of highest caliber scientific and technological talent. Ultimately, education in the Earth sciences in the broadest sense, involving every citizen, will be a determining factor in how well the public is able to use NOAA's products and services and how well difficult public choices are made involving the environment and natural resources of the Earth." (Draft: NOAA's Strategic Plan 1991-2000)

Contributing scientific knowledge to the environmental science curriculum at every level of education is understood to be an integral component of NOAA's public stewardship. In the United States, there are approximately 3,000 marine scientists (with graduate degrees). Atmospheric scientists and meteorologists total approximately 9,000. About one-fourth of these scientists are associated with NOAA operations and research. NOAA is both a developer and primary user of this talent pool, and continuous replenishment is vital to the Nation's future.

HIGHLIGHT NOAA will provide to parents of preschool children science-oriented educational material which these parents can use to inspire their children with an interest and background in science topics.



Location of NOAA Facilities

Technological advances are compelling major changes in NOAA's operations. Even though the National Weather Service now provides six- and 10-day forecasts as accurate as those two- and three-day forecasts of 1970, modernization of the Weather Service over the next ten years will afford much longer-range and more accurate forecasting. The existing 52 Weather Forecast Offices (WFOs) and 197 smaller service units of the Weather Service will be phased into an integrated national system of 115 WFOs located throughout the United States. A major breakthrough has been the ability to forecast "mesoscale" or small-area weather events, which cause more death and destruction than most more-spectacular weather phenomena.

New polar orbiting satellites will provide improved observations during all weather conditions and will allow forecasters to collect better temperature profiles of the atmosphere. To accommodate the substantial increases in data provided by these satellites and other new environmental acquisition systems, a set of high speed supercomputers will be introduced in NOAA during the 1990s.

HIGHLIGHT A directory of resources for earth observations in education will soon be available. The National Sea Grant College Program is helping teachers and administrators nationwide to introduce marine science into the curriculum.

This rush of technological advances in earth systems science intensifies the need to transfer rapidly the latest knowledge to the next generation of decision makers. Science education can be a tool to effect informed choices.

Educational Programs

Traditionally, NOAA has supported individual educational programs. During FY 1992 attention will be directed to a more integrated realization of NOAA's educational contribution through the establishment of the Education Division under the Office of Legislative Affairs. This Division has two Branches: Programs, which transfers technology to the public schools, and Services, which operates a NOAA-wide information referral service and also provides technology transfer to academic institutions and associations. The breadth of NOAA's base of operations is apparent from the map of its laboratories and field installations. These sites serve as technology curriculum resources for their respective communities.

Several new educational programs will reach students and teachers from the preschool through postsecondary levels. A complementary program will encourage partnership alliances with other public and private agencies and will develop an incentive program within NOAA to encourage educational projects across program offices. In addition, NOAA is seeking out new ways to transfer credible scientific information to the public, to help citizens carry out their responsibility for maintaining Earth's vital signs.

NEW INITIATIVES

Precollege (* Not funded directly)

*** Maritime and Science Technology High School**
Dade County, Florida will open a magnet school with a specialized curriculum to prepare students for professional, technical and non-technical jobs in the maritime industry.

Headstart for Science ($10,000)
This program aims to expose minority high school students and their families in Charleston and Beaufort Counties, South Carolina, to the marine environment and to expand their awareness of and familiarity with scientific concepts.

Cooperative Experiment in Education with the Center for Ocean Analysis and Prediction ($3,000)
Selected High Schools in the Monterey Bay Region of California will receive coastal ocean data hardware through telecommunications, under this program.

Career Awareness and Resources Education (CARE) demonstration of cryogenics

HIGHLIGHT NOAA is committed to providing environmental science data to schools in a form that teachers can use in classroom instruction.

Direct Read-Out Satellite Transmission Services ($10,000)
Classrooms in 288 schools within 130 school districts in Virginia have been equipped with electronic receiving equipment that will enable them to receive direct readout of data on the biosphere from weather satellites.

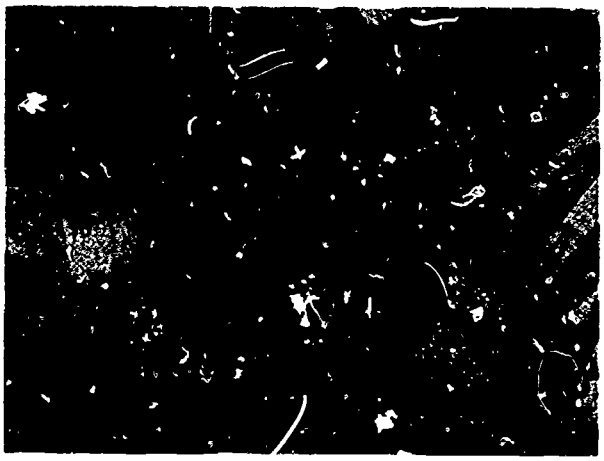
Parent As Teacher ($51,000)
This program will develop educational material that parents can use with their preschool children to generate an awareness of basic scientific and mathematical principles.

*** Project Apply**
Sponsored by NOAA's National Weather Service this program sends meteorologists into fifth and sixth grade District of Columbia classrooms to demonstrate practical applications of the scientific method in everyday problem solving.

Undergraduate (* Not funded directly)

*** Regional Prototype for Education in Pacific Islands**
A joint project with the Pacific Island Network (PIN), this program will develop a prototype curriculum in informed environmental practices and sustainable resource development.

NOAA Science Interactive Teleconferences ($10,000)
NOAA will sponsor two interactive teleconferences on climate and global change issues and research in collaboration with the American Association of Community and Junior Colleges. This Association has a contract for satellite teleconferencing and will be responsible for selecting the time and sites for each event.



Career Awareness and Resources Education (CARE) demonstration of lasers

Science Literacy (* Not funded directly)

Directory of Resources for Earth Observation in Education (English Version) ($15,000)
As a result of the International Space Year (ISY) proceedings, NOAA will provide a Directory of Resources for international scientists and educators.

* A series of National Estuarine Reserve Curricula is being reviewed preparatory to reissuance. Accompanied by a resource guide for teachers in Elementary Science, Junior High Science and Senior High Science, these materials can be used to instill in children and young adults an appreciation of the ecologic value of the Nation's natural resources.

* A four-tape series of 30-to-60 minute informational video for classroom use is being developed under the auspices of the Office of Chief Scientist for use by 8th-12th grade students. The tapes will feature NOAA scientists to introduce students to oceanography and meteorology.

HIGHLIGHT NOAA personnel in the Washington, D.C. area teach science on Saturdays to junior and senior high school students.

* In addition to making better use of its extensive field organization, NOAA is also planning ways to expose people to the latest results of the agency's scientific efforts through public and private portals, such as museums, aquariums, theme parks, marinas and airports.

ONGOING PROGRAMS

Precollege (* Not directly funded)

*** Geostationary Operational Environmental Satellite (GOES) Educational Project**
Loral/Space Systems, Sinclair Communications and NOAA are developing a network of eight high schools where students will receive and use real-time NOAA satellite data in classroom curriculum.

*** Joint Educational Initiative (JEDI)**
An effort of several Federal agencies this program provides environmental science data to precollege earth science teachers. NOAA, NASA, and the Geological Survey (the lead agency) create and distribute diskettes and curricula to 100 test sites in schools around the country.

Satellites and Education Program ($45,000)
Through the Satellite and Education program, NOAA encourages high schools to build satellite receiving stations so that students can acquire cloud and land images from NOAA satellites ($10,000 annually); sponsors a S & E Conference; and publishes an Educators' Guide for Building and Operating Environmental Satellite Receiving Stations ($35,000 one-time expense).

Metropolitan Consortium for Minorities in Science and Engineering ($10,000)
Administered by Howard University, this program brings promising minority high school students to NOAA facilities for summer assignments in science, engineering and related fields.

Precollege Education and Teacher Training ($350,000)
Investigators funded by the National Sea Grant College Program develop marine science materials for use in K-12 classroom instruction. In addition to evaluation and dissemination of these materials, these investigators instruct teachers in their use and provide backup support to teachers and administrators who are trying to introduce marine and aquatic education into their school systems.

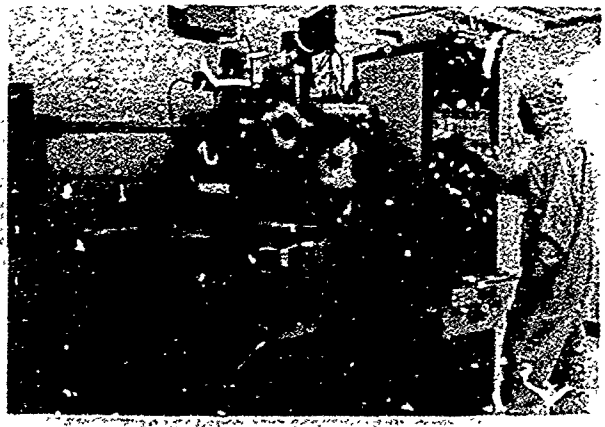
Student employee performing research connected with Josephson Junction array volt standard

Come Rain or Come Shine Program ($5,000)
This program is an elementary school elective that provides experiences for elementary students to learn how the weather is forecast. National Weather Service meteorologists give presentations to about 35 classes in grades four to six in the Washington, D.C. area.

HIGHLIGHT Approximately 45 of the Nation's top young scientists and engineers will conduct research at the cutting edge of discoveries in science and engineering through NIST postdoctoral fellowships in FY 92.

*** NOAA Saturday Academy Program**
This program is designed to introduce and stimulate academic and career interest in the marine sciences among junior and senior high school students. Conducted under a memorandum of agreement with NOAA's National Marine Fisheries Service, the University of the District of Columbia, and the District of Columbia Public Schools, this program features two three-hour sessions taught by NOAA personnel in University facilities each Saturday of an entire semester.

*** Partnership Agreements**
As a participant in the Partners in Education Program, NOAA employees serve as positive role models and science contacts for school staff. Others contribute their own time to tutor students. In some cases these programs are local; for example, at NOAA's Pacific Marine Center in Seattle, Washington, staff participates in a local program called Partners in Public Education, which provides an opportunity for school students to work part-time at the Center for four months each year.



Postdoctoral student working with superconducting microcircuit fabrication facility

Graduate

Sea Grant Federal Fellows — Dean John A. Knauss Marine Policy Fellowships ($200,000)
This program provides educational experience in the policies and processes of the Legislative and Executive Branches of the Federal Government to graduate students in marine related fields. Recipients are designated Dean John A. Knauss Marine Policy Fellows. Legislative Branch Fellows are funded by the National Sea Grant College Program Office and Executive Branch Fellows are funded by the host agency.

Voluntary Activities

In the Washington. D.C. metropolitan area, the National Weather Service maintains an active educational outreach and speakers program for the area schools, scouting clubs, and community centers. In 1990 more than 69 volunteers gave presentations in local schools on weather forecasting and career opportunities in the atmospheric sciences.

The level of volunteerism is high across the Agency. During FY 1992 NOAA proposes to record these efforts to develop a data base.

Other Activities

The NOAA staff serves as judges of student projects and speakers at school science fairs and career days. This is designed to stimulate student interest in science careers.

At NOAA's Aircraft Operations Center teaching tours are conducted for student science groups at the elementary, high school, and junior college level.

Special Agency Actions
With the July 15, 1990 establishment of an Educational Affairs Division, NOAA has committed itself to an organized effort for education in the environmental sciences.

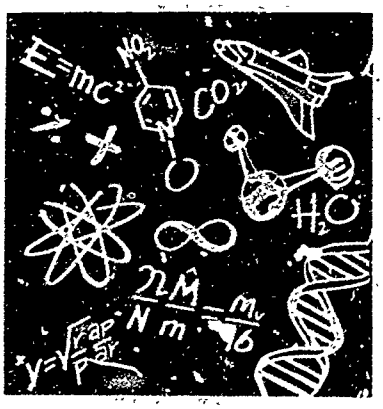
NOAA CONTACT

Future Inquiries should be made to:

Arva J. Jackson, Chief
Educational Affairs Division
Universal South - Suite 627
Washington, D.C. 20235
(202) 606-4380
Fax: (202) 606-4425

"I want to encourage you in your support for the President's efforts to improve the technical education of our youth—the defense of the intellectual base that must go hand-in-hand with the defense industrial base if we are to succeed."

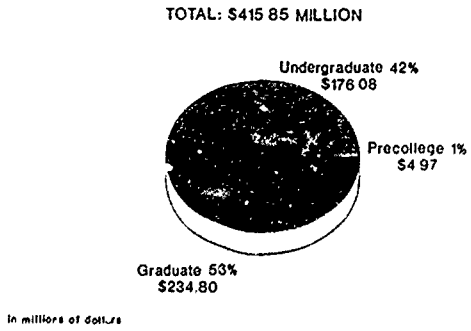
Richard Cheney
Secretary of Defense



SCIENCE AND ENGINEERING EDUCATION IN THE DEPARTMENT OF DEFENSE

Approximately 14% of all U.S. scientists and engineers are employed in defense activity. Since the Department of Defense (DOD) relies heavily on a strategy of technological superiority, the Department directly employs more than 100,000 scientists and engineers, approximately 3% of the national pool. Of this number, approximately 25,000 are engaged in research and development in DOD laboratories and centers. Nine thousand graduate students every year are supported through DOD-sponsored research and fellowships. The DOD has a vital interest in the ability of our Nation's colleges and universities to produce highly trained scientists and engineers.

A number of factors may affect DOD's future ability to recruit and retain qualified scientific and technical personnel. Chief among the concerns are changing demographics that will markedly affect the composition of the work force. It is estimated that by the year 2000, 85% of the increase in new entrants to the work force will be women, minorities, handicapped persons and immigrants, groups which traditionally have chosen careers other than science and engineering.



DOD Education Budget FY 1992

This year, the DOD authorization act directed the Secretary of Defense to designate an individual within the Office of the Secretary of Defense to advise on science, mathematics and engineering education. The act also authorized DOD laboratories to enter into partnerships with schools in which surplus equipment can be donated, allow DOD personnel to teach and advise students, and allow students to work in DOD facilities. These facilities employ scientists and engineers from a wealth of disciplines and provide a multidimensional educational resource.

DOD has a clear interest in and concern for maintaining an adequate supply of well-trained scientists and engineers; however, its course of action to address this issue must be consistent with the mission and statutory authority of the DOD. The Department of Education and the National Science Foundation have a major mission and a clear mandate to develop and conduct programs in science and engineering education. The DOD mission is to provide for national security, and any education programs it conducts must be in support of that mission.

DOD already makes a major investment in education and training. In the traditional educational setting, DOD provides education for grades K-12 for 200,000 dependents in overseas locations through the Department of Defense Dependents School System (DODDS) and in U.S. locations where the local civilian schools cannot meet the needs of the dependent population. The Service Academies, with a total enrollment of 14,000, will graduate about 3,300 officers in 1990. ROTC programs enroll about 87,000 with 21,740 on scholarships. Over 750,000 enlistees are participating in the Montgomery GI Bill plan, which provides subsidies to assist them in completing their college educations. These activities are rep-

resentative of DOD education and training activities for military personnel, but they are concerned only in part with science and engineering education.

Science and Engineering education activities in DOD include undergraduate Reserve Officer Training Corp (ROTC) scholarships, graduate fellowships, conduct of research by graduate students in support of national defense, and programs designed to enhance recruitment and retention of civilian employees in science and engineering career fields.

The Service research programs are coordinated for the Secretary of Defense by the Office of Research and Laboratory Management. DOD also coordinates with other agencies, such as the National Science Foundation, Department of Energy, National Aeronautics and Space Administration, and National Institutes of Health, to assure that stipends are comparable, policies are uniform, and common problems are recognized. The Office of Personnel Management coordinates all Federal personnel programs but each organization may emphasize different programs to fit its needs. Equal Employment Opportunity (EEO) guidelines are likewise established government-wide.

ONGOING PROGRAMS

The Department of Defense supports a wide variety of science and engineering education programs. Some provide direct student support, in the form of fellowships for students or tuition payments for employee training; others provide indirect support, such as work experience in DOD laboratories or research performed through DOD grants to universities. Table 1 is a list of DOD laboratories. There are over 60 of these facilities in 20 States. DOD programs encompass all levels of education from precollege to postdoctoral, with the greatest support at the graduate level. Programs include both training for Department civilian employees and broader educational efforts to increase the supply of scientists and engineers. Science and technology education activities in the military Service academies, Service postgraduate schools, technical training schools, and education programs for Service personnel are substantial and do include a science and engineering component.

Program descriptions are categorized by the education level (precollege, undergraduate, graduate, and postdoctoral). The programs are then further characterized by the primary purpose. Unless specifically stated to the contrary, U.S. citizenship is a requirement to participate in all these programs.

Precollege

Programs to Improve the Quality of Science Education:

The National Science Resources Center (NSRC) is sponsored by the National Academy of Sciences and the Smithsonian Institution. DOD has provided approximately one-third of the funding for a study to examine factors that improve the quality of science teaching at the elementary school level. The first three years of this five-year program have focused on identifying school systems with exemplary science programs; collecting science resource materials; disseminating information on science resource materials through a network established by NSRC; developing instructional materials for three critical science concepts; field testing these materials; and conducting training workshops for elementary

Facility	Location	Affiliation
Aeromedical Research Laboratory	Ft. Rucker, AL	Army
Missile Research, Dev, and Engr Cntr	Huntsville, AL	Army
Aviation Research and Technology Activity	Moffett Field, CA	Army
Letterman Army Institute of Research	Presidio, SF, CA	Army
Biosciences Laboratory	NSC Oakland, CA	Navy
Civil Engineering Laboratory	Port Hueneme, CA	Navy
Health Research Center	San Diego, CA	Navy
Ocean Systems Center	San Diego, CA	Navy
Personnel Research & Development Cntr	San Diego, CA	Navy
Weapons Center	China Lake, CA	Navy
Astronautics Laboratory	Edwards AFB, CA	Air Force
Frank J. Seiler Research Lab	USAFA, Col Spngs, CO	Air Force
Submarine Medical Research Laboratory	Groton, CT	Navy
Institute of Dental Research	Washington, DC	Army
Walter Reed Army Institute of Research	Washington, DC	Army
Naval Research Laboratory	Washington, DC	Navy
Aerospace Medical Research Laboratory	Pensacola, FL	Navy
Armament Laboratory	Eglin AFB, FL	Air Force
Engineering and Services Laboratory	Tyndall AFB, FL	Air Force
Construction Engineering Reaserch Lab	Champaign, IL	Army
Dental Research Institute	NTC Great Lakes, IL	Navy
Biodynamics Laboratory	New Orleans, LA	Navy
Atmospheric Sciences Laboratory	White Snds Msl Rng, NM	Army
Ballistic Research Laboratory	APG, MD	Army
Biomedical R&D Laboratory	Ft. Detrick, MD	Army
Chemical Rsch, Dev and Engr Cntr	APG, MD	Army
Engineer Waterways Experiment Sta	Vicksburg, MD	Army
Harry Diamond Laboratories	Adelphi, MD	Army
Human Engineering Laboratory	APG, MD	Army
Materials Technology Laboratory	Watertown, MA	Army
Medical Research Inst of Chemical Defense	APG, MD	Army
Medical Research Inst of Infectious Dis.	Ft. Detrick, MD	Army
Natick Research, Development & Engr Cntr.	Natick, MA	Army
Rsch Inst of Environmental Medicine	Natick, MA	Army
Tank Automotive RD&E Center	Warren, MI	Army
Clothing & Textile Research Facility	Natick, MA	Army
David Taylor Ship R&D Center	Bethesda, MD	Army
Medical Research Institute	Bethesda, MD	Army
Ocean R&D Activity	Bay St. Louis, MO	Army
Geophysics Laboratory	Bedford, MA	Air Force
Armed Forces Radiobiology Rsch Institute	Bethesda, MD	DoD
Armament Research, Development & Engr Center	Picatimmy, NJ	Army
Avionics R&D Activity	Ft. Mommouth, NJ	Army
Center for Electronic Warfare	Ft. Mommouth, NJ	Anny
Cold Regions Research & Engr Lab	Hanover, NH	Army
Electronic Technology & Devices Lab	Ft. Mommouth, NJ	Army
Air Propulsion Center	Trenton, NJ	Navy
Rome Air Development Center	Griffiss AFB, NY	Air Force
Weapons Laboratory	Kirtland AFB, NM	Air Force
Aero Propulsion Laboratory	WPAFB, OH	Air Force
Aerospace Medical Research Laboratory	WPAFB, OH	Air Force
Avionics Laboratory	WPAFB, OH	Air Force
Flight Dynamics Laboratory	WPAFB, OH	Air Force
Materials Laboratory	WPAFB, OH	Air Force
Underwater Systems Center	Newport, RI	Navy
Institute of Surgical Research	Ft. Sam Houston, TX	Army
Human Resources Laboratory	Brooks AFB, TX	Air Force
School of Aerospace Medicine	Brooks AFB, TX	Air Force
Belvoir RD&E Center	Ft. Belvoir, VA	Army
Center for Night Vision & Electro-Optics	Ft. Belvoir, VA	Army
Center for Signals Warfare	Warrenton, VA	Army
Engineer Topographic Laboratories	Ft. Belvoir, VA	Army
Rsch Inst for Behavioral & Social Sciences	Alexandria, VA	Army

Table 1

Lt. Lynn Title tutors an inner city student as part of the "Navy Kids" Washington program. Title is assigned to the Naval Military Personnel Command.

science teachers. The field testing was conducted at 21 elementary schools in 13 school systems including DOD Dependents Schools in the Philippines and several schools with large black or Hispanic student populations. A workshop was conducted in 1987 for participants representing 13 school systems with a combined enrollment of over 500,000 students.

Another program that addresses the quality of science and technology education is the Army High School Science and Mathematics Faculty Program, administered by the Army Research Office. This program provides six to ten weeks of experience in an Army laboratory for high school faculty members. The experience is intended to foster an appreciation for the professional challenges faced by scientists and engineers; an exposure to current state-of-the-art research topics; and hands-on experience with modern research instruments. The program is conducted at 30 Army laboratories at various locations around the country during the summer months.

Programs to Stimulate Interest in Science and Technology Careers

Programs in this category are intended to capture the interest of students at an early age by making them aware of science activities and providing them with information on career opportunities in science and technology. Many programs expose students to science activities through tours of DOD laboratories and centers, classroom lectures by DOD scientists and engineers in the school, and other creative use of DOD scientists. Because of the varied nature of these activities, data are generally not available on the numbers of participants or the funds expended in these programs.

The Army and Navy, through the Army Research Office and the Office of Naval Research respectively, have made a concerted effort to stimulate and encourage the technical development of our Nation's youth through involvement in the national science fair program, which typically attracts about 100,000 students annually. The Army Science Fair Program awards first and second place prizes at each of 350 State and regional science fairs and in a national fair. The Navy Science Awards Program follows a similar format.

An example of a more structured approach to these activities is the Adopt-A-School Program carried out by many DOD facilities. In these programs DOD employees volunteer to support the school by tutoring students; providing assistance on math and science research projects; judging science fairs; participating in career day presentations; lecturing on math, science and technology subjects; hosting Honors teas for students and parents; instructing students and staff on the use of computers in science and math; and serving as

mentors for students. Adopt-A-School programs were established in 1983-84 in many locations following a memorandum from President Reagan to the Federal departments and agencies. Vigorous Navy programs were established in the San Diego and Great Lakes areas in 1984.

Yeoman 2nd Class G. E. Simpson tutors an inner city student as part of the "Navy Kids" Washington program. Simpson is assigned to the Naval Military Command.

A more comprehensive stimulation program is the Junior Science and Humanities Symposium, the first and largest precollege program sponsored by DOD. Initiated in 1957 and administered by the Army Research Office, the program consists of two to three-day regional meetings, which include presentations of papers on research performed by the students; tours of research facilities; a keynote talk by a prominent scientist; discussions on current issues in science; career guidance; and discussions on the relationship of science to the humanities. The program reaches approximately 10,000 students and 250 teachers annually. Ninety-eight percent of the participants go on to college.

The Texas Pre-Freshman Engineering Program (TEXPREP) is similar in scope but was established by a consortium of State and local governments, colleges and universities, Federal agencies, and private industry in the State of Texas. The program provides academic instruction, tours and presentations on science and engineering subjects to students in grades 6-11 who have high potential for science or engineering careers. The program has a high percentage of women and minority participants (91% in 1989) and has had an outstanding success rate in encouraging students to attend college (90%); 60% of those attending college pursue careers in science and engineering.

Programs Targeted on Minorities, Women and Persons with Disabilities

Activities pursued in this category are very similar to those described above but are targeted on women, minorities, and handicapped persons, groups which are traditionally less likely to pursue careers in science or engineering.

The Uninitiated Introduction to Engineering (UNITE) Program, administered by the Army Research Office, provides a four-week intensive experience, primarily for minorities (98%), but also for other disadvantaged youths. The programs are conducted at eight universities across the U.S. and consist of academic instruction on trigonometry, pre-calculus, computer science, physics, chemistry, and communication skills.

Other examples of successful precollege programs conducted at the local level include the Minorities in Engineering and Handicap Outreach Programs conducted by the Naval Air Development Center (NADC) in Warminster, Pennsylvania. The Minorities in Engineering Program consists of two-hour sessions held every two to three weeks during the school year at NADC. The sessions include an introduction to

digital electronics; computer programming; career workshops and college information; a tour of the center; and a student project. Students are drawn from four local high schools, based on interviews and recommendations of science teachers. The program is targeted for minorities and conducted by the EEO office, but others are not excluded.

The Handicap Outreach Program targets junior and senior high students with a disability and involves tours of NADC and establishment of a mentor relationship with NADC employees with a similar handicap. The Technical Mentor program at the Naval Weapons Center is intended to provide support to women, minorities, and economically disadvantaged youths who are underrepresented in science and engineering. The program starts with high school juniors who perform educationally related tasks in an unpaid status under the student volunteer program. During their senior year these students are hired for a year as student aides under the Stay-in-School program.

Programs to Provide Work Experience in DOD-Funded Research

The goal of these programs is to stimulate interest in science and engineering careers through a hands-on work experience in a DOD-funded laboratory and through a mentor relationship with an active scientist. Under the DOD Science and Engineering Apprenticeship Program for High School Students, students work on research projects in DOD Laboratories or with principal investigators at universities who have DOD research contracts or grants. Since 1981, when the program was concentrated primarily in the Army and Navy laboratories in the Washington, D.C. area, this initiative has grown to include

NRL's commanding officer, Capt. John J. Donegan, Jr., visits the Young Astronauts Club of Woodlawn Elementary, Woodlawn, VA and discusses agency space research.

participation by all three Services. The Office of Naval Research administers the local program for the Washington, D.C. area on behalf of the Army and Navy laboratories in the area, via a contractor that provides for recruits, screens and matches student apprentices with laboratory mentors. The program placed 667 participants in 24 laboratories and organizations in the Washington-Annapolis area in 1989 for a period of ten weeks during the summer. Teachers can also participate and earn credit with additional weekend lectures prior to the start of the student program. Students and teachers work on real research projects in DOD labs under the tutelage of DOD civilian scientists. The students and teachers prepare reports on their projects and present the results in a staff seminar. Teachers monitor and coordinate the activities of the students. The Air Force has a similar program for students in the Dayton, Ohio area called the High School Apprenticeship Program. There were 103 participants in 1989 in the Air Force program.

The High School Apprenticeship and Research and Engineering Apprenticeship (REAP) programs are sponsored respectively by the Office of Naval Research and the Army Research Office. These initiatives provide research experiences for high-potential high school students in an academic environment. Students are placed with Principal Investigators on DOD research grants and are paid minimum wages during the work period. During 1989 the Navy had 80 apprentices and the Army had 110 at 56 institutions. Surveys indicated that 85% of the REAP students attended college.

The NRL Gifted and Talented Program and the Naval Coastal Systems Center Gould Science Award provide work experiences for students over an extended period of time. The Gifted and Talented program of the Fairfax County Public Schools allows high achievement students in their junior and senior years to work in local industry and government facilities. The Gould Science Award is given to the top science students in three of the NCSC area local high schools, and the students are offered a summer appointment following their senior year.

Students with less experience, such as junior high school students, may be allowed use of government facilities for Student Volunteer Services. OPM has relaxed the age limit for the student volunteers to allow 14 and 15-year-olds to participate, as long as there is no conflict with State and local child labor laws.

Undergraduate

The main purposes of DOD support for undergraduate science and education programs are to ensure a supply of college graduates trained in science and engineering for the Services; to offer work experiences for students that may assist in recruiting; and to provide job related training for full-time employees. The largest undergraduate program is the ROTC program, which in recent years has selectively sought science and engineering majors. Several of the older summer programs such as Stay-in-School, Federal Junior Fellow, and Summer Aid were conceived as means to supplement the incomes of students from low-income families who would otherwise not be able to attend college. The Cooperative Education (Co-op) program provides on- the-job work experience and an income supplement interspersed with full-time academic periods. The newest undergraduate programs are targeted on increasing the number of minority students pursuing careers in science and technology.

Scholarship Support Programs

All three Services operate ROTC programs at cooperating universities nationwide. Eight hundred fifty universities have an ROTC affiliation, and 87,000 students participate in ROTC training, most in non-scholarship status. The ROTC program was initiated in 1916 under the Morrell Act, but since 1964 the program has been refocused to emphasize scholarship support and active recruitment of science and engineering majors. The Air Force program in particular recruits 70-80% science and engineering majors. The Services had a total of 21,739 participants on scholarships in 1989. Approximately 60% were majoring in science, math and engineering fields. Scholarship support of tuition, books, fees and monthly stipends of $100 are paid during the school year, and summer training and cruises bring the total support to approximately $8,000 per year. Total support for the science and engineering scholarships amounted to $105 million in

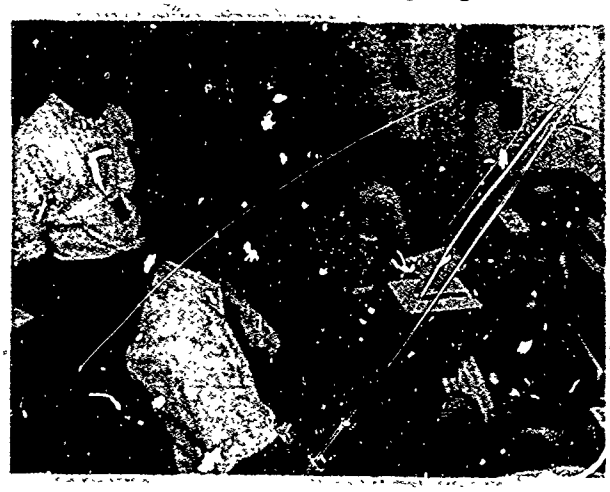
1989. The graduates are obligated to four years active duty military service but may be commissioned in the reserves depending on force requirements.

The Army has developed the Science and Engineering ROTC Co-op program, as an alternative to the basic ROTC program, to recruit scientists and engineers. Students must be enrolled at one of the 145 participating universities that offer a science and engineering curriculum, an Army ROTC program, and have a Co-op program. The students are eligible for up to $5,000 per year for tuition, fees, and room and board. Participants are also offered co-op jobs at an Army laboratory with additional pay for the work period. Upon graduation, the students are commissioned in the Army Reserves and are obligated to work at an Army laboratory until a service commitment is met. The program was adopted permanently and transferred to the Army Personnel Command for administration. Initial efforts to recruit for active duty service were not as well received as the Reserve status. The program currently has over 200 participants.

Programs to Provide Research Experience

Co-op programs, to provide alternate periods of work experience at DOD facilities and academic education, are available at many universities and colleges. The program is usually open to sophomore or junior level students meeting certain academic standards. The program helps students make more informed choices of career specialties and supplements to their income. The program has proven to be an effective recruitment method for undergraduate personnel and provides an opportunity to evaluate a potential employee's abilities before hiring. Students in the undergraduate program are permitted up to 1,040 hours of work per year at a GS-2 or 3 level, consistent with their qualifications. Students may be converted to career conditional appointments upon graduation.

The Stay-in-School program supplements income for students who would have difficulty otherwise meeting the financial burdens of a college education. The need requirements for admission to the program are established annually by OPM. The program permits high school and undergraduate college students to work up to 20 hours per week during the school year and full-time during summer and holiday vacation periods, not to exceed 1,040 hours per year. Appointments are for a period of one year but may be extended for additional periods not to exceed one year. Defense Mapping Agency and Naval Coastal Systems Center participate in this program. The Federal Junior Fellow program is somewhat similar to the Stay-in School program but also has a merit requirement: in addition to having financial need, students must be in the top 10% of their classes. Students are appointed upon graduation



Mr. Kenneth McGrath of NRL's Chemistry Division instructs visiting summer high school students Richard Olson and Melanie Staples on the operation of a nuclear magnetic resonance spectrometer.

from high school and work the summer after graduation and succeeding summers and vacation periods while in college. Students are eligible for non-competitive appointment to career conditional positions upon receipt of their degrees. Defense Mapping Agency, Naval Research Laboratory, Naval Air Development Center, and the Naval Coastal Systems Center participate in the program.

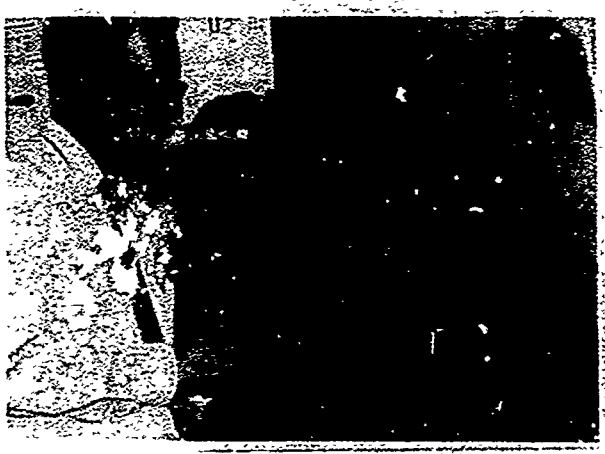
The Naval Research Laboratory hires approximately 80 college and high school students as research aides during summer and holiday breaks or intermittently during the year. The total hours cannot exceed 1,040 per year—hence the name of the program, 1040 Hour Appointment.

The Summer Aid program provides job experience for needy youths through summer employment and allows reappointment of those with satisfactory performance. Applicants must be referred by a State employment agency and are ranked in order of need. Defense Mapping Agency and Naval Electronic Systems Engineering Activity use the program.

The Summer Hire program of the Naval Research Laboratory and S&E Summer Employment program of the Naval Air Development Center are highly competitive merit programs that provide summer work experience for students in disciplines of interest to the agency. The National Security Agency conducts a similar Summer Program.

Programs Targeted to Increase Participation of Minorities in Science and Technology Careers

Executive Order 12320 in 1980 and Executive Order 12677 of April 28, 1989, provided for the establishment of programs to strengthen the Historically Black Colleges and Universities (HBCUs) by providing assistance and advice to faculty and training opportunities for their students. A number of programs such as the HBCU initiative and Adopt-a-College have been developed in response to the Executive Order. Most use the authorities for student employment and OPM excepted service schedules, but are specifically targeted on the HBCUs. The Office of Naval Research (ONR) has developed a comprehensive program to address both the availability of students and faculty research. The Naval Oceanographic Research Center has established



Dr. Noel Turner of NRL's Chemistry Division explaining the operation of an x-ray photoelectron spectrometer to visiting summer high school students enrolled in Prince Georges County Community College "Young Scholars Instrumentation Institute."

an Adopt-a-College program with Jackson State University and provides summer job opportunities in science and engineering disciplines for undergraduate and graduate students and faculty members. The Naval Air Development Center has targeted about a dozen schools with black and Hispanic populations that conduct engineering programs; different NADC departments have adopted schools, establishing communication on NADC career opportunities. Students participate in two-day visits to NADC, co-op programs and

faculty work in summer research programs. Defense Mapping Agency is developing a program which will include summer programs, co-ops, and faculty exchange and provide HCBUs with excess equipment and opportunities to bid on research contracts.

The ONR HBCU program currently provides $3.9 million per year in research and scholarship support to HBCUs. Six additional grants, totaling $14 million over a five-year period, were announced in 1989. The grants fund a spectrum of programs, including direct scholarship and research assistantship support to more than 100 undergraduate students; faculty research grants; student summer research experiences; visiting scholars; and improved laboratory training. Each of the schools is expected to complement the ONR support with its own programs to stimulate interest and improve teaching of science and engineering in grades K-12. The ONR program attempts to reduce attrition in science and engineering majors at the undergraduate and graduate levels.

The National Security Agency conducts a unique Undergraduate Training program for minority students to provide educational and conditional employment opportunities. The program requires an SAT score of 1100, a GPA of 3.0 and an interest in science and math fields of interest to NSA. The program pays tuition, and the student incurs an obligation of one and one-half years of service for each year in the program. The program is slated for expansion to 50 participants in 1990.

Programs to Provide Job-Related Training for Employees

The DOD makes a significant contribution to education in science and technology fields by programs provided for its own employees, who comprise 3% of the national pool of scientists and engineers. Training may be full-time or part-time, on or off-duty, day or evening. It may be provided by the agency itself, an educational institution, another Federal agency, a professional association, or a manufacturer. DOD agencies may pay for all or part of the expenses of authorized training. The training must be in fields that are or will be directly related to the performance of official government duties. Training covers many activities, such as attendance at conferences and short courses. This chapter reports only those training activities that provide formal educational course work in science, math, or engineering disciplines at an accredited academic institution (or DOD Agency programs of equivalent stature). Most training programs apply equally to undergraduate and graduate course work.

The Naval Air Development Center offers a Part-Time Undergraduate Study Award program for non-science and non-engineering employees who wish to pursue a scientific or technical degree. The employee must have already completed one full academic year in the subject field and have career status (three years government service) with one year employment at NADC. Participants may take up to 20 hours education per week at a local college or university, and the program provides full pay, tuition and academic fees. Appointment to the program is for one year, renewable until the Bachelor of Science degree is granted. An obligation of three years service for each year of training is incurred. The Undergraduate Academic program of the Naval Ocean Systems Center offers a very similar program except it is limited to nine credit hours per semester and applies only to upper division courses. The National Security Agency offers an

Advanced Studies program on a 20 hours study/20 hours work format.

The National Security Agency also offers an After-Hours College program that covers up to eight credit hours per semester at a local college in job-related undergraduate and graduate level courses. The Defense Nuclear Agency also has a similar program for off-site educational opportunities for employees.

The National Security Agency is also authorized to operate the National Cryptologic School to provide specialized education and training for employees in computer science, electronic engineering, cryptology and related fields. The courses are at undergraduate and graduate levels and are taught during duty hours.

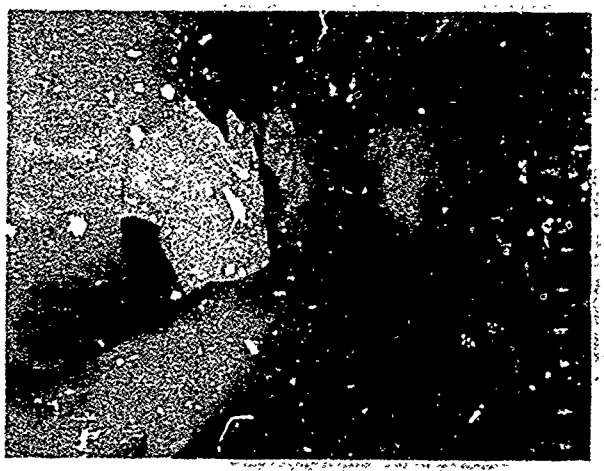
Most components of the DOD offer long-term, full-time training programs that permit residence at a college or university campus, primarily at the graduate level. The Defense Mapping Agency offers its long-term, full-time training program to full-time permanent employees with two years continuous service, a top secret clearance, high potential, and relevant academic background. The employees must pursue training in cartography or related disciplines; be willing to relocate; and incur a three-year service obligation for each year of training. In 1989, four of 35 participants were enrolled in undergraduate education programs. The Naval Weapons Center and the Air Force offer a long-term training program similar to the one above but concentrated in science and engineering fields, without the requirement for the TOP SECRET clearance and willingness to move. The National Security Agency offers an external training program called the Directed Fellowship/ Scholarship program similar to the above programs.

Another special training program is the Career Intern program, which rotates job assignments for entry level personnel in administrative, professional and technological fields who are on management or executive track. Participants may also receive some educational training. Career Intern participants enter at GS-5, 7 and in some cases 9 level and generally reach the full performance level over a period of several years. Career Interns are often recruited directly out of college. Finally, the National Security Agency offers two programs intended to fill shortages of skilled personnel below the B.Sc. level. The Grow Your Own program addresses the need for technicians in collection operations, signals conversion, telecommunications , traffic analysis and computer operations. Program recruits, who are high school graduates and agency employees, receive a combination of formal and on-the-job training. Program graduates must spend two years in the field for which they trained. The Computer Operations Associates program is targeted on community college students in computer science, data processing or computer operations programs. The students are partially supported for continuing educational programs at universities and on-the-job training programs that lead to an Associate degree and qualification for a GS-5 or 7 position.

Graduate

Graduate level education receives the most support from DOD and is focused on the physical sciences, engineering, and mathematics. Skills in these disciplines are crucial to the accomplishment of the Department's mission. The graduate level programs include direct fellowship support; indirect support through research grants to universities, which provide research assistantships

for graduate students; and training programs for DOD employees.



Dr. Lloyd Hillman, SFRP from Cornell University, and his graduate students, Mr. Stephen McClain and Ms. Mojdeh Anderson, in the Nonlinear Optics Laboratory at the Frank J. Seiler Research Laboratory.

Programs to Provide Educational Support through Fellowships

In 1989 DOD provided fellowship support to approximately 540 students in 1989 through programs administered by the Army Research Office (ARO), the Office of Naval Research (ONR), the Air Force Office of Scientific Research (AFOSR), and Defense Advanced Research Projects Agency (DARPA). These programs are advertised nationally through the distribution of brochures to schools and principal investigators on DOD contracts and grants, advertising in professional journals and announcements at professional society meetings. The fellowship programs are authorized as part of the annual appropriation for DOD research programs or, in the case of the National Defense Science and Engineering Graduate Fellowship program, directly in U.S. Code.

The AFOSR supports two of the oldest fellowship programs, Advanced Thermionic Research Initiative (ATRI) and Air Force Research in Aero Propulsion Technology (AFRAPT), both of which are targeted on critical Air Force needs and are conducted by a few cooperating schools. The ATRI Fellowship program was initiated in 1977 at Stanford, transferred to University of Utah in 1981, and to UCLA in 1987. It is focused on microwave and millimeter wave thermionic amplifiers and components and requires a B.Sc. in Electrical Engineering and U.S. citizenship. The AFRAPT program is a fellowship co-op program involving AFOSR, industry and university cooperation to provide a supply of critically needed engineers in the aeronautical propulsion field. The students are typically selected for the program in June, work at their respective companies over the summer, and begin graduate study in the fall. Thesis work may be done either at the university or at the supporting company. A stipend of $1,400 per month plus tuition and fees is paid during academic periods, and competitive salaries are paid during company work periods. Approximately half of the graduates are currently employed in the gas turbine industry. In 1989 the Joint Services Electronics Committee initiated another fellowship program targeting the electronics area. The program started at a level of $90,000 and is intended to increase to $300,000 in 1991.

The Laboratory Graduate Fellowship Program (LGFP) is an AFOSR program designed around the fellowship co-op concept. The program is primarily focused on the physical sciences and engineering, but includes some life sciences and behavioral sciences opportunities. Each fellow is assigned to an Air Force laboratory researcher in his or her area of interest to serve as mentor and advisor. Fellows, who are selected on merit, are

encouraged to spend the summer period at their sponsoring laboratory. Fellows receive stipends plus tuition and fees. The university department attended by the fellow receives $2,000 per year to cover additional administrative costs. The program attracts high-potential students to science and engineering disciplines of interest to the Air Force. It supports approximately 75 students. A similar program, ONR Graduate Fellow program targets the physical sciences, engineering, biological science, oceanography, and cognitive and neural science. Students receive stipends plus tuition and fees. The students are encouraged to work in Navy laboratories during summer and vacation periods. Approximately 50 awards a year are made on the basis of merit as determined by an advisory panel of technical experts. In 1989, approximately 100 participants earned Ph.D.s, and the attrition rate for the program is less than 7%. Program history, exit surveys from fellows, and evaluations from the selection panels indicate the program is very successful in attracting and retaining high quality students and in integrating them into the research infrastructure. The Navy plans to continue the program at approximately the present level. A similar Science and Technology Fellowship program, administered by the Army Research Office, had 53 and 57 participants in 1987 and 1988, respectively, but is now being phased out in favor of two new fellowship programs (URI and NDSEG). The Army University Research Initiative program has a large fellowship component; in 1989 it had a budget of $3 million and supported 149 fellows. Administered by the Army Research Office, this program targets the physical sciences and engineering and is intended to increase the number of students pursuing careers in science and engineering. The program is expected to support about 130 fellows at a cost of $2.5 million per year.

The National Defense Science and Engineering Graduate Fellowship (NDSEG) program is the most recent fellowship program and has specific authorization in U.S. Code. Fellowships are awarded for study and research leading to doctoral degrees in mathematics, physical science, biological science, oceanography, and engineering. The program is sponsored by the three Services and DARPA and operated under contract. The Fellows receive stipends as well as full tuition and fees for three years. DOD also provides $2,000 per year support to the fellow's department at the university. Fellows are selected on the basis of merit by panels of experts convened by the contractor in each discipline. Approximately 4,200 applications were received for the first competition, and 126 fellows were selected with support as follows: ONR-39; ARO-31; AFOSR-30; and DARPA-26. The program is scheduled to receive $10.5 million in 1990 and $11 million in 1991, enough to provide three-year fellowships to approximately 120 fellows per year. The program has enjoyed exceptionally high quality applicants.

Programs to Perform Research

DOD is authorized to provide grants and contracts in areas of research relevant to its mission. In 1989 DOD spent approximately $800 million on basic and applied research contracts and grants to colleges and universities (exclusive of R&D centers operated by universities). A major benefit of this research is the training of graduate students in science and engineering. Approximately 9,000 full-time graduate students receive research assistantships and other related support. Assuming a cost of $[illegible],000 per year for graduate assistantships, the level of support for assistantships would be approximately $170 million per year. Research programs of DOD are

administered by the Army Research Office, the Office of Naval Research, the Air Force Office of Scientific Research, and the Defense Advanced Research Projects Agency and are coordinated by the Office of the Director for Defense Research and Engineering, Research and Laboratory Management. Individual assistant-ships are selected by the Principal Investigator and the school, and are not limited to U.S. citizens or nationals. The DOD research effort has been responsible for the training of a large number of the scientists and engineers who now work in the physical sciences and engineering and has therefore made a major contribution to the Nation's supply of highly trained scientists and engineers.

Programs to Provide Research Experience

Many of the programs that provide research experience at the undergraduate level are also conducted at the graduate level. In particular the Co-op programs and the Summer Hire programs are used extensively at the graduate level. The Air Force Graduate Student Research program provides for a ten-week research experience for graduate level science and engineering students. The program is closely coordinated with the Summer Faculty Research program so that faculty members can supervise the students' research.

Programs to Provide Science and Engineering Education for Employee Training

Training programs for employees include tuition support for a few courses, part-time work programs, and full-time, long-term programs.

Examples of the short-term tuition support programs include After Hours Tuition Support at Defense Intelligence Agency, the Tuition Assistance program of the Defense Mapping Agency, the NAVSEA Institute at Naval Sea Systems Headquarters (which offers career specific courses in cooperation with Virginia Tech), and Instructional Television offered by Naval Ocean Systems Center and Naval Research Laboratory. Under the On-Site Education Center Classes arrangement with the University of California at Chico State and Irvine, Service employees of the Naval Weapons Center receive live and televised graduate and undergraduate classes; a similar arrangement exists at the Army Corps of Engineers Waterways Experiment Station Graduate Institute, carried out in cooperation with Louisiana State, Texas A&M, and Mississippi State Universities.

Examples of part-time study programs include the Edison Memorial Training program at Naval Research Laboratory, which combines work and academic study at full salary after one year at NRL. The Graduate Academic program at Naval Ocean Systems Center is a 20 hour academic/20 hour work program at full salary.

Several programs allow participants to attend graduate school full-time while they receive full salary and tuition. Usually employees are eligible after three years of service and must commit to three years of continued service for each year of education. Programs of this type include the Mission Related Graduate program at the Army Corps of Engineers; the Long-Term Graduate Training programs at the Naval Sea Systems Headquarters and the Naval Ocean Systems Center; the Full-Time Graduate Education program at the Naval Air Development Center; the Full-Time Study program at the Defense Intelligence Agency; and the Advanced Graduate Research program at the Naval Research Laboratory. The Naval Research Laboratory's Select Graduate Student program offers one-half

salary support for full-time study after only one year of government service. Several organizations offer long-term training opportunities in critical disciplines such as the Operations Research Systems Analyst Fellows offered by the Department of the Army Headquarters and Operations Research Advanced Fellow offered by the Army Materiel Command; the DCI Exceptional Analyst offered by the Defense Intelligence Agency; and the Coastal Engineering Education program, Water Resources Planning Associate and Water Resources and Environmental Law Associate, all offered by the Army Corps of Engineers.

The Air Force has two unique programs that couple recruiting with advanced education. The Palace Acquire program recruits recent college graduates in engineering into the Career Intern program and allows them to pursue advanced job-related studies leading to a M.Sc. degree during the trainee period. The program has been in operation since 1986 with about 50 interns per year, and has produced very satisfactory results. The Palace Knight program, developed and administered by the Air Force Civilian Personnel center, enables personnel to pursue advanced studies in their career fields at both the M.Sc. and Ph.D. level. New recruits are hired at the GS-7 level and report directly to their universities as their first duty stations. They usually receive a Master's degree during the first one to two years, then are assigned to a lab/work position for three years. With satisfactory ratings in their work assignments, the Palace Knight trainees can then return to school to continue their studies toward a Ph.D. degree. Full salary, tuition, and relocation expenses to the duty station are paid. A continued service agreement of three years for each year of training must be signed prior to employment. The program is slated to have approximately 100 participants per year.

Postdoctoral

Postdoctoral and faculty education programs expose new Ph.D.s to state-of-the-art science and technology or provide opportunities for faculty enrichment, including faculty at minority institutions. Since the programs employ trained scientists and engineers, they are classified as research programs. They also serve, however, to introduce faculty to areas of research interest to DOD and, in the case of the postdoctoral fellow programs, are one of the most effective recruiting programs available to the laboratories.

Programs That Perform Research

The National Research Council Research Associateship program is one of the oldest education programs supported by DOD, dating back to 1957. During 1989 the program placed 239 postdoctoral fellows in 17 DOD laboratories and centers, including all three Services and several agencies. The program is operated for the Department of Defense by the National Research Council. Most associateships are limited to U.S. citizens, but the Air Force accepts foreign nationals. The NRC postdoctoral program is highly regarded and has provided many outstanding scientists and engineers for the DOD laboratories and centers.

The Office of Naval Technology supports the ONT Post-Doctoral Fellowship program for selected science and engineering fields of interest to the Navy. In 1989 the program placed 77 participants at participating Navy laboratories.

Programs Targeted to Increase the Participation of Women and Minorities

The Women Science Scholars program, developed by Office of Naval Research, provides postdoctoral experience for women with Ph.D.'s are at points in their careers where this experience can make a critical difference. The program is based at Bunting Institute of Radcliffe College and is operated in collaboration with other New England schools. The women are paid a stipend of $25,000 for one year. The program is rated highly by the participants and credited with substantially aiding their careers and attracting them to research areas of interest to DOD.

NEW INITIATIVES

The National Defense Science and Engineering Graduate (NDSEG) Fellowship program is the most recent graduate research education initiative. The program was authorized by Congress in 1989 to increase the number of students pursuing advanced degrees in science and engineering fields of importance to DOD. The fellowship pays a stipend for three years as well as full tuition and fees for a period of three years. The program will provide fellowships for approximately 120 fellows a year with a total of 360 in the program after three years. Support for the program is provided by the Service research offices (ARO, ONR, AFOSR) and DARPA. The initial solicitation for fellows was very well received with 4,200 applications for the 126 NDSEG Fellows selected in 1989. Annual funding for the program was $10 million in 1989. In report language, the Congress has called for $20 million for 1991.

SUMMARY

Among the most effective recruiting programs are the Career Intern programs that recruit from campus for an accelerated promotion track and also provide advanced education. Co-op programs are also rated as very effective, with recruitment rates of 65-70% reported in some organizations. At the advanced degree level, the postdoctoral research associateships are very effective in providing a continuing supply of well qualified graduate scientists and engineers for conducting research in DOD laboratories c under university grants and contracts.

The in-house training programs are generally considered important both for providing educational opportunities for employees and as a recruiting tool.

Among the research office programs, the research assistantships resulting from research awards to universities are considered the most effective because the student support is coupled with research performed in an area of interest to DOD. Fellowship programs with a laboratory tie are next most effective in terms of training students in an area of research of interest to DOD and recruiting the students upon completion of their education. In terms of direct recruitment of scientists and engineers, the unrestricted fellowships appear to provide the least return to DOD in terms of direct recruitment of scientists and engineers.

DOD's investment in science and engineering research and related education programs at HBCUs rose to approximately $30 million in FY 1989. Moreover, efforts are being made to meet the requirements of section 1207 of Public Law 99-661, the 1987 National Defense Authorization

Act, which directed DOD to reach a goal of 5% for contract awards to small disadvantaged businesses, HBCUs and MIs. Until recently, DOD's relationships with a large number of these institutions was circumscribed, because DOD's support for science and engineering education at the university level was derived from authority to conduct research, and because fewer than a third of the 106 HBCUs have graduate programs in science and engineering fields, and only ten offer the Ph.D. degree. Recently passed legislation provides authority that will enable broader DOD activity in educational programs at HBCUs and MIs.

Precollege programs range from short exposure tours, seminars and science fairs to more intense tutoring and summer experience programs. The most effective are those that influence career decisions for science and engineering, provide the necessary career guidance and provide a glimpse of the excitement and adventure in a science and engineering career. The High School Apprenticeship Programs provide these elements.

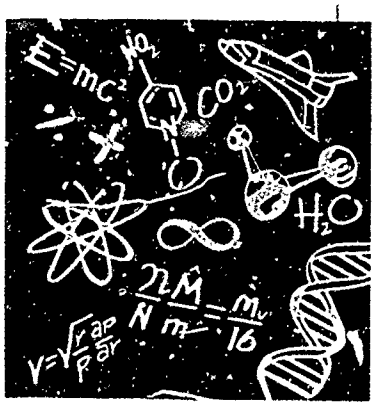
DOD brings large numbers of high school, undergraduate and graduate students, postdoctoral scholars and faculty researchers into its laboratories for research experiences during the summer.

The DOD has substantial experience and resources invested in the training and preparation of personnel. The increasing sophistication and complexity of the defense systems in use today require the Department to train the technicians and managers necessary to maintain and utilize these systems effectively. The development of new systems depends on the science and technology base in the DOD laboratories and the defense industry, and this in turn depends on new knowledge generated by the university, industry and DOD laboratory research communities.

The DOD has the experience and capabilities to contribute to the improvement of the quality of science and engineering education and to motivate and educate a new generation of scientists and engineers. The DOD uses its authority to recruit, develop and retain scientists and engineers and also to motivate students to pursue careers in science and engineering.

"Making American students first in the world in science and mathematics achievement is a high personal priority because of my background in mathematics. Quality programs and talented, dedicated teachers are needed to maintain our lead in basic science and technology, and to build a proficient workforce for the 21st century."

Deputy Secretary
Ted Sanders
Vice Chair,
FCCSET Committee on
Education and
Human Resources



THE DEPARTMENT IN BRIEF

Created in 1980, the U.S. Department of Education (ED) is one of the 14 Cabinet-level agencies assisting the President in executing his policies for the Nation and in implementing laws enacted by Congress. The Department has four major responsibilities:

- to establish policies relating to Federal financial aid for education, to administer distribution of those funds, and to monitor their use;
- to collect data and oversee research on America's schools and to disseminate this information to educators and the general public;
- to identify the major issues and problems in education and to focus national attention on them; and
- to enforce Federal statutes prohibiting discrimination in programs and activities receiving Federal funds and to ensure equal access to education for every individual.

The Department of Education has existed as a Cabinet-level agency for only a short time, but its history goes back to 1867. Originally created as a non-Cabinet level Department, it quickly was changed to an Office of Education. For over a century, the Office of Education was located within a series of Federal agencies, primarily charged with collecting information and statistics about the Nation's schools.

In the late 1950s and 1960s societal concerns with the quality of education in the U.S. led to the creation of a great number of programs to improve education, particularly focused on the disadvantaged. In the 1970s, these programs expanded with national efforts to help racial minorities, women, individuals with disabilities, and non-English-speaking students gain equal access to education.

In October 1979, Congress passed Public Law 96-88, creating the present U.S. Department of Education. The Department has more than 4,800 employees and an FY 1991 budget of approximately $28 billion.

ROLE OF ED IN MATHEMATICS AND SCIENCE EDUCATION

Opportunity, improvement and understanding are the principal missions of the Department. That is, the Department provides resources to increase opportunities for students to learn math-

Blocks and puzzles are excellent educational tools that help young children develop skills for other learning activities.

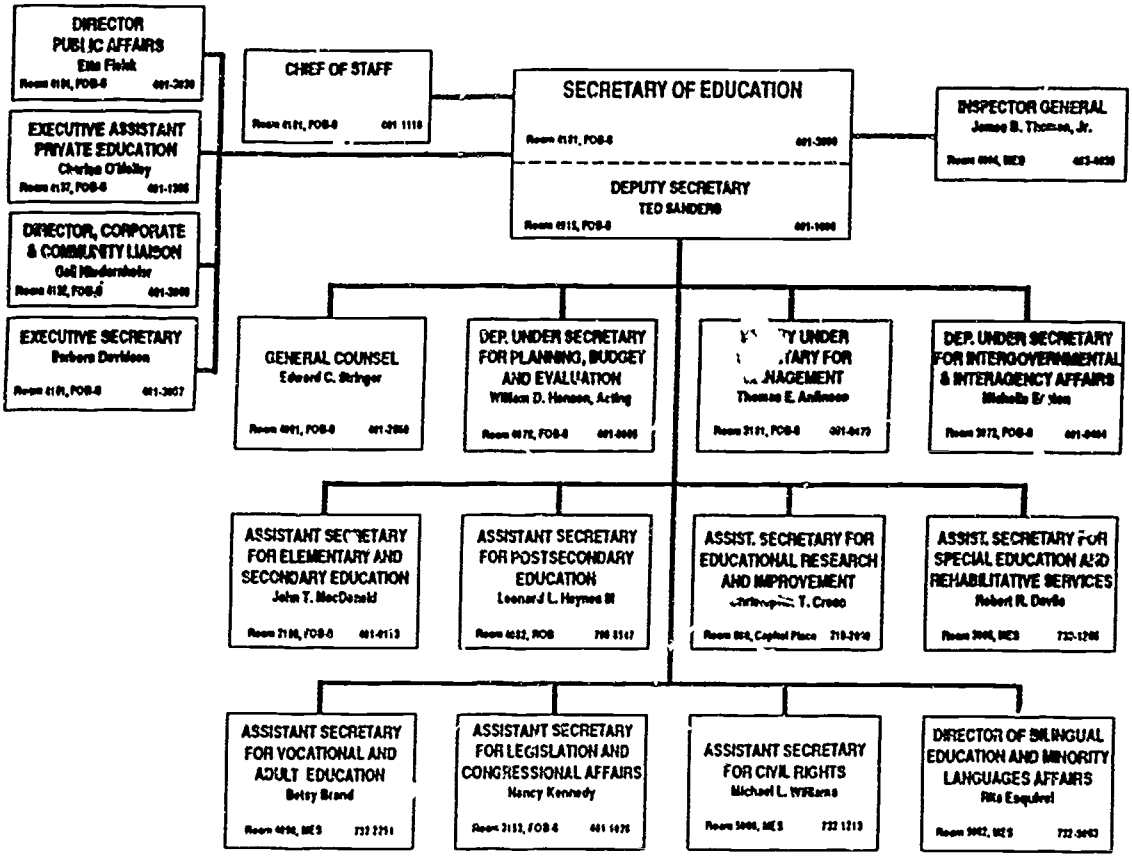


Table of Organization - Department of Education

ematics and science. ED supports research and assistance programs designed to improve the quality of mathematics and science education. And ED collects data on student learning and conducts studies and analyses on the condition of science and mathematics education.

The programs targeted on mathematics and science allow the Department to influence the direction of its larger formula grant programs to States and localities. A major grant program (Dwight David Eisenhower Mathematics and Science Education), research and improvement programs and initiatives, and focused studies on the condition of science and mathematics education are all designed to improve the quality of mathematics and science education.

ED's role is broadly based and connected to every level of formal education. ED programs reach nearly every school system and institution of postsecondary education. Programs support mathematics, science and technical education for the disadvantaged, handicapped and students for which English is not a primary language. ED programs increase student access and opportunities

An elementary school child studies the sequence of numbers—a precursor to a formal program of mathematics.

in elementary school through graduate school study. The Department also supports the integration of science and mathematics learning with vocational and technical education.

Most of the Department's precollege funds are allocated to States and localities by formula. These formulas are based primarily on a specific student category. Most postsecondary education funds are allocated through grants or loans to individual students. These funds support opportunities to learn science and mathematics, however, they also serve broader purposes such as assistance to enhance all learning programs for the disadvantaged or disabled. The actual amount spent on mathematics and science education is, with the exception of the Eisenhower State program, up to the grant recipient--State, local education agency, or individual student.

About 6% of the approximately $330 billion spent on education in this country (1988-89) comes from ED. However, the Department plays an influential role in making opportunities available to underrepresented groups and in stimulating improvement in mathematics and science education.

ED's role in mathematics and science education is broader than that of most other Federal agencies. Whereas the Federal agencies with scientific missions focus primarily on undergraduate and graduate level programs that prepare top students to become scientists and engineers, ED begins its efforts much earlier in the educational process, addressing the needs of students of all ages and ability levels. While the Department of Education does have some programs for gifted students aiming at science careers, these programs do not represent a dominant theme in ED's total mathematics and science efforts.

The Department does not have a single major operating unit specifically charged with overseeing mathematics and science education. Rather, the Department is organized by educational level (Elementary and Secondary Education and Postsecondary Education) and particular educational concern (e.g. vocational education, bilingual education, and special education). Mathematics and science education activities are carried out within these larger units. Because the units address broader concerns, mathematics and science activities, even though substantial, are not often featured prominently.

ED MATHEMATICS AND SCIENCE BUDGET

The President's FY 1992 overall request for the Department is $29.1 billion, with $329.9million specifically earmarked for those programs that directly address mathematics and science education. This request represents a 40% increase in mathematics and science. A new initiative is proposed - Mathematics and Science Achievement Awards to schools - with a budget request of $40 million. Major increases are proposed for the Eisenhower Mathematics and Science Education Programs, National Science Scholars, and the collection of statistics and national assessment information to aid in measuring progress toward the National Educational Goals and general educational attainments.

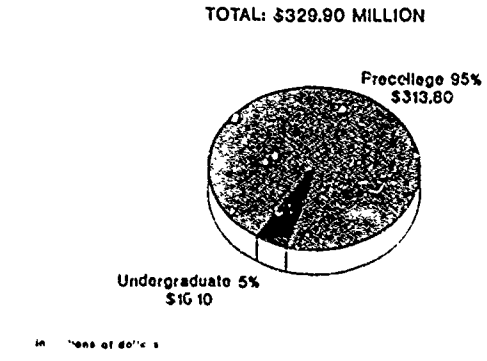
About 95% of ED's direct mathematics and science program requests are aimed at the precollege level. Within precollege, teacher development and enhancement represent almost 76% of the Department's total request. At the precollege level, ED's request is 50% of the total Federal budget; the Department's teacher development and enhancement request is 71% of the total.

Programs directly focusing on mathematics and science education represent only a small proportion of the Department of Education's investment in these subjects. The formula grant programs have been estimated to provide over $2 billion additional support for mathematics and science education.

A major effort of the Department is to use its programs that are focused entirely on mathematics and science education to maximize the impact of the much larger formula grant and student aid programs. This will be accomplished through increased coordination with State and local education agencies and among Federal agencies through cooperative efforts and working partnerships. For example, the National Eisenhower program is used in cooperation with the National Science Foundation's materials development and leadership training programs to provide technical assistance to State Eisenhower mathematics and science education coordinators.

The Department will join other agencies through the FCCSET-CEHR to coordinate Federal support. This will encourage greater coordination among States and localities so that all funds can form a vector of support for systemic change and reform efforts. Through these efforts the dramatic changes needed to reach national education goals can be sustained from year to year.

Chart 1
ED Education Budget FY 1992



HIGHLIGHT The new Mathematics and Science Achievement Awards initiative will provide $40 million to school systems that have demonstrated high levels of mathematics and science education improvement.

Table 1
Department of Education's FY '92 Budget Directly Supporting Mathematics and Science Education

Education Level	FY 1992 (in millions)	FY 1991-92 Change (Dollars)	(Percent)
Total	$329.9	$94.9	40.3%
Precollege	$313.8	$85.7	37.6%
Teacher Enhancement	$239.0	$37.0	18.3%
Curriculum	$ 34.8	$ 8.7	33.3%
Undergraduate	$ 16.1	$ 9.2	133.0%
Curriculum	$ 6.1	$ 0.2	3.3%
Student Incentives	$ 10.0	$ 1.0	900.0%

ED MATHEMATICS AND SCIENCE MISSION

The Department of Education has been strengthening its efforts in mathematics and science education over the past several years. The Eisenhower Mathematics and Science State Grant Program remains the cornerstone program in these subjects, having received a 59% increase in FY 1991. However, other activities also received attention in FY 1991. The aim of the Department is to provide a balanced portfolio of programs that will benefit teachers, students, and schools at all educational levels. To this end, a number of initiatives have been undertaken.

Cooperation and collaborative support for programs among Federal agencies is a key part of the Department's strategy to improve mathematics and science education. Working with the National Science Foundation, for example, the Department is supporting several national efforts to improve mathematics assessment, the dissemination of exemplary materials and the design of secondary science education. Further, the Department is working with other agencies to strengthen the clearinghouse function with regard to research information, materials, and exemplary practice.

As part of its competition for national research and development centers, the Office of Educational Research and Improvement has recently funded two five-year **National Research and Development Centers, one in Mathematics and one in Science Education.** The mathematics center is located at the University of Wisconsin-Madison while the science center is at Ohio State University. The mathematics Center mission includes development of authentic assessments of mathematics instruction and techniques for implementation of board scale mathematics curriculum changes. The Science Center will include study of incentives for students to select science careers and the relevance of science to their daily lives.

The purpose of these centers is to provide a focus for research in learning, teaching and assessment that will inform and enhance reforms underway in these subject areas. These Centers will also disseminate current findings to practitioners and policymakers, as well as to researchers. A total of $1.4 million was awarded to these two centers in FY 1991.

On April 5, 1989, as part of the Educational Excellence Act of 1989, President Bush submitted to Congress a proposal to create a **National Science Scholars** program. The authorization for this program, which will be administered by the Department of Education, was enacted by

HIGHLIGHT With additional FY 1992 funds, the Eisenhower Mathematics and Science Education State Grants program will be able to place priority on assisting elementary and middle school teachers.

Congress and signed into law on November 16, 1990. The high visibility, prestigious nature and significant financial reward of these scholarships will draw the attention of educators, capable high school students and the American public to the importance of science and mathematics education. More specifically, by recognizing their achievement, the program will provide an incentive to high school students to excel in science and mathematics at the postsecondary education level.

In a high school biology lab, young women discover the fascination of science.

The **Eisenhower State Mathematics and Science Education Program** is the largest single precollege math and science program supported by any Federal agency. Because of the Department's concern about program accountability, the Department contracted for a **two-year national study** of the State Mathematics and Science Education Program, which was completed in the fall of 1990. Although the program is relatively new, this study found that the program is already playing a role in reform efforts now taking place in a large number of school districts. Often the Eisenhower funds provide the major portion of support available for teacher development in many districts. Further, the program reaches large numbers of the Nation's teachers. In 1988-89, over 600,000 professional development experiences were supported. The Eisenhower State Grants program has also served the function of bringing together various elements of the educational system, from school districts to State agencies and institutions of higher education.

The **Eisenhower National Mathematics and Science Education Program** funds grants and cooperative agreements for projects of national significance in mathematics and science education. This program has been instrumental in promoting educational reform by supporting projects, such as the National Science Teachers Association project to reform the scope, sequence and coordination of secondary school science. Under this new design, students will study physics, chemistry, biology and earth/space science every year for six years. The Eisenhower National Program is also assisting **Project 2061**, the American Association for the Advancement of Science program aimed at fundamental reform of the long-term science and mathematics learning of American students. Several of these efforts are jointly funded by ED and the National Science Foundation. Eisenhower National funds are also used to provide technical assistance to State Eisenhower program leaders.

The **Office of Special Education Programs** recently funded studies analyzing general education mathematics and science curricula for grades K-8 and developing curricular approaches for

teaching mathematics and science to students with disabilities who are integrated into regular classrooms. These projects will generate curriculum guides to be used by textbook publishers, teachers and curriculum specialists.

To increase the number of exemplary mathematics and science projects in its network, the **National Diffusion Network (NDN)** and its technical assistance contractor initiated a search for new projects. NSF aided in the identification of projects, referring projects developed with NSF funds to the NDN program. Several of these projects have already become part of NDN and others are preparing for validation.

In December 1989, Deputy Secretary Ted Sanders organized Departmental Task Force on Mathematics and Science Education, chaired by the Director of the Office of Research and composed of representatives from each organizational unit in ED. The Task Force recommended procedures to identify exemplary mathematics and science programs. Recommendations also included new approaches to extend the mathematics and science education impact of formula grant programs.

Deputy Education Secretary Ted Sanders talks with high school students about their perspective on education and our world.

Deputy Secretary Sanders has already established a Department-wide **Mathematics and Science Education Steering Committee** and charged it with determining how the Task Force's recommendations can be implemented.

INTERAGENCY COOPERATION

The Department has a wide range of interactions with other Federal agencies regarding its mathematics and science education programs. The Eisenhower Program has coordinated its planning with NSF, NASA and the Department of Energy. ED and the Department of Energy have signed a memorandum of understanding to encourage and facilitate closer relationships between States and local school districts and Department of Energy facilities.

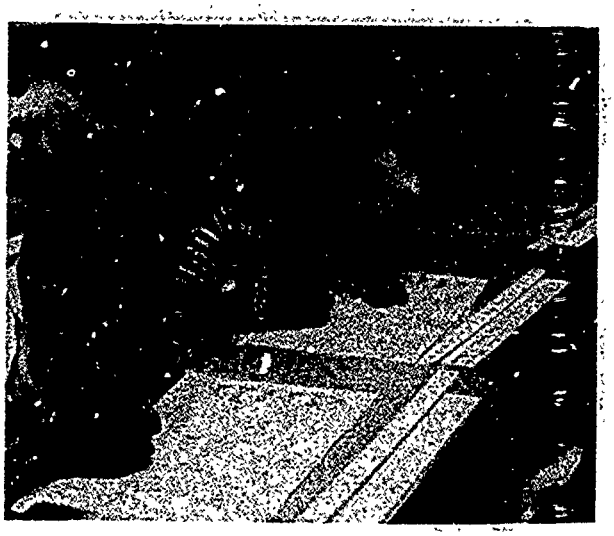
The Department has designated Assistant Secretary Christopher T. Cross to coordinate interagency activities. Joint funding ventures have been undertaken with NSF on a number of projects, including AAAS's Project 2061 and the Mathematical Sciences Education Board of the National Academy of Sciences.

NEW INITIATIVES

Mathematics and science education is a major priority for the Department of Education in FY 1992 and beyond. The Department is recommending the establishment of one new program that specifically targets mathematics and science education and a major expansion of another that began in 1991.

125

HIGHLIGHT With additional FY 1992 funds, the Eisenhower National Mathematics and Science Education program will include an emphasis on projects aimed at changing the whole school to support mathematics and science teaching and learning.



Tasks involving handwriting and drawing help children improve hand-eye coordination and learn skills essential to reading and arithmetic.

Mathematics and Science Achievement Award
This program, a new initiative proposed by the Department for 1992, is meant to stimulate schools in their attempt to better students' achievement in mathematics and science. Its requested appropriation of $40,000,000 would be used to reward school districts whose students have demonstrated the highest level of improvement in mathematics and science performance. **(Precollege Other - $40 million)**

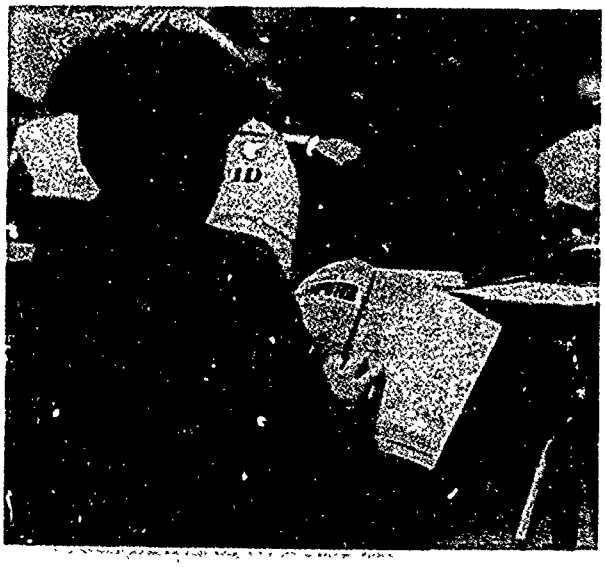
National Science Scholars
Many colleges and universities have recently reported precipitous decreases in mathematics and science undergraduate majors. With graduate science and engineering programs that already consist of up to 50% foreign enrollments, the U.S. is not maintaining an adequate supply of new candidates for the science professions.

The National Science Scholars Program provides an excellent vehicle to begin addressing these problems. Scholarships of up to $5000 per year will be given to two students in each Congressional district. The request for FY 1992 will increase the program by 900%, permitting a much larger set of awards to beginning undergraduate students while continuing to support the first set of awardees in their sophomore year. The Science Scholars Program is projected to grow to $20 million by FY 1994. **(Undergraduate Direct Student Support - $10 million).**

ONGOING PROGRAMS

Precollege Programs

Eisenhower Mathematics and Science Education State Grants Program
The Eisenhower State Grants program provides assistance to State educational agencies, local educational agencies, and institutions of higher education to strengthen the economic competitiveness and national security of the United States by improving the skills of teachers and the quality of instruction in mathematics and science. Since the bulk of Eisenhower funding is available



A middle school child takes an interest in the operation of computers and their varied uses.

HIGHLIGHT Increased FY 1992 funding will expand the National Science Scholars program by 900%.

through formula grants, the program is easily accessible and popular with grantees. The requested increase to $239 million will permit greater flexibility in programming at State and local levels, and increase the opportunities for cooperation with NSF's Teacher Preparation and Enhancement program.
(Precollege Teacher Enhancement - $239 million)

Eisenhower National Program
This program is a major component of the Department's efforts to ensure that U.S. students will be first in the world in science and mathematics achievement by the year 2000. Anticipated priorities for 1992 include projects designed to implement curricula that would introduce students to and enable them to learn higher order mathematics and science concepts at earlier ages; and programs to encourage and assist persons with training and experience in mathematical and scientific fields to enter teaching through alternate teacher certification routes. Requested increases in program funding will support reforms at elementary and secondary levels that change the whole school rather a single element such as curriculum or teaching practices. Whenever possible, National programs will be designed to leverage Federal, State, and local funding, particularly Federal funds distributed by formula, such as Chapter 1 and Chapter 2.
(Precollege Curriculum Materials - $147 million)

National Assessment of Educational Progress (NAEP)
NAEP is the only nationally representative assessment of what American students know and can do. It is an ongoing, Congressionally mandated project created to survey the educational attainments of young Americans. Its primary goal is to determine and report the status and trends over time in educational achievement, subject by subject. In 1990, NAEP began the collection of mathematics achievement data to provide State-by-State comparisons. This initial testing was done in 8th grade. An increase of funds will permit this testing to be carried out in 4th as well as 8th grade in 1992.
(Precollege Curriculum Materials - $14 million)

National Research and Development Centers
The national education research and development centers are the Department's primary vehicle for supporting new research to inform efforts to improve the quality of American education and advance progress toward the goals. The Office of Educational Research and Improvement fully intends that the research and development centers will be active and essential partners in its effort to provide greater service and practical assistance to policymakers, practitioners and lay people throughout the country. In addition to the two centers that specifically address mathematics and science, at least 10 of the other 23 centers are engaged in efforts to improve mathematics and science education. These projects include mathematics, science and technology projects relating to teaching students at the elementary and secondary level, including the disadvantaged. **(Precollege Curriculum Materials - $2.0 million)**

National Diffusion Network (NDN)
NDN helps make available to schools, colleges, and other institutions hundreds of exemplary programs, many of which are in mathematics and science. In the last few years, NDN has issued a booklet of high quality mathematics programs and a companion booklet of outstanding science programs. One such program is Life Lab Science, an elementary school program that strives to

HIGHLIGHT Funding increases in FY 1992 will expand the state-by-state mathematics comparisons of the National Assessment of Educational Progress to 4th grade in addition to 8th grade.

ensure students' future interest and success in science by improving student attitudes toward the study of science, and increasing students' level of knowledge and skill acquisition in science. The instructional approach is a combination of indoor and outdoor hands-on science activities with the key component being the garden lab. Through a national network of "developer demonstrators" and "State facilitators", thousands of NDN programs have been adopted by schools and school districts. **(Precollege Curriculum Dissemination - $3.6 million)**

Educational Resources Information Center (ERIC)
ERIC is a nationwide information network that acquires, catalogs and provides access to education literature. The ERIC system includes 16 Clearinghouses. A Clearinghouse located at Ohio State University specifically focuses on Mathematics, Science and Environmental Education. This Clearinghouse generates syntheses and summaries on mathematics and science topics as well as compilations of promising programs and practices. **(Precollege Curriculum Dissemination - $400,000)**

Undergraduate Programs

Minority Science Improvement (MSIP)
MSIP provides financial assistance to projects at postsecondary institutions with predominantly minority enrollments. It is designed to enhance the capacity of such institutions to develop and to maintain quality science education programs, as well as to help increase the representation of ethnic minorities in science and engineering careers. Department studies indicate that MSIP has been successful in improving the quality of science instruction at participating institutions and in increasing the number of students in those institutions majoring in science.
(Undergraduate Curriculum Materials - $6.1 million)

Other Education Programs

Many other Department of Education programs support activities that promote improvements in mathematics and science education as part of their broader missions. The Department is taking steps to ensure that knowledge gained from the projects about how to improve science and mathematics education is made available to others who can benefit. Highlights of some of these activities include:

ESEA Title I, Chapter 1
Chapter 1 is the largest Federal elementary and secondary education program with a 1991 appropriation of over $6 billion. The program is designed to improve the access and quality of learning for disadvantaged children. Reading and mathematics are the major components of the LEA grants program, with approximately 45 percent of the participants receiving mathematics instruction. In 1987-88, the program involved 66,000 teachers, 4.9 million children (2.2 million in mathematics), and nearly all of the LEAs in the country.

Star Schools
Star Schools supports telecommunications partnerships of schools, higher education institutions, industry and others to develop, construct, or acquire telecommunications equipment, develop and acquire instructional programming, and obtain technical assistance. The purpose is to improve instruction in science, mathematics, foreign languages and other subjects, primarily by means of satellite or microwave relay between centrally located sources of instruction and stu-

dents in different locations, especially students in Chapter 1 schools or with limited access to instruction in science, mathematics, and foreign languages.

Technology, Educational Media, and Materials for Individuals with Disabilities
This program supports projects and centers that advance the availability, quality, use, and effectiveness of technology, educational media, and materials in the education of children and youth with disabilities. In FY 1990, approximately 15 percent was spent on projects in mathematics and science areas. The program recently sponsored national conference on cognitive and metacognitive approaches to mathematics instruction, and research and development on interactive assessment technologies that use microcomputer-based expert systems and artificial intelligence for mathematics instruction.

Fund for Innovation in Education (FIE)
FIE supports projects that strengthen and expand appropriate uses of technology and other innovative approaches to the comprehensive reform of public and private elementary and secondary schools. Mathematics and science education accounted for 21% of this program in 1990. For example, BBN Systems and Technologies Corp. of Cambridge, Massachusetts is developing a collaborative teacher-enhancement program for middle school mathematics teachers. This system draws on a computer curriculum developed by BBN.

Magnets Schools Assistance
This program provides grants to eligible local educational agencies to establish and operate magnet schools that are part of approved desegregation plans and offer special curricula designed to attract students from different social, economic, racial, and ethnic backgrounds. A substantial proportion of magnet schools are focused on mathematics and science instruction. For example, the Long Beach (CA) Unified School district is using its grant for an aerospace technology magnet program.

Vocational Education
The Vocational Education appropriation supports programs designed to train a skilled and literate workforce. These funds are used by State and local administrators to expand and improve vocational education programs, and ensure equal opportunity in vocational education programs to traditionally underserved populations. With current concern for applied science and technology, vocational education has become a focus for mathematics and science. The reauthorization of the Perkins Act also stresses the integration of basic academic subject matter with vocational education, providing greater opportunities for mathematics and science learning.

Fund for the Improvement of Postsecondary Education (FIPSE)
FIPSE stimulates institutions of higher education to identify and pursue improvement in educational quality. The program supports a wide range of curriculum reform, faculty development, and educational improvement projects. Approximately one-quarter of the FIPSE projects in recent years have dealt with mathematics and science in four broad categories — postsecondary mathematics curriculum and faculty development, postsecondary science curriculum and faculty development, minority access and retention in science and mathematics, and teacher education for mathematics and science. For example, Bridgewater State College (MA)

provided academic support for minority and disadvantaged students to improve their performance in calculus.

EDUCATION DEPARTMENT PROGRAM CONTACTS

Assistant Secretary, Office of Educational Research and Improvement (OERI)
Christopher Cross (202) 219-2050
David Florio (202) 219-2050
Interagency Cooperative Arrangements

Office of Research (OERI)
Milton Goldberg (202) 219-2079
Conrad Katzenmeyer (202) 219-2210
Henrietta Moody (202) 219-1982
Research and Development Centers
Educational Resources Information Center
National Center for Educational Statistics
National Assessment of Educational Progress
Fund for the Improvement and Reform of Schools and Teaching(OERI)
Allen Schmieder (202) 219-1496
Eisenhower (National)
Fund for the Improvement and Reform of Schools and Teaching
Fund for Innovation in Education

Programs for the Improvement of Practice (OERI)
Mary Lewis Sivertsen (202) 219-2141
National Diffusion Network
Regional Laboratories
Star Schools
Javits Gifted and Talented Students Education

Office of Postsecondary Education (OPE)
John Childers (202) 708-8596
Lawrence Grayson (202) 708-5656
Argelia Velez-Rodriguez (202) 708-9996
National Science Scholars
Minority Science Improvement
Fund for the Improvement of Postsecondary Education

Office of Legislation (OL)
Sandra Cook (202) 401-1438

Office of Management (OM)
Ruth E. Hall (202) 401-0470

Office of Special Education and Rehabilitative Services (OSERS)
Tom V. Hanley (202) 732-1110
Research in Ed. of Individuals with Disabilities
Technology, Educational Media, and Materials for Individuals with Disabilities
Media and Captioning Services
Special Education — State Grants

Office of Private Education (OPRE)
Karen Kelly (202) 401-1365

Office Intergovernmental and Interagency Affairs (OIIA)
Mary Whitten Neal (202) 401-0427
Samuel McKee (202) 401-0430

Office of the General Counsel (OGC)
Richard Mellman (202) 401-0807

Office of Vocational and Adult Education (OVAE)
Winnie Warnat (202) 732-2441
Vocational Education Programs

Office of Elementary and Secondary Education (OESE)
Lee Wickline (202) 401-1062
Eisenhower (State)
Elementary and Secondary Education Act-Chapter 1
Magnet Schools (Desegregation)

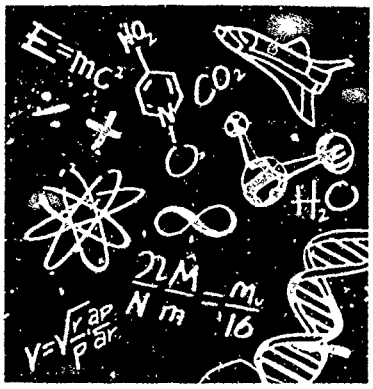
Office of Planning, Budget and Evaluation (OPBE)
Joanne Wiggins (202) 401-1958
Eisenhower State Program study

Office of Bilingual Education and Minority Languages Affairs
(OBEMLA)
Esther Yao (202) 732-5063
Bilingual Programs

Office for Civil Rights (OCR)
Anne Yorke (202) 723-1505

"We need to start now to show our kids that they do have a future and that they can learn science and math without being afraid. If we do not step up our efforts, the U.S. will relinquish what to date has been an American birthright, preeminence in science and discovery."

James D. Watkins
Admiral, U.S. Navy (Retired)
Secretary of Energy

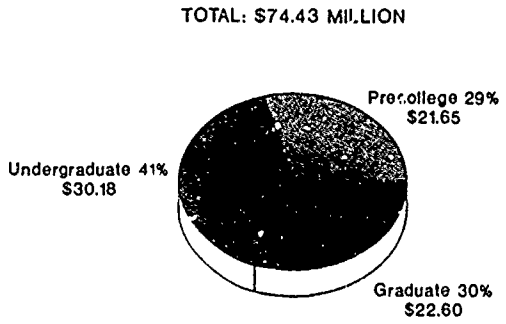


AGENCY OVERVIEW

Mission and Structure

The U.S. Department of Energy (DOE) was created in 1977 by the Department of Energy Organization Act, which consolidated into one Cabinet-level department the responsibilities previously carried out under the Atomic Energy Commission, the Energy Research and Development Administration, several other small, independent energy-related agencies, and offices in other Federal departments. The President's FY 1992 budget request for the Department of Energy is $18.9 billion, of which $74.43 million is earmarked for math, science and engineering education programs.

DOE carries out missions that include fundamental scientific research, research and development of energy technology, energy conservation, strategic weapons development, energy regulation, energy data collection and analysis, Federal power marketing, and education in science and technology. To fulfill these functions, DOE and its contractors employ approximately 146,000 men and women, over one-third of whom, about 50,000, fill positions in DOE's scientific, engineering and technical workforce.



In millions of dollars

Chart 1
DOE Education Budget FY 1992

Eight offices administer the majority of DOE's research and development programs: Energy Research, Civilian Radioactive Waste Management, New Production Reactors, Environmental Restoration and Waste Management, Fossil Energy, Nuclear Energy, Conservation and Renewable Energy, and Defense Programs. Three additional offices also have programmatic responsibilities in science and technology: Environment, Safety and Health, International Affairs and Energy Emergencies, and Minority Economic Impact. The remaining offices discharge Department-wide support functions, such as policy analysis, financial and legal management, personnel administration and public affairs.

In addition to its headquarters components, the Department has an extensive field structure of laboratories, research facilities, regional operations and support offices, and regional power administrations. These facilities are dispersed widely across urban and rural areas of the country.

Of particular relevance to mathematics and science education are the 9 National Laboratories and 30 additional specialized research facilities. Within the walls of DOE laboratories, some of the most exciting research in contemporary science is conducted. The National Synchrotron Light Source, the Fermi Accelerator and the Superconducting Super Collider projects, lasers, electron microscopes, advanced robotics and supercomputers are examples of some of the unique tools that DOE employs in exploring research frontiers. Nobel laureates and other eminent scientists employed by DOE laboratories

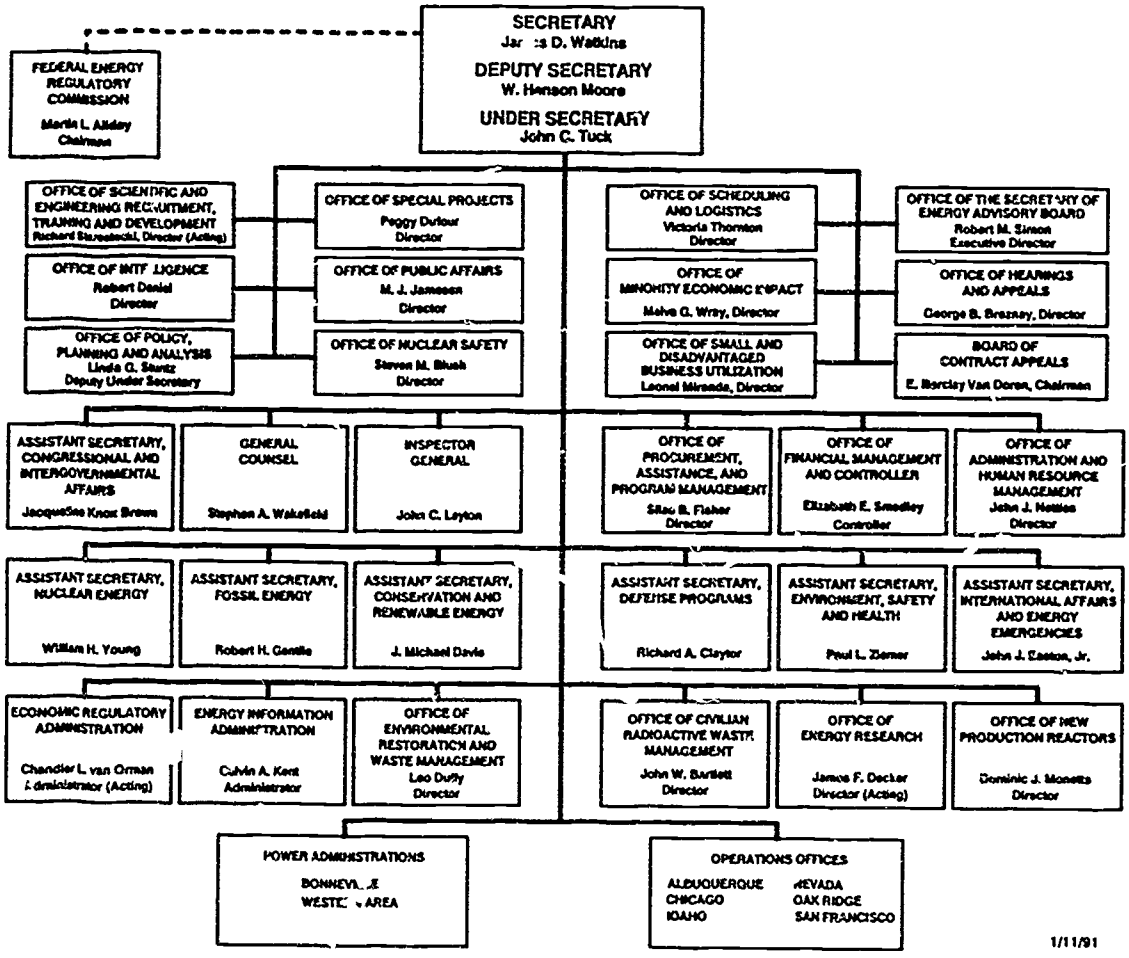


Table of Organization - Department of Energy

have accomplished landmark work in physics, chemistry, biology, materials science and other disciplines. The Department oversees an unparalleled collection of scientific and technical facilities and equipment with extraordinary potential for kindling in students and the general public a sense of excitement about science, and increasing public science literacy. During 1990, programs at the Department's facilities reached over 200,000 teachers and students.

Education Mission

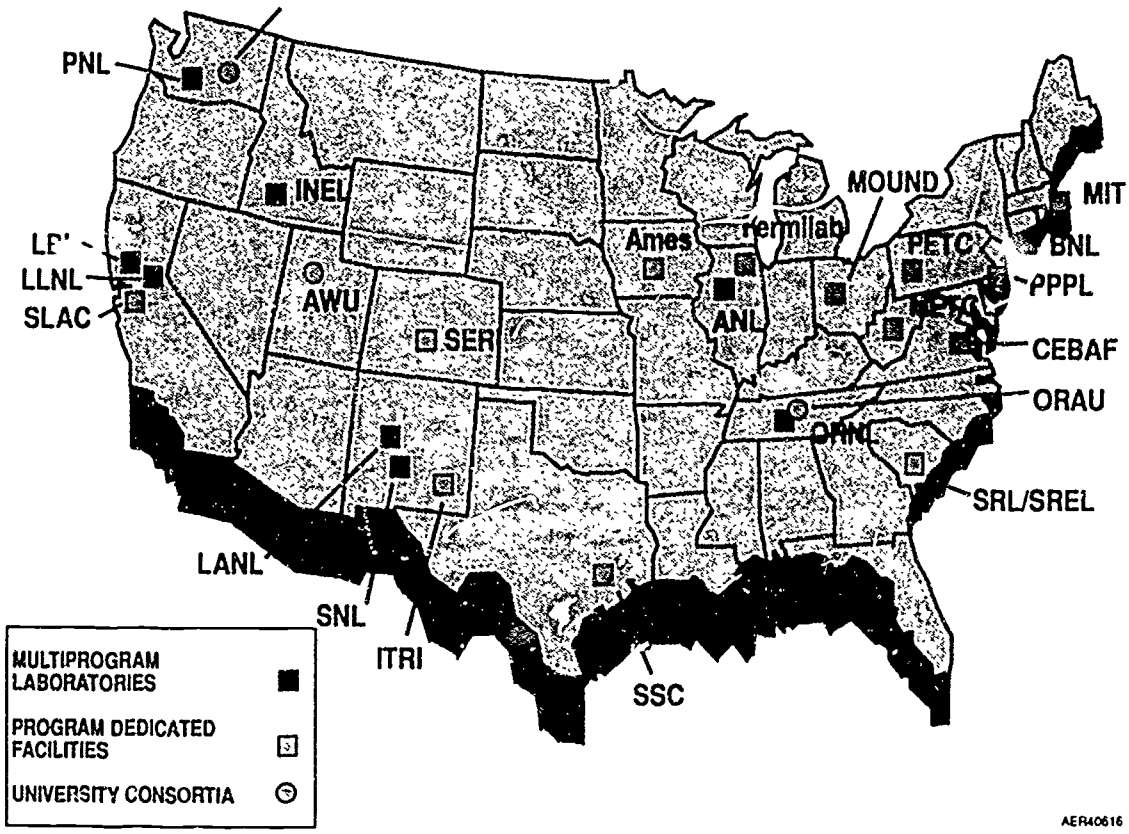
Like all mission agencies, DOE is both a user and a patron of a large portion of the Nation's scientific and engineering talent. DOE needs a steady flow of well-educated, highly skilled scientific and technical personnel to carry out its basic research and development and operational missions.

In recognition of this need, education has been an essential part of the Department's mission

since its creation, just as it was under the Atomic Energy Commission and other predecessor agencies. Traditionally, the emphasis was on university-level education, through student scholarships and research appointments at DOE facilities. In recent years, however, the education mission has expanded to include precollege and public education.

The 1977 DOE Organization Act authorizes education and training activities necessary to ensure the Nation an adequate technical workforce in energy-related research and production fields, including mathematics, physics, geology, chemistry, zoology, biology and other areas of basic and applied research. The Department of Energy Science Education Act of 1990 (P.L. 101-50, Section 3161) expands the Department's authorization to support science education, and amends the 1977 Act to make support for science education a major mission of the Department.

The Department's Office of Energy Research (ER) is the principal DOE organization responsible for the execution of this mission. ER directly supports a variety of science and engineering education programs from the precollege to the postgraduate levels. In 1990, Secretary Watkins created the new Office of University and Science Education Programs within Energy Research to serve as the coordination center for the Department's education activities.



DOE Laboratories and Other Education Sites

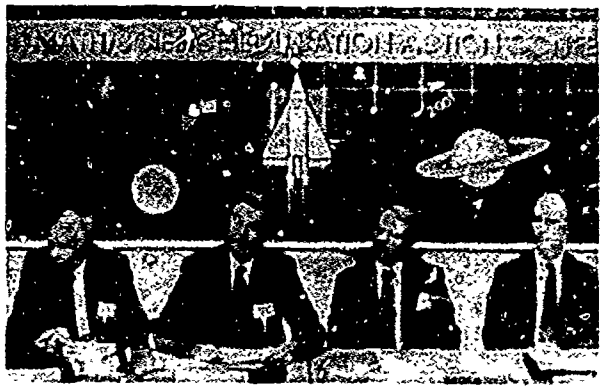
In collaboration with this new office, other DOE program offices support national education activities related to their own program functions. For example, the Office of Environmental Remediation and Waste Management is developing major new educational initiatives to encourage more young people to consider careers in environmental remediation, enhance the skills of teachers, and improve public awareness of environmental and waste management issues. The Office of Fossil Energy supports efforts to reach elementary school students with information on coal, oil and the use of fossil fuels. The Office of Conservation and Renewable Energy sponsors the annual SunRayce and an energy conservation program in schools.

DOE provides its most substantial support of education through its National Laboratories and other research facilities, e.g., Morgantown and Pittsburgh Energy Technology Centers, with each conducting its own education programs and making its resources available to precollege and university faculty and students. Each center plans and administers a range of precollege and university science education programs, which vary according to laboratory specializations and local needs, and which place special emphasis on providing students and their teachers with hands-on experiences in cutting-edge science and technology. A list of the Education Directors at these facilities may be found at the end of this chapter.

To chart a new course for its precollege education efforts, the Secretary convened the Math/Science Education Action Conference, a assembly of government, education, science and business leaders held in Berkeley, California, ten days after the Charlottesville Education Summit. The conference report, published in May 1990, outlines a new Departmental strategy for precollege science education. It presents a set of public-private initiatives to be undertaken by the Department and its laboratories, in partnership with other Federal agencies, States, schools, businesses, industries, and community groups.

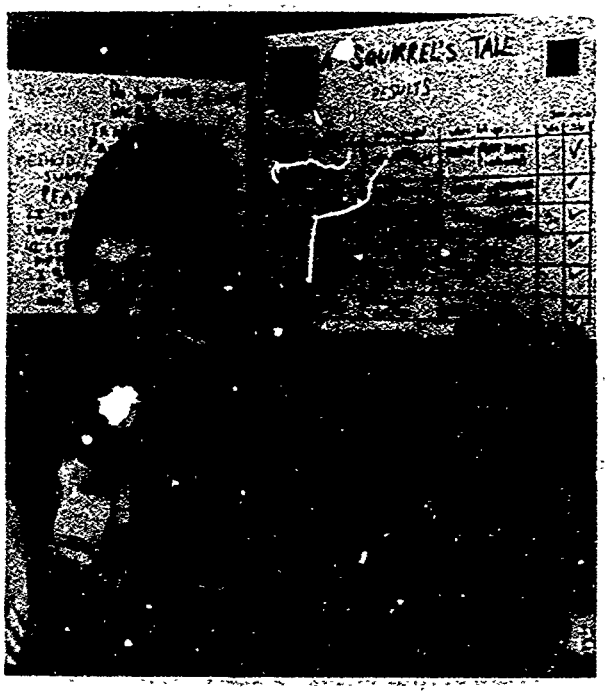
The strategy is based on five premises:

- Serious efforts to produce students with excellent math and science skills must begin at the elementary school level and reach all students.
- Science and math teachers must become full partners in the scientific community.
- Programs must encourage full participation by women and minorities, groups currently underrepresented in math and science fields.
- DOE must utilize more fully its unique, regional scientific facilities and staff to improve math and science education.



News Conference at the Math/Science Education Action Conference at the Lawrence Hall of Science in Berkeley, held in October 1989. (l-r) Dr Glenn T Seaborg, Nobel laureate, and Admiral James D. Watkins, Secretary of Energy, co-chairmen of the conference; Vice Admiral Richard H. Truly, Administrator of NASA, and Dr. David P. Gardner, President of the University of California.

- DOE's efforts must be integrated with those of other Federal agencies, the States and Territories and the private sector to yield the greatest benefit for the Nation.



The smile of pride. Kindergartner Corey Sack won a blue ribbon in the 1989 Brookhaven National Laboratory's Elementary School Science Fair for her entry "A Squirrel's Tale," which documented her observations of squirrel behavior.

Many of DOE's major laboratories are located near large cities or disadvantaged rural areas and have the potential to reach large numbers of urban, rural, minority and low-income students, groups currently underrepresented in the science and technology pipeline. DOE scientists and engineers have the knowledge and equipment to expose students and teachers to exciting frontiers in science. By working with local school districts, State education officers and local industry, DOE scientists can make a great contribution to math and science education.

At the heart of the strategy, therefore, are the specific education initiatives that DOE and its National Laboratories and research facilities are undertaking in partnership with others. These initiatives include formal agreements with other agencies, teacher training activities using Laboratory facilities, programs for groups of students underrepresented in science and technology fields, and volunteer and community programs involving DOE scientists, engineers and technicians. Together they form the "next wave" of DOE's education mission.

The thrusts of the action plan—more emphasis on precollege student and teacher activities, increased use of DOE's facilities, partnership and coordination—became formal policy when Secretary Watkins issued a notice on May 21, 1990, expanding the Department's education mission. This Notice directed all DOE offices, facilities and contractors to commit programmatic funding and overhead support to education, through such activities as loans of equipment and staff to schools, education-oriented community service by DOE employees, and joint programs with schools, businesses, museums and other community partners. In addition, the Notice expanded the missions of all the technology program offices to include support for program-specific science education activities.

BUDGET PRIORITIES FOR FY 1992

The President's request for (Category 1) DOE math and science education programs in FY 1992 is $74.43 million, representing a 16% increase in the Department's science education commitment over the FY 1991 enacted level, and a 77% increase over FY 1990. Additional indirect (Category 2) support will be provided for higher education through the awarding of approximately

$450 million in university research grants as requested for FY 1992, which will support the training of over 4,000 graduate students.

The following charts show the distribution of funds among precollege, undergraduate and graduate programs in the FY 1992 budget request, and the growth in these programs from FY 1990 to FY 1992:

Table 1
Changes in DOE's Education Budget from FY 1991 to 1992

	FY 1991	FY 1992	Dollars Increase	Percent Increase
Total	$64.14	$74.43	$10.29	
Precollege	$20.82	$21.65	$ 0.83	4%
Undergraduate	$20.53	$30.18	$ 9.65	47%
Graduate	$22.79	$22.60	-$ 0.19	0%

dollars in millions

Chart 2
DOE Growth by Education Level FY 1990-92

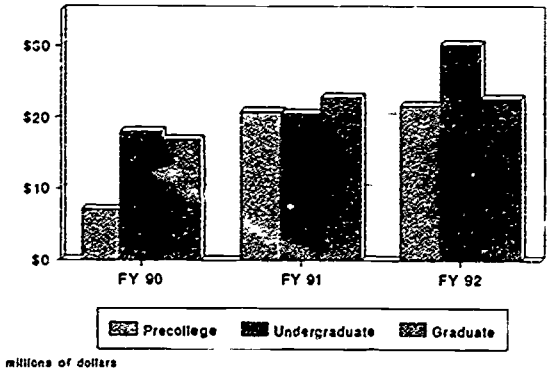
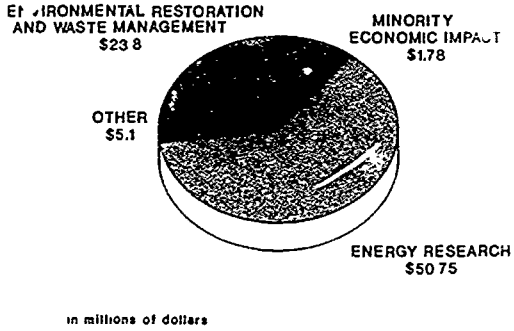


Chart 3
DOE Education Funding by Program Office



The largest concentration of DOE education funds and the largest increase in precollege funds are within the Office of Energy Research (ER). ER has the responsibility of overseeing the National Laboratories in which most of the new initiatives are taking place. For FY 1992, ER education programs total $49.25 million. The second largest site of DOE education programs is the Office of Environmental Restoration and Waste Management (EM). The primary educational focus of this office is the undergraduate level. For FY 1992, EM education programs total $18.3 million. The Office of Minority Economic Impact (MI) carries out programs designed to reach underrepresented minorities and encourages their pursuit of careers in science and technology. MI education programs total $1.78 million in FY 1992. The remainder of the DOE FY 1992 education request, $5.1 million, is targeted for graduate fellowships in three program offices: Nuclear Energy ($2.5 million), Environmental Safety and Health ($1.9 million); and Civilian Radioactive Waste Management ($700,000).

Compared with FY 1991, the FY 1992 budget request contains a larger increase for undergraduate programs than for precollege programs. The

Education Summit in September 1989 ushered in a period of considerable growth in DOE precollege education programs. Immediately following the Summit, the Secretary shifted funds to precollege programs through reallocation. In a single year, FY 1991, the DOE budget for precollege education nearly tripled—from $7.12 million in FY 1990 to $20.82 million in FY 1991. During the same period, the DOE budget for undergraduate education grew by 14%.

Recognizing the emerging need for trained technical workers in critical energy fields, the Department has placed special emphasis this year on undergraduate education. The FY 1992 request of $30.18 million for undergraduate education represents a 47% increase over FY 1991. The proposed expansion is a direct and immediate response to DOE's workforce need for technicians and other skilled personnel in such fields as environmental remediation, waste management and nuclear energy. Investments in undergraduate education, particularly at the two-year college level, can yield quick, tangible returns: within 24 months, a community college can produce a skilled technician, ready to join the energy workforce.

The DOE education budget priorities for FY 1992 are consistent with and supportive of the National Education Goals and the CEHR priorities. In FY 1992, 92% of the requested funding is for programs identified as high priority by CEHR. These priorities will also be reflected in the National Energy Strategy, which will include education and human resource development strategy items.

The remainder of this chapter discusses the Department of Energy education programs, grouped as follows: new initiatives, ongoing programs, volunteer programs and laboratory outreach, and partnership agreements.

NEW INITIATIVES

Nearly all of the new education initiatives announced by the Department in FY 1991 and FY 1992 are at the precollege level. These programs fall almost entirely into the "informal" or "non-classroom based" category developed by CEHR.

The new initiatives have two broad purposes:

- Providing opportunities for students and teachers to improve their scientific and technical skills and knowledge, often by working directly with DOE scientific and research personnel.
- Utilizing the unique resources of the Department's National Laboratories to support and prepare young people for careers in science, mathematics and technology, especially students from groups underrepresented in these professions.

Precollege

Most of the new Departmental activity in precollege education tracks two of the top precollege priorities of CEHR: (1) training and improving the skills of teachers; and (2) establishing "comprehensive" programs to revitalize mathematics and science education throughout a community or a region, in partnership with urban and rural school districts, business and industry.

These activities are categorized as "Comprehensive," and are predominantly managed through the ER Office of University and

HIGHLIGHT Comprehensive DOE laboratory partnerships with local school districts will reach many thousands of students and teachers in 19 States, the District of Columbia and Puerto Rico. These long-term partnerships are expected to raise student performance and increase teacher preparedness through hands-on classroom work, improved curriculum materials, and visits to DOE laboratories and local science institutions. These cooperative efforts link DOE scientists with local teachers, students, parents and administrators on a daily basis.

Science Education Programs. Total FY 1992 funding in the Precollege Comprehensive category is $6.4 million.

Chicago Science Explorers
A collaboration of Argonne, Fermilab, the Chicago Public Schools, 10 other Chicago science education institutions, and local business and industry, the Science Explorers program uses *The New Explorers* PBS science television series to stimulate interest in science and mathematics among all 410,000 Chicago students. *The New Explorers*, hosted by Chicago anchorman Bill Kurtis, shows how scientists explore the new frontiers of science and technology and how exciting their work is.

Each program in the series is followed up with corresponding classroom materials and visits to local labs, museums, planetariums, aquariums and industry sites. Teachers are trained to use the programs, supporting activities and materials in a coordinated way. Activities also include meetings with DOE and other scientists, as well as career discussions and mentoring by retired scientists. Over 17,000 Chicago Public School students and their teachers participated in the Explorers Program in May 1990. The series began its national broadcasts in January 1991.

Science and Mathematics Action for Revitalized Teaching (SMART)
Established by DOE facilities in the Oak Ridge, Tennessee region, SMART links three local school systems in Chattanooga and Roane Counties with Oak Ridge Associated Universities (ORAU) and the Oak Ridge National Laboratory (ORNL). Scientists and staff at ORAU and ORNL, in partnership with local business and industry, will work closely with school district teachers, counselors and administrators to increase the effectiveness of K-12 science and mathematics education. The program is multi-year and comprehensive and is intended to reach every teacher and student in the three participating districts with research participation, workshops, and summer camps. In addition, a number of DOE laboratory employees will be volunteering their time for this initiative.

OPTIONS
Begun in Spring 1990, the OPTIONS Program involves the Pacific Northwest Laboratory in a collaborative effort in Washington and Oregon to improve science education opportunities and promote awareness of science careers for Hispanic, black and Native American populations in the Yakima Valley and Portland areas. The program is focused on middle school students in the target regions. Students are paired with scientist mentors and also receive ID cards with an 800 number they can use to call for homework assistance and other help.

Students in Pacific Northwest Laboratory's OPTIONS program get help from a PNL scientist in their study of robotics.

HIGHLIGHT The OPTIONS program will be expanded in FY 1992 to include several hundred middle school students in the Seattle area.

Native American and Hispanic Initiatives
The Sandia and Los Alamos National Laboratories are working to improve mathematics and science education in Native American schools, including Tribal Schools, in New Mexico and Arizona and in the predominantly Hispanic schools of the Albuquerque Public School system (APS). Through Sandia's Science Advisors Program scientists serve as consultants to teachers and mentors to students in APS.

Rural Teacher Training Program
The Rural Teacher Training Program was developed by Los Alamos and Sandia National Laboratories to enhance the skills of middle school science and mathematics teachers in the rural areas of New Mexico with large Hispanic populations. The three-year program provides a summer training institute at the laboratories, academic year followup, and classroom visits, as well as teacher research experiences at the two DOE laboratories.

Chicago Academy for Mathematics and Science Teachers
The Academy's goal is to enhance the math and science teaching skills of the 15,000 mathematics and science teachers in the Chicago Public Schools and provide specialized training for all new teachers, with the ultimate goal of better preparing Chicago's 410,000 students in mathematics and science. In addition to providing funding, DOE will loan scientific and technical personnel and offer teachers hands-on experiences in state-of-the-art science at DOE's two Chicago-based laboratories, Argonne and Fermilab. The National Science Foundation, the State of Illinois, the local teachers' union, a consortium of businesses, and local Chicago colleges and universities will also contribute funding, oversight and other services.

Bay Area Science and Technology Educational Collaboration (BASTEC)
BASTEC is a multi-laboratory regional initiative to improve mathematics, science and technology education in grades K-12 of the Oakland Unified School District. All 2,800 mathematics and science teachers will participate in teacher enhancement programs. BASTEC partners include four DOE National Laboratories (the lead laboratory Lawrence Berkeley, Lawrence Livermore, Stanford Linear Accelerator Center and Sandia-Livermore). business and industry, universities and community-based organizations.

Alternative Certification
The University of Tennessee, Knoxville, in association with the Oak Ridge National Laboratory, has developed a pilot program in alternative certification of science and mathematics teachers for rural school districts. The purpose is to encourage and support scientifically and technically trained professionals to pursue new careers as precollege science and mathematics teachers.

Mathematics Initiative
This laboratory initiative supports summer research appointments on new concepts and techniques in math instruction for high school math teachers and math coordinators. It also funds cost-shared projects with NASA and NSF for development of advanced computer graphics for use in middle schools. The major focus is on inner-city and rural teachers.
(Precollege Teachers - $1.75 million)

Undergraduate

As part of a continuum of efforts to keep students in the science pipeline, the Department has also expanded its support of undergraduate-level science education programs, particularly those

HIGHLIGHT In FY 1992, the first group of Oak Ridge National Laboratory scientists will complete the University of Tennessee pilot program and receive certification to teach elementary or secondary science classes.

that encourage students from underrepresented groups to pursue scientific and technical studies and participate in cutting-edge research. Over the past year, DOE has worked to develop stronger ties to minority educational institutions to expand opportunities for minority students seeking careers in energy-related technical fields.

Minority Undergraduate Training for Energy-Related Careers (MUTEC)
This program seeks increase the number of minority students selecting courses of study that specifically lead to energy-related careers. Institutions receive grants to strengthen or create energy-related undergraduate research programs. Students receive scholarship assistance, summer job opportunities at DOE and industrial labs, and mentoring and counseling on future career and educational options. Faculty members at participating institutions are also involved in research on energy-related topics.
(Undergraduate Direct Student Support - $850,000)

Brenda Laster, a researcher at Brookhaven National Laboratory, uses sign language to discuss a scientific experiment with Eva Marie Holloway, a recent graduate of Gallaudet University in Washington, D.C., a school for the hearing impaired. Holloway is one of three Gallaudet students who participated in BNL's summer research program for college students in 1990.

Native American Scholarship Program
Co-sponsored with Johnson & Johnson Company, the Native American Scholarship Program encourages Native Americans and other historically disadvantaged students to pursue technical degrees at community colleges in such fields as environmental restoration and waste management.

Gallaudet University Program
This program provides hearing-impaired students and faculty from Gallaudet University in Washington, D.C. with summer research appointments at Brookhaven National Laboratory (BNL). Participants engage in intensive research under the guidance of BNL scientists, who have learned to "sign." With implications for all laboratories, this unique effort demonstrates ways to adapt the laboratory working environment for hearing-impaired researchers.
(Undergraduate Direct Student Support - $100,000)

University Partnerships for Environmental Restoration and Waste Management Curriculum
A major initiative of the Office of Environmental Remediation and Waste Management, this program supports partnerships among universities, industry and laboratories to update curriculum, expand course offerings, develop faculty, increase public and student awareness, and increase the number of professionals, especially technicians, in the growing field of environmental restoration and waste management. A 15-member consortium of Historically Black Colleges and Universities (HBCUs) and Minority Institutions were recently awarded $4.3 million through this program, for a collaborative project on two- and four-year college curriculum development. Another example is the Savannah River Laboratory's establishment of four-year under-

HIGHLIGHT The Gallaudet University program will be expanded in FY 1992 to bring an additional six hearing impaired undergraduate students and two faculty members to Brookhaven National Laboratory for summer research.

graduate scholarships, through the South Carolina University Research and Education Foundation, for women and underrepresented minorities to obtain science and engineering degrees in environmental restoration and waste managment fields.
(Undergraduate Curriculum/Faculty - $11.5 million)

Graduate

The historic focus of DOE efforts has been at the graduate and postdoctoral levels, through DOE support of university research. New initiatives at the graduate level concentrate on preparing skilled workers in energy-related fields with projected national need.

Fellowship Programs
In response to projected increases in demand, DOE is expanding its graduate research fellowships to provide 80 new fellowships in nuclear engineering and up to 40 new fellowships in environmental restoration and waste management.
(Predoctoral Fellowships - $1.8 million)
(Postdoctoral Fellowships $1.8 million)

Public Science Literacy

Public understanding of mathematics and science issues is vital if the Department is to exercise enlightened leadership in solving complex national energy issues. To increase public knowledge of scientific and technical subjects, DOE is co-sponsoring two television series that will appear on PBS next year and has initiated a museum exhibit program.

FUTURES
FUTURES is a television series designed to stimulate student interest in mathematics. Hosted by East Los Angeles teacher Jaime Escalante, the program shows how mathematics plays an integral part in a range of exciting careers, from skateboard design to architecture. Celebrity role models discuss how they use mathematics in their daily work. The series is co-sponsored by ARCO, IBM and the Carnegie Corporation of New York and will be seen by millions of students over the PBS instructional television network. Teacher workshops are being conducted at the Superconducting Super Collider and other National Laboratories.
(Precollege Other - $250,000)

The New Explorers
The New Explorers series described above is being shown nationally on PBS stations and is already being used in schools. With the help of local teachers and scientists, DOE and Argonne National Laboratory have developed teaching materials to accompany each program in the 13-part series. *The New Explorers* teaching materials and copies of the videotapes will be made available nationally to parents and teachers, through an 800 telephone number shown after the program. This series is co-sponsored by Waste Management, Inc. and AMOCO Corporation.
(Precollege Other - $500,000)

Museum Program
DOE is supporting museums in their efforts to develop exhibitions on energy-related science and technology that will travel to science museums across the country. The program supports interactive exhibits, hands-on activities, and film and video production. These exhibits also include materials suitable for use by students, parents and classroom teachers and will highlight energy conservation technology.
(Precollege Other - $1 million)

HIGHLIGHT Increased funding in FY 1992 will enable 15,000 teachers and 450,000 students on a national basis to use the instructional materials developed for *The New Explorers* PBS television series.

Fooble D. Robot gets an enthusiastic welcome from some of the 4,700 elementary school kids he talked to at DOE's American Museum of Science and Energy at Oak Ridge, TN. Fooble is part of an anti-drug program called "The Million Dollar Machine." It stresses to children that their bodies are "million dollar machines" and that they are responsible for their personal health.

ONGOING PROGRAMS

The FY 1992 budget plan provides continued and, in some cases, increased support for existing educational programs at the precollege, undergraduate and graduate levels.

Precollege

High School Science Student Honors Research Program

This national competitive program brings the very best high school science and mathematics students to National Laboratories for two weeks in the summer, where they perform and present to their peers actual research. Students from the 50 States, the District of Columbia, Puerto Rico, American Samoa, and several foreign countries attend. In response to an invitation from the Secretary, Governors select participants from their States. Three hundred seventy-four students are supported every summer. Approximately 40% are women or minorities. Seven National Laboratories participate.

(Precollege Direct Student Support - $1.4 million)

High School Student Research Apprenticeship Program

This program is designed to motivate freshmen and sophomore high school minority and female students to pursue science careers. About 130 students (over 80% minorities and women) come to a laboratory for six to eight weeks during the summer, where they do laboratory research, attend lectures and seminars, and participate in field activities. Four laboratories (Argonne, Brookhaven, Fermi and Pacific Northwest) were involved in FY 1990.

(Precollege Direct Student Support - $400,000)

High School Teacher Research Associates (TRAC) Program

Under this national competitive program, the Governors of each State (based on recommendations by the chief state school officers) nominate science and mathematics teachers for a special eight-week summer research experience at selected laboratories. Each year, 150 to 200 teachers participate, about half of whom are women. The teachers serve on research teams, and some prepare supplemental materials and experiments to take back to their classrooms. This program increases teacher awareness and understanding of current science and technology and promotes transfer of new knowledge to the classroom.

(Precollege Teacher Preparation/Enhancement - $2.5 million)

HIGHLIGHT Additional FY 1992 funding will enable the Department to create energy science and technology exhibits. Through DOE's new Museum Program, these will be seen by an estimated 400,000 elementary school students and their teachers nationwide.

Secretary Watkins meets high school physics students using a Van de Graaff accelerator at Argonne National Laboratory to perform experiments. (l-r) Iching Chang, Amy Reeder, Andrea Shisk and Julie Kim are participants in Argonne's comprehensive science education program for students and teachers.

PreFreshman Enrichment Program (PREP)
One national precollege program that is not laboratory-based is the PreFreshman Enrichment Program (PREP). Participating institutions, primarily colleges and universities with engineering degree programs, conduct summer institutes for students in grades 7-10. The goal is to keep students in the engineering pipeline by guiding them to select college preparatory science and mathematics courses. The summer activities focus on encouraging students, including women and minorities, to consider careers in science-related fields. PREP provides a number of pre-engineering enrichment experiences, including laboratory work, field trips, tutoring and counseling. Institutions are encouraged to share the cost, using university or industrial support. This program reaches about 6,000 students each summer.
(Precollege Direct Student Support - $2.65 million)

Undergraduate

Research Partnership Programs
During the school year and in the summers, DOE laboratories provide undergraduate science and engineering students with research opportunities at DOE facilities. Students are selected competitively and are carefully paired with a DOE scientist, with whom they participate in an ongoing research project. The summer Laboratory Cooperative Science Education Program places approximately 1,100 students per summer in over 20 DOE facilities.
(Undergraduate Direct Student Support - $6.5 million)

Minority Access to Energy-Related Careers (MAERC)
This four-year pilot project is a collaborative effort among four DOE laboratories, the Associated Western Universities, and the California State University system. The program identifies, encourages and supports minority undergraduate students as they pursue science or engineering careers.
(Undergraduate Direct Student Support - $500,000)

Science and Engineering Research Semester (SERS)
SERS provides semester-long research opportunities for about 400 students per year at six DOE laboratories. Competitively-selected students participate in cutting-edge research, learn more about their chosen fields of study, and gain experience working with sophisticated equipment.
(Undergraduate Direct Student Support - $3.6 million)

Undergraduate Faculty Development
Undergraduate faculty receive summer, academic

HIGHLIGHT The FY 1992 increase will allow 3,000 additional middle school students to spend the summer studying science on college campuses in DOE's PREP program.

year and sabbatical research appoi. tments at DOE facilities. Faculty may participate with students from their home campuses or conduct instructional sessions with their students. Complementary short-term education and training activities meet special training needs and reinforce subject matter knowledge about energy-related curricula. Supplementary activities include one- to four-week institutes on energy topics; workshops on topics closely tied to laboratory research programs; conferences; DOE staff lectures on university campuses; and faculty visits for continuing collaborative research with DOE staff. The FY 1992 request is expected to increase the number of participants by 30%.
(Undergraduate Faculty Preparation/ Enhancement - $2.4 million)

Laboratory Alliances with HBCUs and Minority Institutions
DOE National Laboratories have formed formal alliances with HBCUs and Minority Institutions (MIs) to provide comprehensive and long-term technical assistance to upgrade the research and teaching capabilities of the HBCUs and MIs and to attract and retain minority students in scientific and technical careers. Activities include faculty research opportunities at DOE facilities, student research opportunities, visiting scientists programs, academic support systems for minority students, seminars, new course development assistance, equipment loans and other support. Examples of partners are Lawrence Berkeley Laboratory with Jackson State University, and Sandia, Los Alamos and Oak Ridge National Laboratories with North Carolina A&T State University, New Mexico Highlands University and the Mendez Education Foundation in Puerto Rico. Other alliances are under development.
(Undergraduate Student Support and Faculty Enhancement - $3 million)

Minority Honors Training and Industrial Assistance Program
This program seeks to increase the number of minority students pursuing energy-related technology programs at two-year colleges by providing scholarships and other assistance. Students study such fields as computer science, electronics and engineering sciences.
(Undergraduate Direct Student Support - $430,000)

Graduate

Graduate Research Experiences
This program provides summer support for graduate students to conduct research at DOE facilities and also provides academic year support for graduate students to conduct short-term research (a few days to several weeks) using DOE's special equipment and resources. In addition, one-year appointments are available for full-time graduate students to carry out dissertation research in residence at DOE facilities when the necessary resources are not available on campus. Approximately 250 students participate.
(Graduate Direct Student Support - $1.66 million)

Graduate and Postdoctoral Fellowships
DOE provides merit-based fellowship support to approximately 100 pre- and post-doctoral participants per year in energy-related fields, including such disciplines as fusion science and engineering, health physics, nuclear engineering, and environmental waste management and remediation. Programs are conducted in cooperation with universities and industry, enabling students to combine study at universities with research at DOE or industrial laboratories.
(Graduate Direct Student Support - $16.5 million)

HIGHLIGHT Increased FY 1992 funding will provide greater scholarship assistance to students in predominantly minority colleges to study in the growing fields of environmental restoration and waste management.

VOLUNTEER PROGRAMS AND LABORATORY OUTREACH

In addition to the above programs, each laboratory conducts a number of ongoing formal and informal programs, including research opportunities for students and teachers; workshops and institutes; supplemental materials development; in-house tours, lectures and demonstrations; direct classroom instruction; community outreach; and a variety of special events. For example, Fermi National Accelerator Laboratory offers a Saturday Morning Physics lecture series for high school students and a workshop on particle physics for junior high and middle school teachers. CEBAF's monthly science series brings 200 to 300 6th and 12th graders together for a participatory evening seminar and informal discussions with community scientists and engineers. Pacific Northwest Laboratory provides a Sharing Science with Schools program for junior and senior high schools. In general, the student programs seek to stimulate student interest in science careers and improve general scientific literacy. The teacher programs aim to build content knowledge, improve instructional strategies, increase career awareness, improve understanding of relationships among science, technology and society, and improve supplemental materials.

Laboratory scientists also participate in activities conducted by professional societies and community organizations. In addition, laboratory employees and DOE headquarters personnel participate in a variety of volunteer education activities.

Partnership Schools Program

As part of the President's National Partnerships in Education Program, DOE regional operations offices and laboratories have formed partnerships with local elementary and secondary schools. Examples are DOE Headquarters and Woodrow Wilson Senior High School in Washington, D.C.; Chicago Operations Office and Bolingbrook High School; Nevada Operations Office and Mountain View Elementary School; and Oak Ridge National Laboratory and the science departments of six local high schools. Adopted schools receive loaned equipment and materials, career counseling and tutoring, field trips to scientific facilities, help with science fair projects and judging, and other forms of support.

Physicists and doctoral students check a particle detector used in a rare K decay experiment at Brookhaven's Alternating Gradient Synchrotron, the world's most prolific source of kaons.

HIGHLIGHT Funding increases in FY 1992 funding will train an additional 120 pre- and post-doctoral students in the important fields of nuclear engineering and environmental technology.

Becoming Enthusiastic about Science (BEAMS) The Continuous Electron Beam Accelerator Facility (CEBAF) and the Newport News, Virginia, Public Schools launched the BEAMS program in FY 1991. BEAMS brings inner-city 5th and 6th grade classes with their teachers to CEBAF for a specially modified version of their regular academic week. During each day of this week, the children are immersed in CEBAF's forefront research environment and experience science events, activities, computers, and numerous contacts with scientists, engineers, and technicians. Preliminary and followup training for teachers and CEBAF staff visits to the regular classrooms prepare for and reinforce the immersion experience.

Lacey Learson of Sandia National Laboratory helps students Miguel West (left) and Michael Kirby during a computer class at Albuquerque Public Schools' Career Enrichment Center. This class and others are sponsored and taught by members of Sandia's Black Outreach Committee.

PARTNERSHIP AGREEMENTS

All of DOE's new math and science education initiatives are being carried out in partnership with schools, businesses, museums and other entities that can offer expertise and support. In addition, to broaden program outreach, the Department has signed Memoranda of Understanding (MOUs) with other Federal agencies and with private sector organizations that will be implemented in conjunction with DOE's National Laboratories.

Interagency

The Department signed five MOUs, directed at encouraging more students to pursue careers in science, mathematics and engineering, with the National Aeronautics and Space Administration, the Appalachian Regional Commission, the Department of the Interior, the Department of Education, and the Environmental Protection Agency. In each case, DOE has sought to strengthen existing laboratory-based programs and broaden the scope of the potential contributions that can be made by leveraging the laboratory resources. As an example of one partnership, DOE and EPA are collaborating on SWOOPE—Students Watching Over Our Planet Earth—which teaches children science and mathematics through observations of the environment.

Private Sector

The National Energy Research Supercomputer Center will provide access to a Cray supercomputer donated by Cray Research, for educational programs throughout the United States. This Cray X-MP, designated the National High School Supercomputer, will be used as a learning tool by thousands of high school students and

HIGHLIGHT Expanded legislative authority provided in 1990 will enable the Department to increase the amount of scientific equipment loaned or granted to elementary and secondary schools. The legislation also permits the use of administrative leave for DOE scientists to work with teachers and students in local schools.

teachers. The goal of the National High School Supercomputer Program is to bring the knowledge and expertise of DOE's world-renowned scientists and the research conducted at our laboratories into classrooms to stimulate student interest in advanced studies in mathematics and science. In addition, these programs will strengthen educational partnerships between DOE laboratories and schools by providing an avenue for our professionals to work with educators on bridging the gap between textbook concepts and real-life applications.

DOE also signed an MOU with the Mid-Atlantic Coca-Cola Bottling Company, which will help leverage resources. Coca-Cola made funds available that enabled inner-city and rural students to participate in DOE summer programs at the National Laboratories and work with leading-edge technologies. The first student participant, from the District of Columbia, studied at Oak Ridge National Laboratory.

A new DOE partnership with the Intel Foundation will support the first National Science Bowl, a national competition for high school students. Regional competitions will be conducted across the country at DOE and NASA facilities. Winning teams will come to Washington, D.C. for the national finals in April 1991, during National Science and Technology Week.

Adopted School

Department Headquarters maintains a long-established partnership with its adopted school in Washington, D.C., Woodrow Wilson High School. Through this arrangement, the Department has provided a computer laboratory to the school, and enabled mathematics and

Secretary Watkins presents Department of Energy Scholarships for Science and Engineering to Woodrow Wilson High School students Benita Dair and William Anderson.

science faculty to spend the summers at DOE laboratories conducting research. Woodrow Wilson students and Headquarters personnel also jointly participate in "Hands-On Science," a volunteer mentoring program for elementary school students in Washington, D.C.

DOE EDUCATION DIRECTORS BY FACILITY

DOE HEADQUARTERS
Mr. Richard Stephens
Associate Director for University and Science Education
Office of Energy Research
U.S. Department of Energy
1000 Independence Ave., S.W.
Washington, D.C. 20585
(202) 586-8949

HIGHLIGHT A ten-fold increase in support from the Appalachian Regional Commission will enable 70 additional students and teachers from rural school districts to study at DOE research laboratories next summer.

AMES NATIONAL LABORATORY
Dr. Lynn W. Glass
Professor of Secondary Education
Ames National Laboratory
Iowa State University
N-156 Quadrangle
Ames, Iowa 50011
(515) 294-7006

ARGONNE NATIONAL LABORATORY
Dr. Robert Springer
Director of Education Programs
ANL
9700 South Cass Ave., Bldg. 223
Argonne, Illinois 60439
(708) 972-4114

ASSOCIATED WESTERN UNIVERSITIES, INC. (AWU)
Dr. Thomas G. Squires
Executive Director
AWU
4190 South Highlands Drive
Suite 211
Salt Lake City, Utah 84124
(801) 278-0799

BATES LINEAR ACCELERATOR CENTER - M.I.T (BLAC)
Mr. William Lobar
Administrator Officer
M.I.T.-BLAC
P.O. Box 846
Middleton, Massachusetts 01949
(617) 245-6600

BROOKHAVEN NATIONAL LABORATORY (BNL)
Dr. Donald Metz
Head, Office of Education Programs
BNL
30 Bell Ave., Bldg. 490
Upton, New York 11973
(516) 282-3054

CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY (CEBAF)
Dr. Beverly Hartline
Project Manager
CEBAF
12000 Jefferson Ave
Newport News, Virginia 23606
(804) 249-7567

FERMI NATIONAL ACCELERATOR LABORATORY (FNAL)
Ms. Stanka Jovanovic
Manager, Education Office
FNAL
P.O. Box 500
Batavia, Illinois 60510
(708) 840-3092

IDAHO NATIONAL ENGINEERING LABORATORY (INEL)
Mr. Debu Majumdar
Director of External Affairs
INEL
P.O. Box 1625, MS 1131
Idaho Falls, Idaho 83415
(208) 526-1805

INHALATION TOXICOLOGY RESEARCH INSTITUTE (ITRI)
Dr. David E. Bice
Education Coordinator
ITRI
P.O. Box 5890
Albuquerque, New Mexico 87185
(505) 844-1406

LAWRENCE BERKELEY NATIONAL LABORATORY (LBL)
Dr. Roland Otto
Director, Center for Science & Engineering Education
LBL
Bldg. 90, Rm. 1070
One Cyclotron Road
Berkeley, California 94720
(415) 486-5511

LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)
Dr. Manuel Perry
Manager of Human Resources Planning Development
LLNL
P.O. Box 808
Livermore, California 94550
(415) 423-3177

LOS ALAMOS NATIONAL LABORATORY (LANL)
Dr. Joseph S. Ladish
Office of University Relations
LANL
P.O. Box 1663-MS A-134
Los Alamos, New Mexico 87545
(505) 667-4165

MORGANTOWN ENERGY TECHNOLOGY CENTER (METC)
Dr. Larry Headley
Director, Applied Science Divison
METC
P.O. Box 880
Morgantown, West Virginia 26507
(304) 291-4314

MOUND - EG&G MOUND APPLIED TECHNOLOGIES
Dr. William L. Taylor
Director, University Research Participation Program
P.O. Box 3000
Miamisburg, Ohio 45343
(513) 865-3677

NORTHWEST COLLEGE AND UNIVERSITY ASSOCIATION FOR SCIENCE (NORCUS)
Dr. Bryan B. Valett
Director
NORCUS
390 Hanford Street
Richland, Washington 99352-1620
(509) 375-3090

OAK RIDGE NATIONAL LABORATORY (ORNL)
Dr. Chester R. Richmond
Director, Science Education Programs
ORNL
P.O. Box 2008
Oak Ridge, Tennessee 37831-6248
(615) 576-3886

OAK RIDGE ASSOCIATED UNIVERSITIES (ORAU)
Dr. Alfred Wohlpart
Vice President. for Science & Engineering Education
ORAU
P.O. Box 117
Oak Ridge, Tennessee 37831
(615) 576-3421

PACIFIC NORTHWEST LABORATORY (PNL)
Ms. Irene Hays
Manager, Science Education Center
PNL
P.O. Box 999, MS-K1-66
Richland, Washington 99352
(509) 375-2584

PITTSBURGH ENERGY TECHNOLOGY CENTER (PETC)
Dr. Fred R. Brown
Associate Director for Research & Development
PETC
P.O. Box 10940
Pittsburgh, Pennsylvania 15236
(412) 892-5942

PRINCETON PLASMA PHYSICS LABORATORY (PPPL)
Dr. Rush D. Holt
Assistant Director, Office of Science Education
PPPL
P.O. Box 451
Princeton, New Jersey 08543
(609) 243-2104

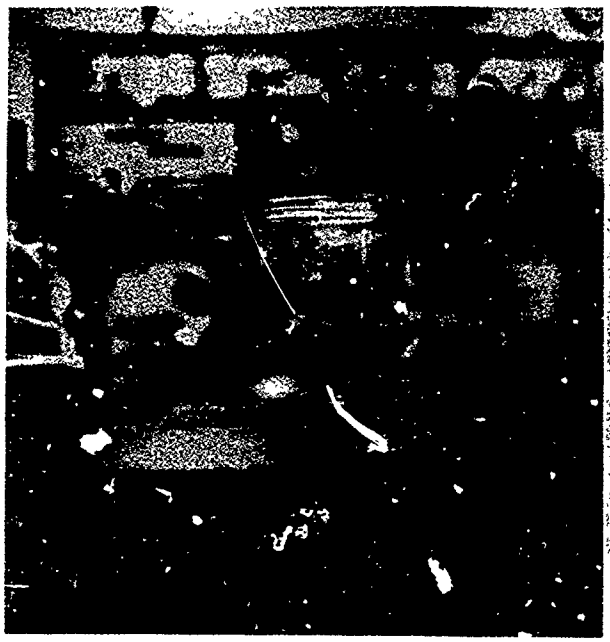
SANDIA NATIONAL LABORATORIES, ALBUQUERQUE (SNLA)
Dr. Michael A. Wartell
Assistant to the President
SNLA
Divison 35A
P.O. Box 5800
Albuquerque, New Mexico 87185
(505) 844-4484

SANDIA NATIONAL LABORATORIES, LIVERMORE, CA. (SNLL)
Ms. Karen Scott
Project Leader
SNLL
P.O. Box 969
Livermore, California 94551-0969
(415) 294-3760

SAVANNAH RIVER LABORATORY (SRL)
Dr. Michael E. Hodges
Outreach Education Coordinator
Westinghouse Savannah River Co.
P.O Box 616, Bldg. 773-41A
Aiken, South Carolina 29802
(803) 725-5328

SAVANNAH RIVER ECOLOGY LABORATORY (SREL)
Dr. Michael Smith
Director
SREL
Drawer E
Aiken, South Carolina 29802
(803) 725-2472

SOLAR ENERGY RESEARCH INSTITUTE (SERI)
Ms. Joan A. Miller
University & Research Participation Program
Administrator
SERI
1617 Cole Blvd.
Golden, Colorado 80401-3933
(303) 231-7044

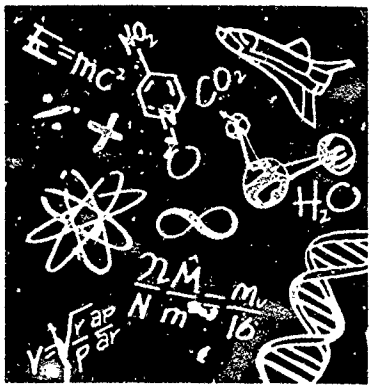


STANFORD LINEAR ACCELERATOR CENTER (SLAC)
Dr. Helen Quinn
Education Administrator
SLAC
Bin-81
P.O. Box 4349
Stanford, California 94309
(415) 926-2713

SUPERCONDUCTING SUPER COLLIDER (SSC)
Ms. Sherrie Kivlighn
Manager of Education Programs
SSC
2550 Beckleymeade Ave.
Suite 125
Dallas, Texas 75237
(214) 708-9000

"If we are to continue to develop our knowledge in biomedical science, it is critical that we increase biomedical science literacy among the public. If we hope to conquer the diseases that still plague mankind, we need to nurture today's students into tomorrow's biomedical scientists. This means that we need to continue to emphasize the importance of science education in our schools and increase our efforts in making biomedical research careers attractive and accessible to all members of society."

Louis Sullivan
Secretary of Health and Human Services



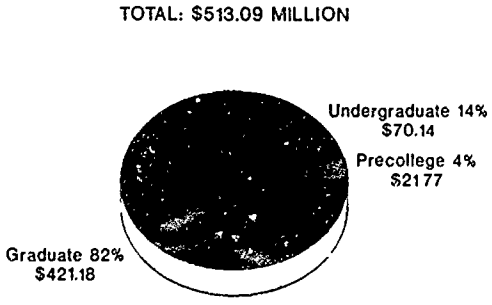
OVERVIEW

The Department of Health and Human Services (DHHS) is the Federal Government's principal agency for promoting the health of Americans, providing essential human services, carrying out clinical and basic biomedical and behavioral research, and providing support for predoctoral and postdoctoral research training in the life sciences. Created in 1980 from the Department of Health, Education, and Welfare, DHHS oversees 250 programs and employs 114,000 full-time workers.

DHHS has the largest budget of all the Federal departments, accounting for about 37% of all Federal Government spending. For FY 1992, DHHS has earmarked $521.47 million for science education programs. (Total includes $8.4 million in DHHS public science literacy programs.)

DHHS MISSION

The work of DHHS is carried out by the Office of the Secretary and five operating divisions—the Social Security Administration, the Health Care Financing Administration, the Office of Human Development Services, the Family Support Administration, and the Public Health Service. The Social Security Administration (SSA) administers the national Social Security program, under which monthly benefits are paid to retired workers, disabled workers under age 65 and survivors of deceased workers. The Health Care Financing Administration (HCFA), created in 1977, consolidates Federal management of Medicare, Medicaid and related programs. The Office of Human Development Services (HDS) builds and maintains community-based service networks for children, families, senior citizens, Native Americans, runaways, the disabled and others who need help with major life problems. The Family Support Administration (FSA) programs aim to strengthen the American family, especially low-income families.



DHHS Science Education Budget FY 1992

The DHHS operating division with the largest discretionary budget is the Public Health Service (PHS), the Federal Government's principal health agency and the world's largest public health program. Comprising the PHS are the Centers for Disease Control (CDC); the Food and Drug Administration (FDA); the Health Resources and Services Administration (HRSA); the National Institutes of Health (NIH); the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA); the Agency for Health Care Policy and Research (AHCPR); the Indian Health Service (IHS); and the Agency for Toxic Substances and Disease Registry.

Working through these agencies, PHS conducts and supports biomedical and behavioral research, helps prevent and control disease, monitors the adequacy of health facilities and staffing, helps deliver health care services to medically underserved populations, ensures the safety and effectiveness of drugs and medical devices, administers State block grants for preventive health and health services, and addresses global health issues with other nations and international agencies.

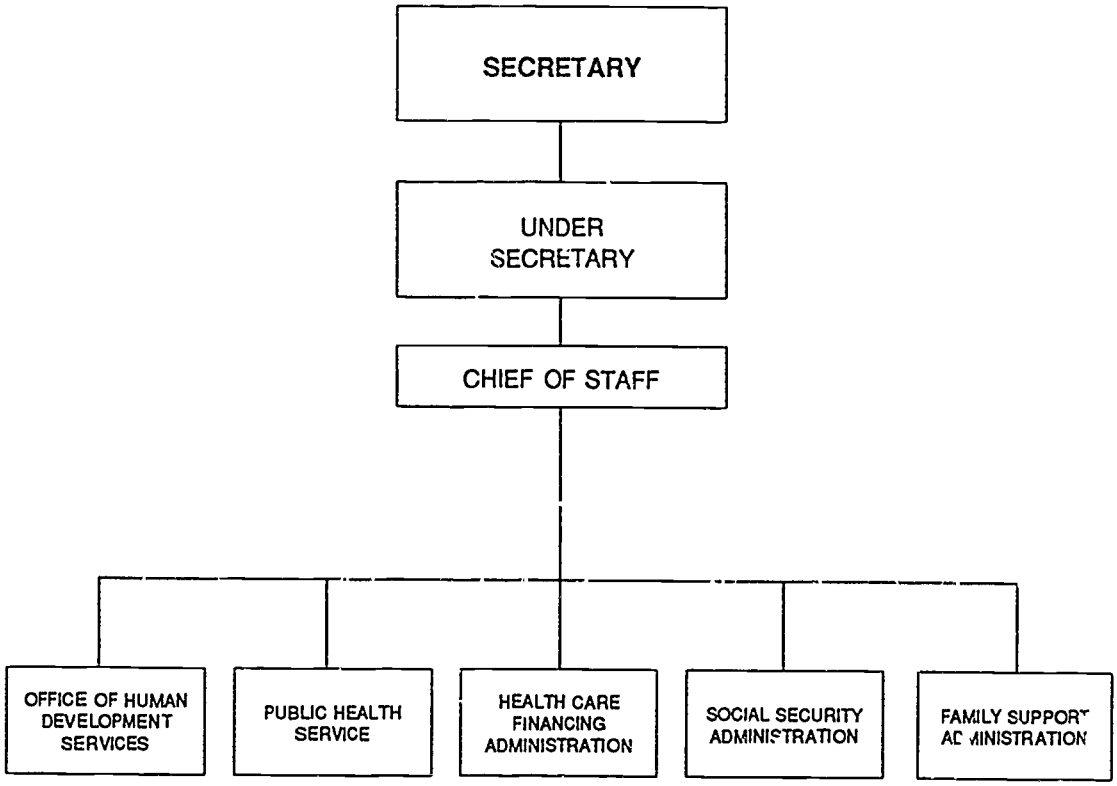


Table of Organization - Department of Health and Human Services

DHHS EDUCATION PROGRAMS

A citizenry that understands the role of science and technology is key to a productive economy and U.S. leadership in medical advances. However, there is evidence of widespread science illiteracy in the United States. For example, U.S. high school seniors finished last in an international comparison of biological science literacy and in the last third in physics and chemistry (*Science and Engineering Indicators*, National Science Board, 1989). Several Federal efforts—notably in mathematics and physics—have sprung up in the last few years to improve these alarming statistics. Yet the worst academic performance of U.S. high school seniors remains in biology.

In *Fulfilling the Promise: Biology Education in the Nation's Schools*, the National Research Council reports that a 1988 biology test taken by 12,000 American high school students yielded an astonishing result: half the students who had not taken a biology course did as well or better than 40% of those who had.

This chapter addresses DHHS educational efforts in the fields of biomedical vioral and life sciences. Spearheading these ts are the two PHS agencies most inherently involved in

Centers for Disease Control

Food and Drug Administration

Health Resources and Services Administration

National Institute of Health

Alcohol, Drug Abuse and Mental Health Administration

Agency for Health Care Policy and Research

Indian Health Service

Agency for Toxic Substances and Disease Registry

Public Health Service

biomedical and life sciences research—the National Institutes of Health and the Alcohol, Drug Abuse, and Mental Health Administration.

Created in 1887 as a one-room laboratory in the attic of the Marine Hospital on Staten Island, New York, NIH today occupies more than 40 buildings on 300 acres in Bethesda, Maryland. The NIH campus houses FDA and ADAMHA laboratories as well. In addition, NIH has sites elsewhere in Maryland and in North Carolina, Minnesota and Arizona. NIH's main purpose is to invest the tax dollars its researchers receive to support and conduct biomedical research. More than 80% of that investment is made through grants and contracts to fund research projects carried out by academia and industry that comprise the NIH and ADAMHA extramural programs.

"NIH speaks the universal language of humanitarianism," President Franklin D. Roosevelt observed in 1940. "The total defense that we have heard so much about of late . . . involves a great deal more than building airplanes and ships and guns and bombs, for we cannot be a strong nation unless we are a healthy nation, and so we must recruit not only men and materials, but also knowledge and science in the service of national strength."

ADAMHA's mission is to find scientifically based solutions to health problems and issues associated with the use and abuse of alcohol and drugs, and with mental illness and mental health. Under its research mandate ADAMHA and its three institutes—the National Institute on Alcohol Abuse and Alcoholism, the National Institute on Drug Abuse and the National Institute on Mental Health—support cutting-edge biomedical and behavioral research relating to substance abuse and support training of basic and clinical research scientists. While the primary mission of ADAMHA is research, the agency also has two offices—the Office for Substance Abuse Prevention and the Office of Treatment Improvement—that support community-based demonstrations and administer certain treatment services programs.

Over the next decade the dwindling supply of scientists—industrial microbiologists, molecular biologists, pharmacologists, toxicologists, enzymologists and others—will become painfully obvious. Unless demand for skilled professionals falls considerably below historical levels, there is projected to be a shortage of biomedical Ph.D.s into the next century, particularly in research and development (Volume 1 of the NRC's *Biomedical and Behavioral Research Scientists: Their Training*

and Supply, 1989). Shortages of research psychologists and clinical investigators are also predicted.

The Department of Health and Human Services has become particularly concerned about this shrinking pool of qualified scientists. If the number and quality of scientific research and clinical personnel declines, the number and quality of biomedical research and health care professionals available to address the Nation's health needs will also drop, a development that will seriously affect the health of our citizens. In addition, DHHS has become disturbed by the large number of U.S. citizens who are scientifically illiterate. The Nation's public, social and economic health depends increasingly on the population's understanding and use of science and technology. Raising biomedical science literacy rates is critical to efficient and effective health care.

In August 1989, the Assistant Secretary for Health established the PHS Working Group on Biomedical Science Education. (The Working Group has since been reorganized as the PHS Life Sciences Education and Science Literacy Board.) He charged the Working Group with developing strategies for increasing the level of scientific literacy among student and adult populations in the United States and with ensuring an adequate pool of well-trained biomedical scientists to meet future national needs. The following December, the Working Group published a report, followed by an action plan with detailed goals, objectives and strategies for improving the Nation's biomedical science education efforts.

One of the primary strategies formulated by the Working Group was the organization of a national conference focusing on the DHHS role in science education. This conference, planned for the summer of 1991, will bring together diverse elements in the science education community—educators, industry leaders, representatives of professional associations and the media, school board members, and biomedical and behavioral scientists—to help develop short- and long-range plans for DHHS involvement in the national science education effort. A planning workshop, attended by experts from the areas mentioned above, was held in November 1990, and additional planning meetings are scheduled for January in preparation for the national conference.

The Working Group's recommendations were also incorporated into the Secretary of Health and Human Services' nine Program Directions issued in the spring of 1990. Direction #7 includes two strategies that speak directly to the need to increase the number of students entering the pipeline and to focus special attention on recruiting women and underrepresented minorities. These strategies also focus on the need to "promote science and scientific literacy in the general population in order to ensure a widespread understanding and support of biomedical and behavioral research."These two issues—ensuring a pool of biomedical professionals and public science literacy—form the basis of the DHHS Science Education Initiative.

Within DHHS, the Public Health Service has played a major role at the terminal end of the science education pipeline. PHS makes substantial investments in research training by supporting graduate and postgraduate research education. The Nation's pipeline issues, however, begin with schoolchildren in K-12. Grade schools, middle schools, and high schools are the real battleground for science literacy. and more programs need to be developed that will make science fun and interesting for students.

Adolescents and younger children have a natural interest in their bodies and the world around them. As a result, the life sciences offer an especially suitable vehicle for capturing and encouraging their enthusiasm for science.

A major new DHHS thrust toward science education at the precollege level capitalizes on the need and opportunities for getting students excited about science and on developing a citizenry capable of making knowledgeable, rational decisions about issues involving science and technology. For example, there is a compelling need for the public to understand the importance of animal models in biomedical and behavioral research, the neurobiology of substance abuse, the role of environmental health, and the benefits and dangers of genetic engineering.

DHHS has initiated efforts to stimulate partnerships between elementary and secondary educators and university- and industry-based life scientists. Such efforts can create channels for transferring information about new scientific discoveries, improve curricula and develop textbooks and other materials that boost students' interest in life science.

Those who educate the next generation of scientists are as important as those who make scientific discoveries. Through programs beginning in 1991, an increased portion of DHHS's cadre of federally supported scientists will contribute time and energy to enhancing the skills and knowledge of K-12 teachers in the biomedical and behavioral sciences and making other contributions to improving science education for young people in those grades.

In 1992, DHHS will continue its major commitment to a special effort that will give underrepresented minorities and women every opportunity to participate in the biomedical and behavioral sciences. The mechanisms used will include supplements to research grants to give hands-on laboratory experience to minority students and teachers, and intramural appointments in PHS laboratories.

Public science literacy while not included in this year's FCCSET budget tables, is a high priority among the agencies and professionals of DHHS. Public attitudes toward science are eroding—even biomedical research, which contributes directly to the health of each individual, is under attack. This erosion is most noticeable in the issue of the use of animals in research. Animal rights groups have become very vocal and have presented to the public misleading information about the use of animals in research. DHHS believes that action must be taken now to combat the attitudes being fostered in our schoolchildren and in the public at large as result. Improving science education in schools and among the general population is the most effective way to do this. As the population becomes more informed about the realities of the scientific research process, public attitudes toward research will become more positive and supportive.

Every DHHS agency—as a consumer of research—has a stake in improved public science literacy. ADAMHA and NIH have already begun active programs. Together they and other PHS agencies are systematically examining their programs to see where science education messages can be integrated into existing disease prevention, health promotion, consumer education, and other public outreach programs.

DHHS will continue to coordinate programs with other Federal agencies. The Department is encouraging biomedical and behavioral scientists to become involved in curriculum projects funded by the National Science Foundation and the National Aeronautics and Space Administration (NASA), for instance, and preliminary steps have been taken to collaborate with private-sector programs such as the Chicago Science Explorers Program sponsored by the Department of Energy's Argonne National Laboratory.

SUMMARY

While many Federal agencies with education and science missions are involved in science education and training, none focus on biomedical and life sciences literacy or education. Through its Public Health Service, DHHS intends to increase understanding and appreciation for biomedical and behavioral science among schoolchildren, college students and adults; increase the exposure of precollege, college and vocational education students to biomedical and behavioral research; expand efforts to recruit and retain underrepresented and disadvantaged groups in the biomedical and behavioral science educational pipeline and in life sciences careers; and improve efforts of PHS agencies to hire and keep life sciences personnel.

PRECOLLEGE EDUCATION

To date DHHS has not had a major focus on precollege education, although it has several important programs at this level. In FY 1992, the DHHS science education program plans to give K-12 teachers new opportunities to learn about biomedical research and the life sciences and enhance the quality of science instruction, especially for minority and female students. DHHS staff will strengthen linkages, consult on curriculum improvement projects and explore collaborative activities with other public and private-sector organizations.

Ongoing Programs

The DHHS Precollege Student Assistance program offers several ways to stimulate and encourage K-12 students and teachers to learn about the biomedical and behavioral health sciences. The program primarily allows high school students and teachers to work part-time in health-related research and attend symposia on health training and career opportunities. Infusing new scientific discoveries into curricula at all grade levels is also a focus. The program gives students and teachers a chance to experience research firsthand. About 3,500 (principally minority) students will be involved in the formal program, with more than 300 teachers involved in the expanded and new programs. For FY 1992, the program has allocated $12.57 million, or 2.5% of the total DHHS science education request.

Listed below are descriptions of a few of the programs.

Minority High School Student Research Apprentice (MHSSRA) Program
The largest single ongoing precollege effort, MHSSRA gives minority teenagers a chance to conduct biomedical research. Students work with established biomedical investigators who broaden students' scientific understanding and teach technical skills. Apprentices carry out research, collect and analyze data, help write scientific papers, and give presentations at research seminars.

The eight-week apprenticeships aim to cultivate interest in the biomedical sciences and motivate

HIGHLIGHT In 1992 more than 3500 students and 300 teachers will be involved in the NIH Minority High School Student Research Apprenticeship Program.

NIH Scientist working with McKinley High School students in McKinley High School laboratory as part of National Cancer Institute's Adopt-a-School Program

students to pursue health research or professional careers. This established program was expanded in FY 1990 to include high school teachers. Teachers are brought into the laboratory with their students to participate in ongoing research projects.

Adopt-a-School Programs

PHS agencies initiated Adopt-a-School Programs in which scientists and other role models visit students and give firsthand information on careers in the biomedical sciences. Activities include domestic and international health awareness projects, special events and exhibits, and school-based presentations and awards.

PHS Teachers Summer Program

To contribute to teacher enhancement in the Washington, D.C., area, local PHS agencies bring high school teachers into their intramural research laboratories for the summer. This program enables teachers to keep up with specific areas of science and be part of the excitement of a research laboratory. In FY 1992, this program will be expanded.

Curriculum Supplements. PHS has developed several curriculum supplements on special topics in the biomedical and behavioral sciences. The following three supplements have been developed as joint efforts between Federal agencies, private industry and educators.

- "Health Careers in the Health Century" grew out of an earlier curriculum supplement based on the Public Broadcasting System series, the Health Century. Using a board game, it provides middle-school students with information and activities that examine the variety of careers in the health sciences. It was developed in 1989 by a consortium of New Jersey educators, pharmaceutical companies and NIH. It was piloted successfully in the New Jersey school system in 1990 and is being reviewed for possible extended distribution.

A science teacher from Walter Johnson High School participating in the ADAMHA Teachers Program is shown working with a lab technician in an ADAMHA lab. Her project was to develop a technique to separate melatonin, a chemical which is produced in the brain, by using high pressure liquid chromatography. In addition to this work, the teacher (seated in the foreground) has been keeping a list of prerequisite skills that her students will need if they hope to pursue a career in a lab.

- "Human Physiology in Space: A Program for America" is a joint NASA/NIH curriculum supplement. The supplement is aimed at generating enthusiasm for biological inquiry through the Spacelab Life Sciences 1 Mission planned for April 1991. This supplement was tested in the spring of 1990 in New Mexico high schools and is now in the evaluation stage. Plans are currently being made for a larger pilot.

- ADAMHA is working with teachers who participated in its summer high school teachers' training program at the Addiction Research Center to develop a science curriculum supplement on drug abuse. This package of curricular materials and experiments is designed for use in the high school classroom and covers a wide range of topics, from the effects of drugs on human body systems to the legalization of drugs and drug abuse prevention. A pilot test is planned for FY 1991.

Regional Educational Laboratories and Development Center Programs

DHHS has signed an interagency memorandum of agreement with the Department of Education to provide partial funding for the Center for Science Teaching and Learning. This center will look at how children learn about science and how this insight can be incorporated into the way science is taught in our schools.

New Initiatives

The DHHS Precollege Life Sciences Education program consists of new initiatives planned to commence in FY 1992. Its objectives are to expand efforts to enhance teacher knowledge of the life sciences and encourage partnerships between the scientific and educational communities to improve science education. While new to the area of precollege education, DHHS recognizes the impact of such an effort on student knowledge, motivation, career interest and health promotion. A major emphasis will continue to be on programs to improve science education for minorities and women.

Through this program, high school teachers will have more opportunities to gain hands-on experience and collaborate with scientists in grantee laboratories and in DHHS intramural laboratories during the summer and throughout the school year. A scientist speakers bureau will be established for K-12 classroom presentations. Aspects of this program can be adapted for high school and undergraduate students, and greater efforts will be made to form partnerships with school systems and community organizations.

DHHS is also exploring ways to work collaboratively with other Federal agencies (such as cofunding projects of mutual interest), national biology and science teachers' organizations, professional societies, and other national groups to enhance teacher knowledge and skills and develop useful classroom materials. Programs and materials will be developed to inform life scientists about how they can help improve precollege science education. These will be developed for intramural scientists (Federal employees who perform research within the bounds of NIH) and extramural scientists (those engaged in NIH-funded research outside the bounds of NIH).

About $9.2 million in new funds are allocated for this program in FY 1992, or about 2.0% of the total DHHS science education request. Following are examples of a few of these programs.

HIGHLIGHT The PHS Summer Science Teacher Program links high school teachers with research scientists. In addition to receiving hands-on laboratory experience, program participants develop curriculum materials for possible widespread distribution to the education community.

ADAMHA/NIH Science Education Partnership Awards (SEPA)
These awards support the development of model programs that join working scientists and educators in enhancing precollege science education and public understanding of such biomedical science issues as the kinds of addictive disorders and mental illness studied at ADAMHA, and in encouraging young people to enter careers in science. Universities and other organizations will receive grants for model programs to improve science education in the life sciences by promoting linkages among scientists and local school and community programs. Activities will include summer institutes for teachers; development of curriculum supplements, audiovisual materials, classroom activities, laboratory guides, and other educational materials; laboratory experience for students and teachers; and mentoring.

Biomedical Research Assistants: Saturday Scholars (BRASS)
Each year 90 Washington, D.C. area junior and senior high students will participate in a 13- to 15-week Saturday morning science program at NIH, taught by PHS scientists. The program will consist of two- to three-hour sessions that include seminars, hands-on laboratory experience, field trips and lectures on topics in biomedical and life sciences.

Academic Research Enhancement Award (AREA)
Grant Support for Science Teachers. This proposed program is being designed to enhance the expertise of high school teachers by providing funds for them to participate in research being done at AREA grant institutions, those that historically have not received major extramural support. Funds would cover the average salary for a junior high or high school science teacher for 120 days (about $4,000), plus administrative costs.

Science Alliance. This program will establish alliances between PHS scientists at NIH and ADAMHA and elementary school educators to increase enthusiasm for science among teachers and students; increase teachers' familiarity with science curricula and materials; integrate science with other subjects; identify talented young people; stimulate PHS staff; and demonstrate PHS's commitment to science education. Paired with an elementary school, a team of scientists will participate in science classes, provide role models for students and generate enthusiasm for science in the classroom. The pilot program is estimated to cost $5,000.

UNDERGRADUATE EDUCATION

The DHHS Undergraduate Educational Enhancement program's goal is to expand and strengthen undergraduate education in the life sciences by recruiting talented undergraduate students into life science careers. This has been done primarily through direct financial support in the form of grants, traineeships and awards to individuals and institutions. The awards are used to support undergraduate students pursuing life science careers, enhance science faculty preparation, and increase the number and quality of research experiences available to teachers and students.

DHHS has allocated $70.1 million for these programs in 1992. This request represents about 13.5% of the DHHS science education effort.

HIGHLIGHT The ADAMHA/NIH Science Education Partnership Award will link whole communities—including scientific, academic, business, government, and the media—in an alliance focused on a shared goal. Consequently, such cross cutting community based collaborative efforts will result in far reaching public participation and support. ADAMHA/NIH anticipate funding over 30 partnership programs that have the potential to serve as national models.

Ongoing Programs

Recruiting and supporting minority students is given special emphasis through the Minority Biomedical Research Support (MBRS) program, the Minority Access to Research Careers (MARC) program, and the Minority Institutions Research Development (MIRDP) program.

The **Minority Biomedical Research Support Program**, established in 1971, is designed to increase the number of underrepresented ethnic minority scientists engaged in biomedical and behavioral research. When the MBRS program began, little or no biomedical research was conducted at predominantly minority institutions. Now, more than 90 minority institutions have the resources to engage in biomedical research and elevate their science curricula to state-of-the-art levels. In addition, the MBRS program sponsors an annual symposium for about 2,000 students and faculty, who present their research results and participate in minisymposia and special lectures.

Laboratory technicians working with rodents in biomedical research trial in an NIH laboratory.

The **Minority Access to Research Careers Program** was established in 1975 to increase the number and capabilities of minority scientists engaged in biomedical research, to strengthen science curricula and research opportunities at institutions with substantial minority enrollment, and to prepare students for careers in biomedical research. The flagship activity of the NIH and ADAMHA MARC program is the Honors Undergraduate Research Training program, an institution-based fellowship program designed to provide support for the individual institutions' best students. The aim is to provide an opportunity for students to do research during the academic year, as well as to go outside the home institution for a summer research project prior to the senior year.

The ADAMHA **Minority Institutions Research and Development Programs** provide grants to institutions with a substantial minority enrollment for the support of research, for enhancement of existing research infrastructure, and for advanced training of faculty. These grants also provide support for minority undergraduate students who wish to serve as research assistants on MIRDP research projects or other research projects on addictive and mental disorders.

New Initiatives

The **Minority Undergraduate Incentive Program**, a new program to recruit talented minority stu-

dents into life science careers, awaits congressional approval. It differs from existing DHHS programs in that it provides a mechanism by which to recruit exceptional high school seniors with an early demonstrated interest in the life sciences and offer them financial support, training and work experience in exchange for obligated employment with an NIH Institute, Center or Division at the completion of their studies.

GRADUATE EDUCATION

The primary emphasis in DHHS science education programs has been support for graduate training in the biomedical and behavioral sciences in order to help ensure the availability of the well-trained manpower pool necessary to meet national health research goals. This effort has been highly successful, and in fact, many of the new disciplines in biomedical sciences today, e.g., biotechnology, human genome research and the neurosciences, were nurtured by the research training programs of NIH and ADAMHA. This training has been an integral part of the DHHS mission for over 40 years and is a stated requirement in section 487 of the Public Health Service Act.

In FY 1992 the DHHS requested a 20% increase in funds, principally to increase stipends for predoctoral and postdoctoral trainees. This increase was cut to 4% in the 1992 allocation Even with the larger 20% increase, the stipends would barely be adequate to maintain the students as they participate in research training programs. Students who choose to pursue research training are thus forced to accept a greatly reduced salary. If DHHS is to maintain a sufficient supply of qualified researchers, it must be able to attract quality students into research careers in the biomedical and behavioral sciences. DHHS training programs have already fallen far behind other areas of the sciences and private industry, and they are continuing to lose students. Stipend catchup has been delayed for more than five years, and if delayed much longer, the losses to DHHS training programs—in terms of qualified students—may be irreparable.

Ongoing Programs

The **DHHS Graduate Research Training and Enhancement Program** aims to strengthen basic research in the biomedical and behavioral sciences by increasing the number of research scientists through awards designed to support and enhance the research capabilities of those in the life sciences pipeline and workforce, with emphasis on recruiting and supporting minorities. Awards include the National Research Service Award, Intramural Appointments and Individual Research Training Awards, the Minority Biomedical Research Support program and the Centers for Disease Control Training Grants.

The **National Research Service Awards (NRSA) Program** was mandated by Congress in 1974 to meet the stated requirement for predoctoral and postdoctoral research training that had been part of the PHS mission for many years. The NRSA program provides both predoctoral and post-doctoral traineeships and fellowships. Traineeships are funded through grants to institutions for research training in a specific discipline or area. These awards account for the largest expenditure of NRSA funds. The fellowships are given directly to individuals so they may pursue biomedical or behavioral research training. The NRSA program is the largest DHHS graduate program and accounts for 80% of the DHHS graduate education request for 1992.

HIGHLIGHT Many of the new disciplines in the biomedical sciences today, e.g., biotechnology, human genome research and the neurosciences, were nurtured by the research training programs of NIH and ADAMHA.

Of the remaining 20%, Intramural Appointments, Minority Biomedical Research Support and Centers for Disease Control Training Grants are the largest components.

- Intramural Appointments bring students and teachers into PHS intramural laboratories for training in research techniques and exposure to the excitement of the research setting.

- The Minority Biomedical Research Support program, while largely focused on undergraduate efforts, also provides support for graduate education at minority institutions.

- The CDC Training Grants offer the opportunity for creative approaches to developing occupational safety and health staffing in under served geographic areas, predominantly black colleges, single-discipline programs and unique areas such as training for occupationally oriented physician assistants.

DHHS estimates that close to 14,000 trainees and fellows will be supported in FY 1992. More than $421 million has been requested for the Graduate program in 1992, about 81% of the total DHHS effort in science education.

New Initiatives

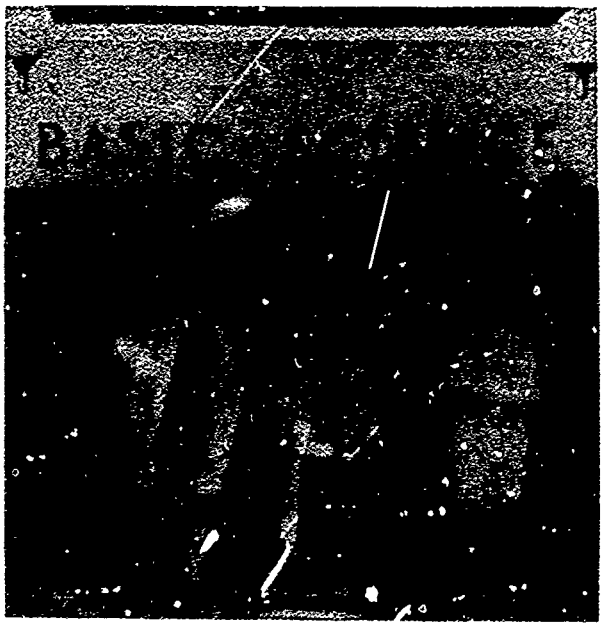
A National Institutes of Health Graduate University has been proposed. This proposal, which will require congressional approval, would authorize the NIH director to grant graduate education degrees (Ph.D.s) to those who complete a study and practical work program in research and graduate education at NIH.

SCIENCE LITERACY AND PUBLIC OUTREACH

Science literacy encompasses many aspe f science education: the ability to understand scientific reasoning; the ability to recognize and understand scientific terms and concepts; and the ability to understand public policy issues that have scientific components.

The current DHHS working definition of public science education is as follows: activities whose purpose is to raise the Nation's level of science literacy by informing the ge eral public or subpopulations such as minority groups, disease patients and parents about the scientific process.

In FY 1992 DHHS has requested an $8.38 million budget to sustain its ongoing Public Science Literacy program.



Much of the research that NIH supports is conducted at universities, medical schools, hospitals, and other research institutions throughout the United States and abroad. This picture was taken at the Georgetown University School of Medicine—an NIH extramural research grant site.

Following are samples of specific DHHS science literacy activities targeted to a general audience, including schoolchildren, parents, teachers. community leaders and other adults.

- Supplements to substance abuse prevention grants for science education efforts are one way that the national drug abuse crisis and the President's drug abuse program can provide an unusual opportunity to link prevention efforts with education about the biological basis of addiction.

- Television programs aimed at young children and their parents are being linked with developmental materials to extend the use of video tapes in science education activities in community groups and classrooms.

- Science Writer Seminars provide background information on research methods and results for science writers and reporters.

- Mini-textbooks are designed to communicate technical information on research methods and results to a broad audience. Altnough these texts are used by many high schools as part of the science curriculum, they were designed for use by the general public.

- Museum exhibits and other displays will be developed that provide general information on research activities and cutting-edge biomedical topics. These exhibits are used in museums and serve as components of traveling displays used in science museums, workshops and conferences nationwide. They also will be linked with community and school programs to maximize impact.

- Windows into the Brain is a multimedia exhibit designed to provide information on specific biobehavioral research activities about the brain. Projects in this initiative dovetail with the Presidentially declared "Decade of the Brain" and offer opportunities to educate citizens about frontiers of research in the neurosciences. Alliances will be forged among universities and community colleges, foundations, local organizations and industry, including television, museums and professional organizations. Cost sharing will be encouraged.

- "Non-animal Methods in Biomedical Research and Development—What They Do and Do Not Do" is a joint effort by DHHS and the Partners in Discovery to develop a brochure that explains the limitations of non-animal tests in biomedical research and development. The brochure will offer accurate, understandable information for the general public.

ADAMHA continues to develop and disseminate materials for secondary school teachers and students to learn about the importance of animals in research and education, including teacher study guides, lesson plans and supporting materials. Data on the general public's science illiteracy and misunderstanding about the need for using animals in medical research make a compelling case for projects such as these.

Health promotion and disease prevention campaigns and services are important aspects of the DHHS mission and provide an essential public service; they also provide opportunities for a more focused outreach effort to raise the level of public scientific literacy and change public attitudes toward the conduct of science. While funds are not included for these activities in the FCCSET budget, the Public Health Service is request-

ing that all its agencies examine their entire range of public information, health promotion, disease prevention and consumer education programs and materials to identify opportunities for incorporating information to educate the general public about the process of science.

CONCLUSION

Over the next decade in the United States, the biomedical, behavioral and life sciences will see a dwindling supply of scientists, while the Nation's citizenry understands less about the role of science and technology. Unless the demand for scientists falls well below historical levels, a shortage of biomedical Ph.D.s is projected into the next century.

Through its PHS agencies, DHHS intends to increase understanding of biomedical and behavioral science and exposure to research among school children, college students and adults; recruit more minorities and women into the educational pipeline for careers in biomedical and behavioral research; and improve efforts to hire and keep highly trained life sciences research scientists.

A critical part of this effort is a PHS-wide drive to develop and disseminate materials for teachers, students and the public on such topics as the importance of animals in biomedical research and education, the biological basis of addiction, and other health issues.

Science education has become a national priority. DHHS has long been involved in training science professionals at the graduate and postgraduate levels and at times the undergraduate and precollege levels. This year and into 1992, every DHHS agency involved in life sciences research will begin reaching future scientists in grades K-12—to help develop well-trained professionals for the biomedical and behavioral sciences, and to help ensure that the United States has scientifically literate citizens.

DHHS AGENCY SCIENCE EDUCATION PROGRAM CONTACTS

National Institutes of Health (NIH)
Dr. Jay Moskowitz/Ms. Bonnie Kalberer
(301) 496-3152

Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA)
Ms. Michele Applegate
(301) 443-4266

Health Resources and Services Administration (HRSA)
Dr. Edward Blasser
(301) 443-6580

Centers for Disease Control (CDC)
Dr. Eric Sampson
(404) 639-3701

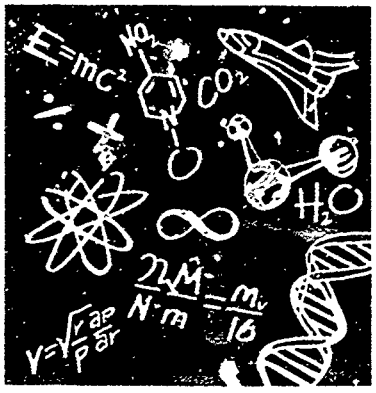
Food and Drug Administration (FDA)
Mr. Alexander Grant
(301) 443-5006

Agency for Health Care Policy and Research (AHCPR)
Ms. Margaret VanAmringe/Ms. Jerry Michael-Dyer
(301) 443-2904

Indian Health Service (IHS)
Capt. Audrey Koertvelyessy
(301) 443-1840

"No greater moral imperative challenges America today than ending the tragic waste of lives trapped in the endless cycle of poverty, welfare, and hopelessness. Science, technology, and education play important roles in this effort, along with HUD's effort to bring jobs, homes, opportunity, and empowerment to low-income Americans"

Honorable Jack Kemp
Secretary of Housing and Urban Development



HISTORY

The U.S. Department of Housing and Urban Development (HUD) came into existence on November 8, 1965. The first Secretary, Robert C. Weaver, had been the Director of the predecessor Housing and Home Finance Agency, which had loosely organized the work of five previously independent agencies concerned with housing and community development. These included the well-known Federal Housing Administration (FHA), along with the Public Housing Administration, the Federal National Mortgage Association, the Urban Renewal Administration, and the Community Facilities Administration. FHA was authorized by the National Housing Act of 1934 and had already insured mortgages for 8.1 million families by 1965. That total has now risen to over 20 million mortgages valued at over $500 billion. The FHA program has been central to the increase in the rate of home ownership—from 46% when FHA was formed to about 63% today. Similar accomplishments have been achieved in the other major constituent HUD programs.

There have been a number of major changes in housing and urban development programs over the years: shifting the emphasis of the housing programs from construction to direct subsidies to individuals, and of the community and urban development programs,from large scale slum clearance to more targeted projects directed and controlled by state and local government officials. The Federal National Mortgage Association is now a private entity, creating a secondary market for both private and government mortgages. The Government National Mortgage Association, a government entity established within HUD, insures only government mortgages. An important added function of HUD has been fair housing and equal opportunity, strengthened in the 1988 Fair Housing Amendments Act to prohibit discrimination based on familial status and handicap along with race, religion, national origin and sex.

Education, especially in public housing communities, is a major concern of Secretary Kemp. He is shown here making one of his frequent visits to public schools to impress upon students from Public Housing projects the importance of education.

BUDGET

Congress provided HUD with a total of $23.7 billion in budget authority for FY 1991, as compared with $14.9 billion in FY 1990, and approximately the same for the two previous fiscal years. The largest spending categories are for subsidies that go directly to help individuals. Subsidized housing helps pay for public housing operation and modernization and, for the first time in several years, new construction. Section 8 funds consist primarily of housing vouchers and certificates that allow eligible individuals to rent housing in the private sector by making up the difference between 30% of their monthly income and the amount of the rent. Community Development Block Grants (CDBG) are the main vehicle for urban development assistance. In FY 1991, $3.2 billion dollars was appropriated for formula grants to large cities and States. As a reflection of the emphasis on housing, CDBG regulations in recent years have permitted a greater proportion of these funds to be allocated for housing and cities have been doing just that.

WORK FORCE

The FY 1991 appropriation for HUD provides funding for 14,587 staff-years, which represents an increase of a little more than 1,000 staff-years over the past few years. Most of these staff increases will be in the housing programs, primarily field staff located in regional and State offices. In the Washington office, there will be an increase in evaluation and monitoring activities. There are three times as many staff in the field offices as in the central office in Washington. Housing accounts for over 62% of total staff, community development another 8%, and fair housing and equal opportunity 5%. The remainder are in management and support.

MISSION

The U.S. Congress has mandated the Department of Housing and Urban Development to: create conditions for every family to have decent and affordable housing; ensure equal housing opportunity for all; and strengthen and enrich our Nation's communities.

When President Bush asked Jack Kemp to serve as HUD Secretary, they agreed that a key goal of the Administration should be to restore to "working people, poor people, all our citizens—control over their own lives." Together they identified six priorities that are essential to revitalizing the American Dream for those who have been left behind:

- Expand home ownership and affordable housing opportunities
- Create jobs and economic development through enterprise zones.
- Empower the poor through resident management and homesteading.
- Enforce fair housing for all.
- Help make public housing drug free.
- Help end the tragedy of homelessness.

If the Department can meet the challenges these six priorities present, the Nation will go a long way in empowering its most needy citizens to participate in democracy, economic choice and opportunity, and to take control of their own lives.

Under the stewardship of Secretary Kemp, the Department is doing everything possible to assure that people have the opportunity to reach their full potential. Using our programs as fully and effectively as possible, we want to give people the chance to live in housing of their choice and raise their children in communities that feed the mind and free the spirit—in communities that offer jobs and opportunity and hope.

The Department of Housing and Urban Development has a variety of policies and programs to support the National Education Goals of the President and the Governors. These programs and activities focus on the special populations served by HUD, particularly low-income families receiving housing assistance, families in public housing, and minorities.

The Department is particularly proud of its new efforts, through Operation Bootstrap, to help low-income families acquire the eduction and job skills needed to move from dependency to employment and self-sufficiency. The Department also has launched an aggressive attack on drug use in public housing and is working with housing authorities and public housing residents across the Nation to provide innovative child care programs and to form public-private partnerships to help residents develop literacy and job skills.

NEW INITIATIVES

Precollege

HOPE-Operation Bootstrap
HOPE-Operation Bootstrap will build upon the existing Operation Bootstrap Program (see below) by permanently linking, where appropriate, all new non-elderly Section 8 certificates and housing vouchers to comprehensive education and training strategies. HOPE-Operation Bootstrap will take effect in FY 1991.

ONGOING PROGRAMS

Precollege

Operation Bootstrap
To provide a ladder of opportunity to help families move into the economic mainstream, HUD initiated Operation Bootstrap, a program providing stable and affordable housing to families participating in a comprehensive and coordinated program of housing, child care, transportation, personal and career counseling, education, job training, and placement assistance.

In 1989, in a nationwide competition, 61 communities and their local public housing agencies (PHAs) were selected to receive Section 8 certificates to implement Operation Bootstrap programs. Operation Bootstrap is not limited to those PHAs awarded funding specifically for the program. Every PHA has the ability to initiate a local Bootstrap program using a portion of its regular certificates or housing vouchers with HUD's encouragement. Starting in FY 1990, HUD will consider the presence of Bootstrap programs in ranking PHA applications for new certificate and housing voucher funding.

Since education is a key component of Operation Bootstrap programs, representatives of the education community and its institutions are encouraged to serve on the local coordinating body that plans and implements the program. The coordinating body is a public-private partnership of local leaders who agree to generate the resources needed, including funds for education and vocational training, for participants to take the first step on the ladder of opportunity to economic

independence. As a general rule (and from our experience with Project Self-Sufficiency, the precursor to Operation Bootstrap), participants are assisted in obtaining, at a minimum, a GED or its equivalent. Many enroll in postsecondary education programs to improve their potential for moving up the economic ladder.

Child Care

The Department's programs of child care assistance support the goal of early intervention for children entering school. None of the programs, however, prescribes the content of the child care activities or the early childhood curriculum. Under the CDBG Program, up to 15% of the funds may be used for social services, including child care and early childhood development programs. Activities in support of child care in public housing developments are described below.

Secretary Kemp, a strong supporter of day-care is shown visiting the day care center at HUD. In FY 90 HUD will be transferring over $4 million to the Department of Health and Human Services in support of full-day care programs in public housing communities

Child Care Demonstration Program

In 1988 and 1989, a total of $10 million was awarded to grantees to provide innovative child care programs in public housing communities. HUD is transferring $4,859,000 of FY 1990 funds to the Head Start Bureau of the U.S. Department of Health and Human Services in a cooperative venture to expand the successful Head Start Program to a full-day program in public housing communities and to serve children who are either older or younger than the three- to five-year-olds served by the traditional Head Start Program. The appropriation for child care for FY 1991 is $10 million. The budget request for FY 1992 is $10 million.

Anti-Drug Efforts

The Department's anti-drug efforts in public housing communities will have an effect on keeping the Nation's schools free of drugs and violence. The Department strongly supports the concept of drug education and prevention for school-aged children as a way to help make public housing communities drug-free. Any success of the Department in these efforts will carry over into the schools. As a matter of policy HUD strongly encourages public housing agencies to work with others in the community, including the schools, in implementing anti-drug programs.

In 1989, HUD awarded $8.2 million in Public Housing Drug Elimination Grants. In 1990, $98 million is available, and in 1991, $150 million has been appropriated for this purpose. Among the eligible activities under this program are innovative programs designed to reduce the use of drugs in and around public housing and funding for resident management corporations and resident councils to develop drug prevention programs. Also in 1989, the Department provided grants totalling $2.4 million to 100 Youth Sports

Programs to combat drugs in public housing. These grants provide sports, cultural, or other activities as an alternative to the drug environment. Most of the programs have educational components that are integral to their cultural activities.

Undergraduate

Historically Black Colleges and Universities
The Department has two programs of assistance to Historically Black Colleges and Universities (HBCUs) that contribute indirectly to the National Education Goals concerning literacy skills and citizenship. While neither program provides aid or classroom assistance to students, both build the capabilities of HBCUs and involve faculty and students in real-world problems of economics, planning and social issues in nearby communities.

The first program, the HBCU Technical Assistance program, has been funded since 1982 at a cost of $11 million. It enables HBCUs to assist local governments in utilizing their Community Development Block Grant funds more effectively by providing them with on-site management assistance, economic plans, surveys and expertise, training and workshops, and other activities.

The second program, the Historically Black Colleges and Universities Program, was enacted in the HUD Reform Act of 1989, approved December 15, 1989. With funding of $4.5 million per year, this program is broader than the HBCU Technical Assistance program. In addition to providing technical assistance, the HBCUs will be able to fund the same sorts of activities as CDBG entitlement communities (e.g., streets, sewers, and special economic development activities) to address a broad range of community development needs, consistent with the purpose of Title I of the Housing and Community Development Act of 1974, as amended.

Community Development Work Study Program
The Community Development Work Study Program (CDWSP) makes grants to institutions of higher education to assist economically disadvantaged and minority students to participate in work-study programs while enrolled in full-time graduate or undergraduate programs in community development and related fields.
The grants provide each student with stipends of up to $9,000 per year; tuition support, up to $3,500 per year; and other support (such as travel) up to $1,500 per year.

The program is funded at $3 million per year. In 1989 and 1990 a total of $5.9 million was awarded to 51 colleges and universities to assist 230 economically disadvantaged men and women to spend two full academic years working toward their degrees. At the same time, the students are gaining professional experience by working to plan, develop, or administer local activities undertaken through HUD programs, such as the McKinney Act Homeless Assistance Programs and Community Development Block Grants.

Public Literacy

Partnership with Kraft General Foods and the U.S. Department of Agriculture
In 1990, HUD initiated a joint initiative with Kraft/General Foods Foundation and the Department of Agriculture to develop model consumer education programs in public housing communities to help residents develop lifelong living skills and move toward economic self-sufficiency. The model is being field tested in eight

locations nationwide: Los Angeles, Houston, Philadelphia, New York City, Decatur (GA), Tampa, Chicago, and Washington, D.C.

VOLUNTEER ACTIVITIES

Precollege

Jefferson Junior High School, Washington, D.C.: HUD's Adopted School
Several years ago, a number of Federal agencies "adopted" local schools to help them with volunteer tutors, mentors and other assistance. HUD adopted Jefferson Junior High School as one way that the Department could interact with the local population and the District of Columbia school system.

When the call for volunteers went out during the 1989-1990 school year, about 75 HUD personnel responded. Under the program, each volunteer tutored two or three students, usually one to two hours a week during the lunch hour. Subjects included mathematics, English, foreign languages and science. Many volunteers did more than tutoring and were in effect "mentors" to individual students. The success of this program is shown by the achievements of the students; Ms. Patricia Edwards, Assistant Principal, noted that some of the students have gone on to several top high schools in the area.

For the 1990-1991 school year, in addition to tutoring in the basic subjects, 54 volunteers were asked to become more involved with other aspects of the school experience, such as community service projects, the science fair, mentoring, career awareness, the Speaker's Bureau, and training cheerleaders. This program is now underway.

High School Student Mentor Program
The "Thousand Points of Lights" Committee of the Department sponsored, initiated and organized the first Volunteer Departmental Committee to develop a mentor program for students participating in the District of Columbia "Summer Youth Employment Program." The Mentor Program provided HUD employees an opportunity to help these youth more realistically experience the world of work.

The Mentor Program provides a one-on-one relationship that is a strong motivating force for the students and an enriching experience for the mentor. Mentors devote time, guidance and listening to build one-on-one relationships and friendships that contribute to the personal growth of both the mentor and the proteges.

Over 60 HUD employees participated as mentors, and more provided training programs and chaperoned a picnic and trips to the White House and the African Museum. At a closing ceremony, Secretary Jack Kemp personally shook hands and talked with each of the students and mentors.

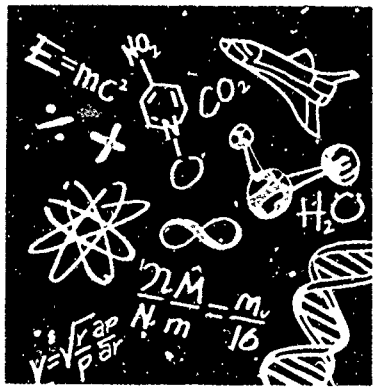
Seventeen HUD employees continue to mentor on a regular basis, and it is expected that more will participate as the program is established as a permanent Departmental volunteer activity under the President's "Thousand Points of Lights" and the District of Columbia's "Stay in School Program." President and Mrs. Bush have provided support to the Mentor Program.

CONTACT PERSON

The contact person for all the Department's education programs is James Stimpson, Deputy Assistant Secretary for Research (202) 708-4230.

"We are beginning to realize that education is not only important to us as individuals, but that the strength and economic security of our Nation depend on how well we prepare our youth for the future."

Manual Lujan, Jr.
Secretary of the Interior



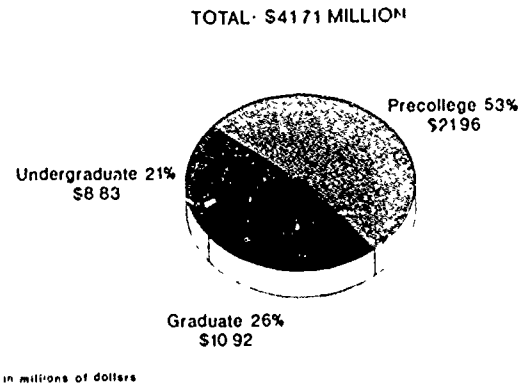
INTRODUCTION

What other agency—Federal or private—can offer what the Interior Department can? Millions of acres of public lands, 467 wildlife refuges, 75 fish hatcheries, and 356 National Parks (including battlefields and seashores) are available for our Nation's children and adults to learn all about science. And what an exciting way to learn—to observe nature first hand rather than from a book or inside a building. The kind of learning that stays with young children, enticing them to learn more and to appreciate our natural resources. With over 440 million acres (that's 20% of our Nation's land area) and hundreds of parks and field sites managed by the Interior Department, no matter where one lives there is always an "outdoor classroom" nearby.

MISSION

The Department of the Interior was formed on March 3, 1849, to administer certain responsibilities of the Federal Government's internal affairs. The 1991 appropriations for the Department total approximately $7 billion. As the Nation's principal conservation agency, the Department of the Interior (DOI) has responsibility for most of our nationally owned public lands and natural resources. The Department is charged with fostering the wisest use of land and water resources, protecting fish and wildlife, preserving the environmental and cultural values of national parks and historical places, and providing enjoyment through outdoor recreation. The Interior Department also assesses mineral resources and ensures that their development is in the best interest of all the people. Resource responsibilities include managing offshore resources and collecting and accounting for revenues from mineral leases on Federal and Indian lands. Through its scientific research, the Department provides the information critical to the wise management of our global environment. The Department has a major responsibility for American Indian reservation communities and for island territories administered by or affiliated with the United States.

The Department's stewardship mission and its extensive scientific and technological expertise present unique opportunities for educational outreach, as evidenced by such longstanding programs as outdoor classrooms in the National Parks. The bureaus in the Department offer many exciting hands-on opportunities for students and citizens of all ages to learn about the natural environment, public resources, and the concept of stewardship. With over 60 regional offices and some 1,500 field offices, and extensive public lands under its jurisdiction, the Department is able to reach out to teachers and students at the grassroots level.



DOI Education Budget FY 1992

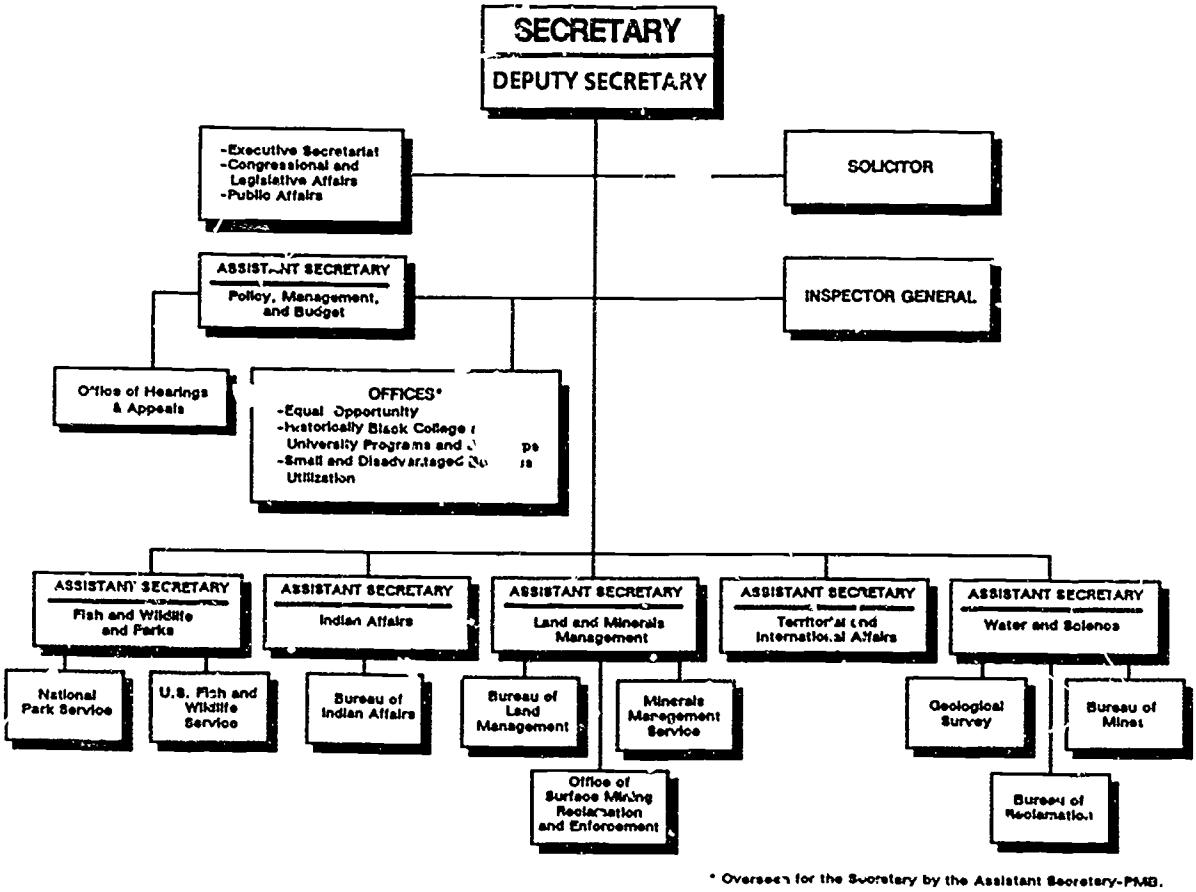


Table of Organization - Department of the Interior

ORGANIZATION

The natural resource stewardship responsibilities of the Department of the Interior are carried out by its bureaus:

National Park Service (NPS)
Fish and Wildlife Service (FWS)
Bureau of Indian Affairs (BIA)
Bureau of Land Management (BLM)
Minerals Management Service (MMS)
Office of Surface Mining
Reclamation and Enforcement (OSM)
U.S. Geological Survey (USGS)
Bureau of Reclamation (BOR)
Bureau of Mines (BOM)

Assistant Secretariats for Fish and Wildlife and Parks, Indian Affairs, Land and Minerals Management, Territorial and International Affairs, Water and Science, and Policy, Management and Budget oversee the Department's various missions.

PRIORITIES

Fostering effective stewardship of the Nation's public lands and natural and cultural resources is the top priority of the Department. In addition to this broad goal, the Department is committed to four special initiatives: volunteerism, excellence in education, the War on Drugs, and enhanced professional opportunities for women, minorities, and persons with disabilities.

"Bringing nature to students in an outdoor classroom."

AREAS OF SPECIAL EMPHASIS

The Interior Department has a long history of programs targeted to special groups. Technical support and professional development programs with Historically Black Colleges and Universities (HBCUs) have effectively promoted the natural and physical sciences at these institutions and have provided career opportunities for minorities. An effective Equal Opportunity Office, participation in the Job Corps, and special outreach to small and disadvantaged businesses have all aided the Department's overall efforts to provide good stewardship. As a result of the President's National Education Goals and the Department's commitment to enhancing science and technology education, many of the Interior bureaus are developing science and mathematics education initiatives. The most intense initiatives focus on precollege education, an area identified by many national groups as the most important emphasis for science and technology education.

Contributory Programs ($88 million)

The Interior Department has several math and science education initiatives that are contributory to the Committee on Education and Human Resources effort. The Department provides almost $75 million for math and science programs in the BIA schools. Most of these funds support math and science instruction at BIA's 182 precollege schools. The Department has placed a high priority on improving Indian education, developing programs to increase parental involvement, improving teacher performance, and establishing a comprehensive review structure to foster school accountability. These programs will assist the BIA to achieve its long-range goal of raising the educational achievement levels of Indian students in BIA-funded schools to levels that meet or exceed national norms by the year 2000.

Another contributory area of emphasis is graduate research, accomplished through the Water Resources Research Institutes Program administered by the USGS, the USGS Earthquake Research Program, and the Minerals Institutes Program of the BOM. These programs provide water resources, minerals, and other earth science data that can be used to make informed land-use planning and engineering design decisions, fund basic and applied research,

HIGHLIGHT: In FY 1992 over three million students and teachers will learn about ecosystems through the National Parks as Learning Labratories program.

and assist in the development of effective emergency preparedness policy and plans.

NEW INITIATIVES

Secretary Lujan's commitment to education prompted the bureaus to establish new initiatives in math and science education in FY 1991, which will be continued in FY 1992. Most of the FY 1991 initiatives are in the precollege area. These include increased emphasis by the FWS for its informal workshops for students and teachers that are held at national wildlife refuges and fish hatcheries; NPS's teacher enhancement program, which encourages science teachers to build curricula around park resources; BOR and USGS's development of materials to support science curriculum; and the BLM's Resource Apprenticeship Program, which gives Alaska Natives opportunities to explore careers in the natural resources. Recent Departmental initiatives include an agreement signed in June 1990 by the Secretaries of Interior and Agriculture with the Hispanic Association of Colleges and Universities (HACU). This agreement will form the basis of a Hispanic-Serving Institutions Partners' Program within each agency. The program will assist in improving the education of Hispanic students and increase their career opportunities within Government agencies. The Department also signed a Memorandum of Understanding with the Department of Energy, which is directed at improving teaching in science, mathematics, and other related technical subjects at Native American elementary and secondary schools. Examples of Departmental agreements at the local level include a partnership with Gallaudet University in Washington, D.C., designed to enhance opportunities for employment of people with hearing and other disabilities in the fields of science.

ONGOING PROGRAMS

Precollege ($21.96 million)

About half of the Department's precollege efforts directly support students through workshops, informal classes and student work appointments. Through the Youth Conservation Corps, the FWS and the NPS hire students as part of the Department's summer employment program. Students work, learn and earn as they develop an understanding and appreciation of the natural environment. The BLM's Resource Apprenticeship Program for Students provides selected Alaska Native high school students with hands-on experience in natural resource management and knowledge about resource management principles. The USGS develops educational materials, such as posters, computerized data and teacher packets, to support science curriculum. The BOM worked with the National Energy Foundation to produce "From Mountains to Metal," an educational poster distributed to 25,000 science teachers nationwide. The FWS's Project WILD is an award-winning environmental and conservation education program of workshops and supplementary curriculum materials for students and teachers. Most of the bureaus participate in the Partnerships in Education program, "adopting" local schools. This program supports activities such as science and career fairs, traveling exhibits for use in the classroom, scientist participation in the classroom, and scientists serving as role models for children. The OSM emphasizes computer literacy in their Adopt-A-School program.

The following are selected examples of education activities in math and science:

HIGHLIGHT The Secretary of the Interior recently signed an agreement with the Hispanic Association of Colleges and Universities to assist in improving the educational opportunities of Hispanic students as well as increase career opportunities for those students within the Interior Department.

- The NPS uses their parks as "Learning Laboratories," providing science activities to be used in conjunction with the National Parks, emphasizing environmental and ecological principles. Workshops are offered at park sites for teachers which encourage teachers to build their curriculum around park resources. This program reaches over three million students and teachers annually.

- The USGS, NASA, NOAA, Smithsonian, and various private organizations are participating in a Joint Education Initiative project designed to strengthen the teaching of science by sharing scientific data through CD-ROM media. Earth science data, such as seismicity, ocean salinity and temperature, and marine geology data, have been compiled on CD-ROM. During the summer of 1990, 20 teachers from across the country participated in a three-week workshop at the USGS to learn how to use the compact disks and manipulate the data. The teachers also developed classroom activities to go with the data.

USGS teacher/student workshop on earth science

- The FWS produced a newspaper entitled "Wetlands, Wildlife, and You," which was distributed to over 390,000 schoolchildren in the northeastern United States. The publication explained how children could help in conserving wetlands and waterfowl.

- The Water Resources Education Initiative is a three-year partnership effort, begun in 1990, with the American Water Resources Association (AWRA), the USGS, BLM and BOR. This program will develop a water resource education package, including a bibliography of materials, designed to be taught in formal and informal educational settings. A national team of educators has been assembled to evaluate existing water educational materials and determine what materials are most useful and what is lacking. Five education posters will be designed by 1992. The first poster has been reviewed and will be published in 1991 in a National Science Teachers Association magazine, reaching over 30,000 teachers nationwide. A nationwide speakers bureau will be developed and coordinated through the AWRA.

- BLM's Resource Apprenticeship Program for Students combines the efforts of Federal and State land-managing agencies, the Alaska school system, and private industry to provide education opportunities and employment for rural Alaska students. The Resource Apprenticeship Program for Students, begun in 1987, is designed to provide natural resource management exposure to Native Alaskan high school students. The students are placed with various agencies, including BLM, NPS and FWS, for employment experience. BLM intends to expand the Resource Apprenticeship Program for students nationwide in 1991.

HIGHLIGHT The Fish and Wildlife Service's "Wetlands, Wildlife and You" newspaper has educated almost 400,000 school children on what they can do to help protect our wetlands.

- The BOR is developing an Adopt-a-Watershed Fish and Wildlife Education Program which will give students an opportunity to observe and follow changes in one watershed for several years. Adopting a watershed as they enter kindergarten, the students will follow the changes in that watershed through their school years. The targeted area for this new curriculum is Trinity County, California, and part of the Humboldt County Public Schools district.

- The FWS developed and published a Federal Junior Duck Stamp Conservation Program bibliography for use in K-12 classrooms. A companion publication has classroom activities that focus on ducks and conservation. Their partners include Ducks Unlimited and California State Education Systems. The FWS hopes to expand the program, working with the States of Illinois and Florida in 1992.

- OSM plans to develop publications and video presentations, in conjunction with lesson plans, on the contribution of earth science fields to environmental reclamation. Each program in the series will emphasize a major type of reclamation and the environmental and community benefits gained from each. Examples include reforestation, wetlands, agriculture, and land for residential commercial and industrial development.

- The USGS, in partnership with the Department of Education, helped develop and publish "Helping Your Child Learn Geography," a booklet designed to help stir a child's interest and curiosity about geographic questions and knowledge.

- The BOM plans to develop a minerals curriculum that will help students discover the nature of mineral resources and their importance in society.

- The FWS recently began an education campaign, "Suitcases for Survival," to acquaint young people with protected wildlife. The FWS, in partnership with various private agencies, donated confiscated commercial products made from protected wildlife products to zoos for use in education programs and to teachers for use in local schools. A dozen kits containing confiscated products will be sent to major zoos across the country in early 1991. The ultimate aim of the program is to get these materials into the hands of teachers who will be specifically trained by the participating zoos to use the kits in the local school system.

"SUITCASE FOR SURVIVAL" Wildlife Education Kit in use at Ashlawn Elementary School, Arlington, Virginia. Teacher's, left to right: Jimsey Frye and Bonnie Bracey holding an Anaconda skin.

HIGHLIGHT Native Alaskan high school students gain invaluable experience in natural resource management programs in the Bureau of Land Management's Resource Apprenticeship Program for Students.

- The BOR, in partnership with Montana State University, the University of Idaho, and the States' governments, established the Western Watercourse to facilitate the development of locally sponsored and administered water education programs. Initial efforts, begun in 1990, focus on education programs in Montana and Idaho. Emphasis is being placed on the development and dissemination of classroom-ready teaching aids. Examples include a ground water flow model education package, which provides a "window" into the earth to take the mystery out of ground water education, and a computer-driven simulator with interactive features, which allows students to "manage" and "compete" for water as it flows through a simulated watershed.

- The Youth Conservation Corps is designed to let students work, learn, and earn while developing an understanding and appreciation of the natural environment. This FWS and NPS program reached over 1,250 students during the summer of 1990.

- The FWS' Chesapeake Bay Estuary Program developed curriculum guides, fact sheets, posters, and brochures on Chesapeake Bay issues and distributed them to over 200 teachers in the Bay area. Chessie, the friendly sea monster, and her companions distribute coloring books and give presentations to school groups, bringing the Chesapeake Bay and its fish and wildlife to the children.

Undergraduate ($0.73 million)

The majority of undergraduate programs provide student support, mostly in the form of student work appointments. Many of the bureaus provide support for HBCUs through teacher enhancement programs and student appointments. The BOM is developing materials to supplement curriculum used at HBCUs to instruct students in the nature of mineral resources. The MMS is helping to develop curriculum for HBCUs in the Atlanta Cluster. The bureaus are helping to encourage women and minorities to pursue careers in mineral industries, particularly in such critical professional areas as engineering, science and computer programming. The BOR is developing a water resources curriculum designed to familiarize faculty in the western United States with water resources development.

The following are selected examples of education activities in math and science:

- DOI bureaus participate in the Stay-in-School program, which allows financially disabled students to work part-time while attending undergraduate school.

- USGS provides summer internships for students recommended by the National Association of Geology Teachers. The program is designed to give students exposure to the earth sciences through field experiences. Almost 950 students from across the country have participated in this program since it began in 1966.

- DOI bureaus actively support HBCUs, providing research experience for students and teachers. A "Career Options Handbook" was developed, aimed at helping HBCU students and faculty recognize the viable linkages between the "traditional" fields of study and Interior's unique and rewarding "nontraditional" career opportunities. Many bureaus provide scientists to instruct at

HIGHLIGHT • Over 1090 Youth Conservation Corps students will work in our National Parks and Wildlife Refuges during the summer of 1992, developing a better understanding of the natural environment.

HBCUs, employ cooperative education students from HBCUs, and are involved in outreach and recruitment efforts to expose HBCU students to science career opportunities. A similar effort is being initiated with the HACUs.

- Through its Minority Participation in Earth Sciences, the USGS has afforded employment opportunities to women and minorities in the earth sciences. Many of the students contribute to a variety of geologic and hydrologic studies, and receive recognition through co-authorship of papers as a result of their work with scientists. Such demonstrable achievements are valuable to students in making their ultimate career choices. Approximately 1,500 students have participated since the program began in 1971, with over half those students obtaining college degrees in science.

- The BLM and BOR, working with HBCUs and the HACUs, have cooperative education programs designed to encourage women and minority students to enter the science fields.

- Staff at the FWS' Bayou Savage National Wildlife Refuge in Louisiana have developed interpretive materials for guided canoe trips specifically designed for college students.

- The USGS has a program for students to emphasize native Hawaiian cultural understanding of the role of the USGS in its study of Hawaiian volcanoes. Students learn about the ongoing eruptive activity of the Hawaiian volcanoes and the geologic processes associated with it. The USGS, in partnership with the Smithsonian, developed a video entitled "Inside Hawaiian Volcanoes," which is often used at workshops for students and teachers.

"Students experience wildlife - up close and personal."

- Several bureaus have an active volunteer program, where people outside the Department volunteer their time with a particular bureau, learning more about science or helping in educational outreach efforts. For example, the FWS' National Bison Range recently was recognized for its educational program that utilizes volunteers to provide education at summer camps and teacher workshops. The USGS headquarters science center is staffed by docents, or retired employees, who conduct workshops and tours for numerous school groups.

Graduate ($10.92 million)

The FWS operates the Cooperative Fish and Wildlife Research Units at 38 land-grant

HIGHLIGHT The FY 1992 budget allows over 100 undergraduate students to participate in the U.S. Geological Survey's "Minority Participation in Earth Sciences" program.

universities nationwide, designed to provide graduate education in fish and wildlife biology and management. The USGS provides postdoctoral fellowships for geologic, remote sensing and hydrologic research. The BOM provides predoctoral fellowships for education in mineral sciences. These programs support State-Federal-academic partnerships in research and education for the management of natural resources.

The following are selected examples of education activities in math and science:

- Through a partnership of Federal and State governments, universities and the private sector, a unique avenue exists for students interested in graduate training leading to careers in fish and wildlife research and management. The FWS Cooperative Wildlife Research Unit program was established in 1935 to meet the need for trained personnel in the field of wildlife management and to obtain and disseminate better technical information on wildlife species. The program currently has 720 students participating.

- The USGS Minority Participants in Earth Sciences (MPES) program has had a major role in the creation of minority Ph.D.s, especially Black students. During 1988, there were nine interns (five M.A., four Ph.D. candidates) and during 1989, there were seven interns (four M.A., three Ph.D. candidates) participating in the program.

CONTACTS

Since the Department of the Interior is responsible for a wide variety of natural resource activities, your requests for science and mathematics education information can be met more rapidly and effectively if they are directed to the office most concerned with the specific subjects in which you are interested. See the maps that follow to locate a park, fish hatchery or refuge near where you live. We suggest you contact parks, fish hatcheries or refuges and other DOI offices near your local community. Should you desire information about the location of such offices, please address your questions to the following sources:

National Park Service:
Office of Public Affairs
National Park Service, Room 3043
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-7394

Fish and Wildlife Service:
Public Affairs Office
Fish and Wildlife Service, Room 3240
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-5634

Geological Survey:
Public Affairs Office
Geological Survey
U.S. Department of the Interior
MS [illegible]9, National Center
Reston, Virginia 22092
Tel: 703-648 4460

HIGHLIGHT: Over 700 graduate students are preparing for wildlife management careers through the Cooperative Wildlife Research Units sponsored by the Fish and Wildlife Service.

Bureau of Land Management:
Office of Public Affairs
Bureau of Land Management, Room 5600
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-5717

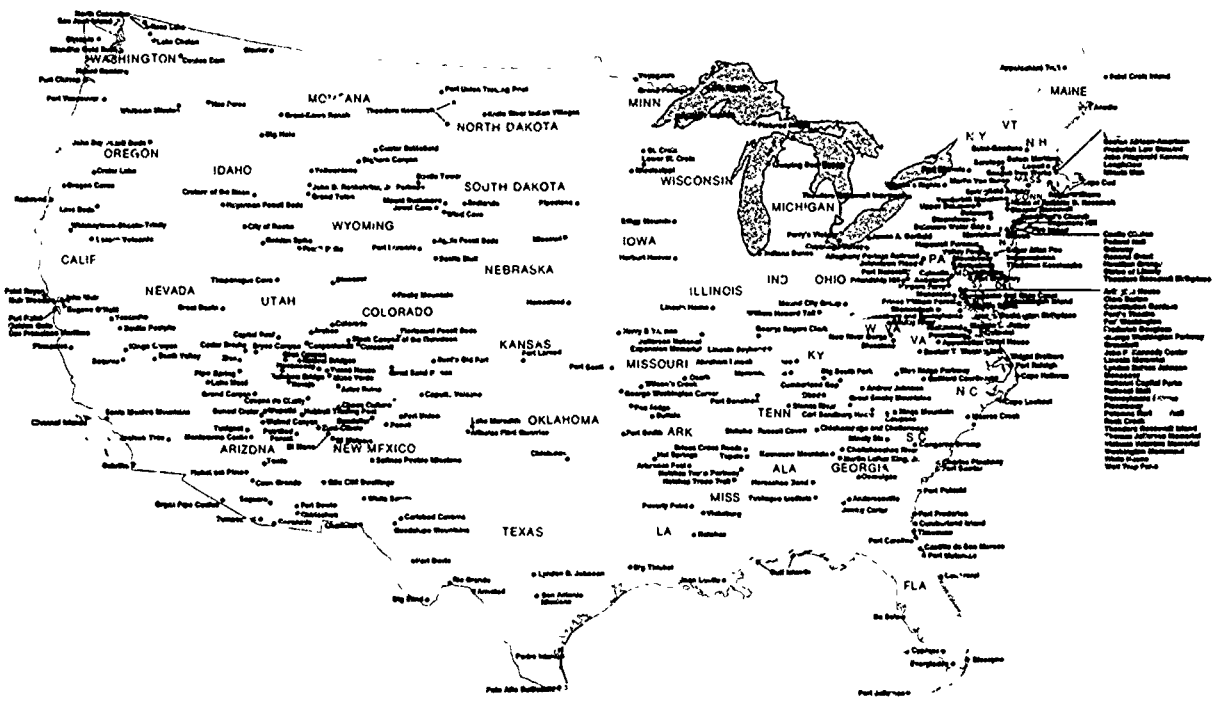
Minerals Management Service:
Office of Minerals Management Information
Room 4245
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-3983

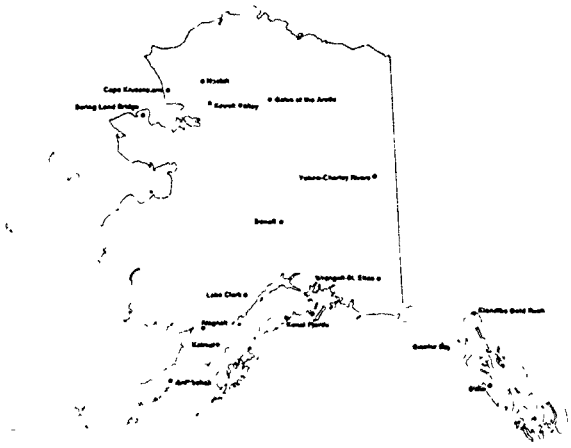
Bureau of Reclamation:
Office of Public Affairs
Bureau of Reclamation, Room 7642
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-4662

Bureau of Mines:
Chief, Office of Public Information
Bureau of Mines, Room 1035
Columbia Plaza
Washington, D.C. 20241
Tel: 202-634-1001

Office of Surface Mining:
Public Affairs Office
Office of Surface Mining, Room 244
South Interior Building
Washington, D.C. 20240
Tel: 202-208-2553

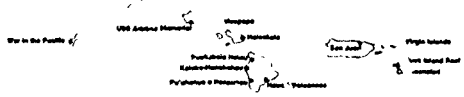
Bureau of Indian Affairs:
Information Office
Bureau of Indian Affairs, Room 4160
U.S. Department of the Interior
Washington, D.C. 20240
Tel: 202-208-7315



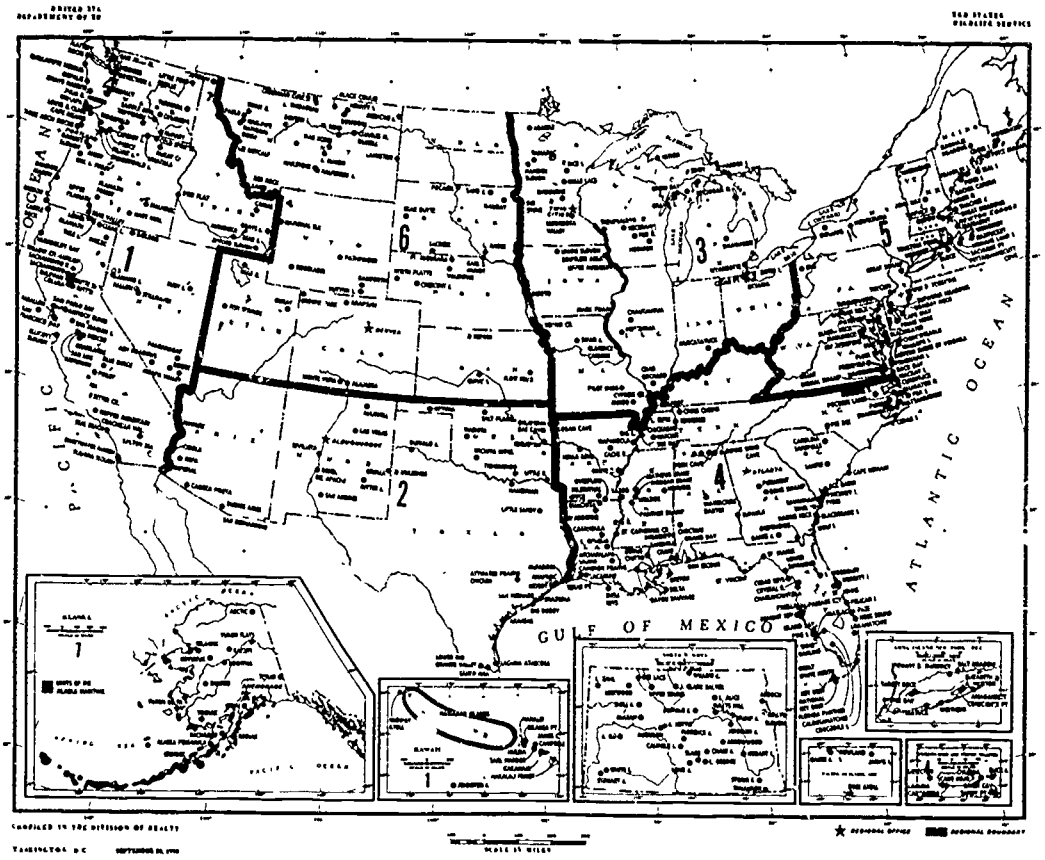


Seven national park areas in Alaska have adjoining national preserves counted as separate units of the National Park Syste They are Aniakchak Denali Gates of the Arctic Glacier Bay, Katmai Lake Clark . J Wrangell St Elias

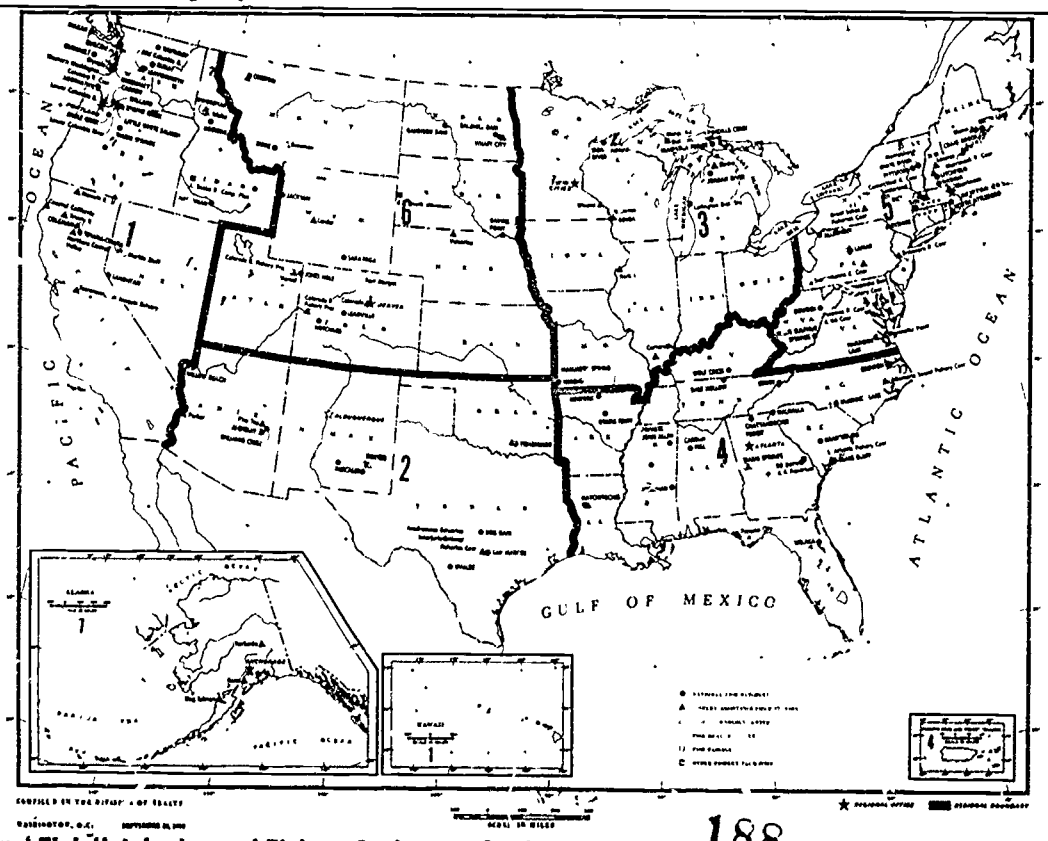
Guam | Hawaii | Puerto Rico and the Virgin Islands



The National Park System



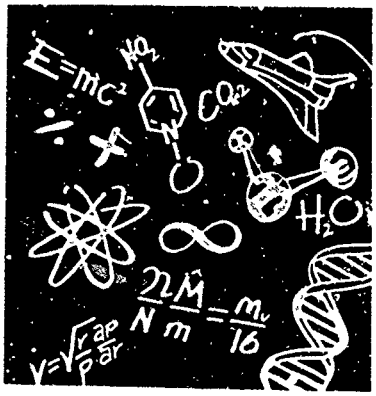
National Wildlife Refuge System



National Fish Hatcheries and Fishery Assistance Stations

"The Forensic laboratories of the Department of Justice are an integral part of the Federal Government's law enforcement efforts. Modern science and technology have become important tools in our battle against the increasingly sophisticated criminal organizations of the day. Strong support for math and science in our schools will be critical in providing us with much-needed crime-fighting scientists and technicians of the future."

Dick Thornburgh
Attorney General of the United States



MISSION AND STRUCTURE

The Office of the Attorney General was established in 1789. The Department of Justice was subsequently established in 1870. The Department employs over 80,000 individuals in the United States and around the world. It is the Department's mission to provide legal advice to the President, represent the Executive Branch in Federal courts, investigate Federal crimes, enforce Federal laws, operate Federal prisons, and provide law enforcement assistance to state and local communities. The Department of Justice is "labor intensive," relying heavily upon its personnel to fulfill its mission. Professionals of the highest caliber comprise the many litigating divisions, law enforcement offices, and management and coordination offices of the Department. Approximately 23% of the Department's personnel are located within the Washington, D.C. metropolitan area. Other employees are located throughout the country and around the world in the United States Attorneys' offices, the Bureau of Prisons, the Federal Bureau of Investigation, the Drug Enforcement Administration, the United States Marshals Service and other components.

Compared with the Federal science mission agencies, the Department of Justice lacks a significant focus on math and science-related occupations. However, math and science play an important role in certain aspects of the Department's mission, particularly the laboratory operations of the Federal Bureau of Investigation and the Drug Enforcement Administration. The remainder of this chapter: (1) gives a general overview of the Department's education activities, (2) describes the Department's specific science, mathematics, engineering and technology education activities, and (3) discusses new initiatives.

DEPARTMENT OF JUSTICE CONTRIBUTION TO THE NATIONAL EDUCATION GOALS

Attorney General Dick Thornburgh joined the President, Cabinet colleagues, and the Nation's Governors at the historic Summit on Education held in Charlottesville, Virginia in September 1989. Supported by his experience as Attorney General and as a former two-term Governor of the Commonwealth of Pennsylvania, Attorney General Thornburgh is dedicated to the role of education in our society and to all appropriate means to enhance education, including adult education. The Attorney General fully supports the National Education Goals which resulted from the Charlottesville meeting of the President and the Governors. The Department of Justice conducts a number of programs that support those goals, some of which are described below.

Goal 2: By the year 2000, the high school graduation rate will increase to at least 90 percent.

The Department's Office of Juvenile Justice and Delinquency Prevention (OJJDP) has supported the Cities in Schools (CIS) program since 1984. This is a major public-private partnership that works to reduce school violence and prevent students from dropping out of school. Three central principles guide CIS: a relationship must be established between a troubled youth and a caring adult, the youth and service provider must be held accountable, and fragmented resources must be coordinated and made available to youth and their families. These goals are accomplished through alternative educational academies developed with existing community public and private resources. CIS provides training and technical assistance to local communities on methods to establish these alternative schools, to which students are referred because of low academic

HIGHLIGHT Approximately 300 Department of Justice staff have taught a variety of subjects in local schools as a result of Attorney General Thornburgh's volunteer education outreach program.

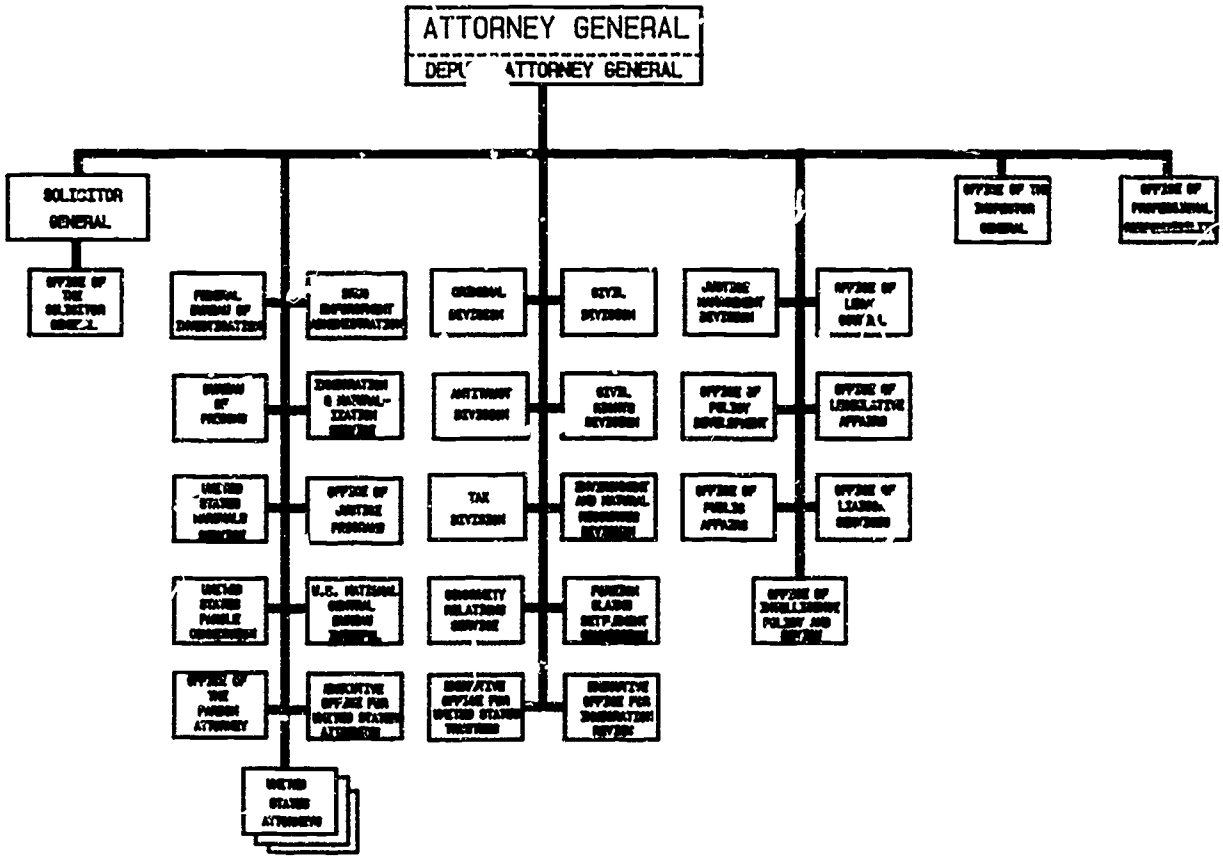


Table of Organization - Department of Justice

achievement, poor attendance, disruptive behavior, or family problems. Counselors, social workers and volunteers work with students to improve their personal, educational and social development skills, provide employment skills, and reinforce positive behavior.

OJJDP also oversees the Alternative School Program. This is a school drop-out prevention program that identifies the needs of youth who are likely to drop out of school and coordinates community resources to help these high-risk youth and their families. The Alternative School program was developed by OJJDP in 1988. It currently serves 10 communities nationwide. Six other communities are in the selection process and should be chosen in 1991 for participation in the program.

Goal 3: By the year 2000, American students will leave grades 4, 8, and 12 having demonstrated competency in challenging subject matter . . . and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy.

HIGHLIGHT The U S Border Patrol is working with schools near our borders, bringing drug education to thousands of students.

The Attorney General has established an educational volunteer outreach program known as Legal Advocates in Education. The program has a simple objective: to assist in the educational process wherever the needs of individual students can be matched with the skills of a volunteer. Volunteers are not limited to attorney employees of the Department nor do they assist students with only those subjects germane to the law. The inspiration for this program came from the Department's Association of Black Attorneys, who perceived the need for educational outreach to the local community. The effort has been strongly supported by the Attorney General and also by the Solicitor General, who had run a similar program when he was a Federal judge. The program commenced in May of 1990 when the Attorney General taught a class in United States history to eighth graders at a local middle school. Attorney General Thornburgh repeated his visit to the middle school in October to teach another eighth grade history class.

While most of the Department's approximately 300 volunteers will focus on the enhancement of verbal skills, the administrators of the program have discovered a number of people with math and science skills. This segment of the program is discussed in section C of this report.

Goal 4: By the year 2000, U.S. students will be first in the world in science and mathematics achievement.

The Department of Justice's contribution to this goal is discussed in later sections.

Goal 5: By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in the global economy and exercise rights and responsibilities of citizenship.

On October 17, 1990, the Attorney General spoke at the First International Conference on Literacy and Corrections, held in Ottawa, Canada, where he announced the proposal of a new, higher standard for literacy for some 58,000 Federal prisoners in the United States.

Mandatory inmate literacy at the sixth grade level was first implemented in the Department of Justice, Bureau of Prisons, in May 1982. The literacy standard was raised to the eighth grade level on July 1, 1990. Under this proposed new procedure, the literacy standard will be raised to the high school diploma or its equivalent in early 1991 following public comment and review. The raising of the standard reflects the trend toward higher academic requirements for almost all entry-level jobs. In order to reflect the accepted literacy standard in the communities where Federal prisoners will be released, the Bureau of Prisons will require all inmates confined in Federal correctional facilities who do not already have a verified GED or high school diploma to attend an adult literacy program.

The literacy standard will also apply to non-English speaking inmates who function below the twelfth grade academic level in their native language. A system of incentives will be established to encourage inmate participation. However, as with other mandatory prison programs, staff may take disciplinary action against inmates with academic levels below the GED or high school level who refuse to enroll in or complete the mandatory literacy program.

On other fronts, OJJDP conducts a program known as Law-Related Education that helps stu-

HIGHLIGHT The FBI's Forensic Science Research and Training Center provides opportunities for student interns to assist FBI scientists on the leading edge of forensic science.

dents understand responsibilities and rights associated with everyday life. It teaches youth about the foundations of a democratic society such as freedom, authority, justice, privacy and equality. It promotes respect for the law and promotes a reduction in delinquent behavior. A drug component has also been added to the curriculum.

Goal 6: By the year 2000, every school in America will be free of drugs and violence and will offer a disciplined environment conducive to learning.

The Department of Justice is acutely interested in assisting the attainment of this goal. As Attorney General Thornburgh stated at the commencement of the Legal Advocates in Education program, "The longer we can make sure our teachers, and not drug dealers, hold sway over our kids, the more promising America's future will be. And we 'part-timers' can help by sharing our experiences and insights."

The Department of Justice supports numerous drug prevention and education programs including the Drug Abuse Reduction Education (DARE) program, Super Teams, the School Crime and Discipline Research and Development Project, the McGruff the Crime Dog Campaign, and the Students Mobilized Against Drugs in D.C. program. The Department also provides drug education and prevention materials for students in schools.

Justice is supporting a new Drug-Free School Zone Project that will mobilize efforts to design and implement comprehensive, system-wide community organization and planning strategies for drug-free schools. The project will also implement a crime reduction strategy and identify and coordinate existing private, Federal, State, city, community and human service resources to improve the delivery of in-school services.

The Drug Enforcement Administration is working actively with state and local law enforcement in the DARE program and other educational/prevention programs. The U.S. Border Patrol Drug Demand Reduction through Education Program is available in schools in all regions of the border patrol. From December 1989 through February 1990 alone, the program provided 18,173 presentations involving 1,756,024 participants. Another program is the FBI's Drug Demand Reduction Program that places a significant number of Special Agents in schools nationwide to assist with school anti-drug education efforts.

The Department has added a supplement to the National Crime Survey to provide data on the availability of drugs and alcohol in schools, efforts to maintain school security, and the effects of the fear of crime on behavior.

Justice is funding a study to examine the motives for firearms acquisition by juvenile offenders and high school students in order to help control gun abuse and gang violence in schools.

These and other ongoing programs are designed specifically to provide for a disciplined environment conducive to learning.

ONGOING PROGRAMS OF THE DEPARTMENT OF JUSTICE IN MATH AND SCIENCE EDUCATION

While the Department of Justice is not a leader among Federal agencies in the field of math and science education, it does have several programs, primarily through the National Institute of Justice (NIJ), the Federal Bureau of

Investigation (FBI) and the Drug Enforcement Administration (DEA).

As mentioned previously, the Attorney General has initiated the Legal Advocates in Education program. While most of the departmental volunteers focus on the enhancement of verbal skills, some also support local schools with math and science education. For example, during the summer of 1990, the Department assisted the Department of Labor with Project Lift, a program for approximately 50 twelve to thirteen-year-olds. Participants attended summer school at the Department of Labor three days a week for five weeks, where they focused on math and verbal skills. Labor asked the Department of Justice to help provide math tutors. After a survey of departmental volunteers, nine employees committed time for this program. It is anticipated that this cooperative program with the Department of Labor will continue next summer. In addition, NASA is interested in establishing an educational outreach program using the Department of Justice model.

The National Institute of Justice

The National Institute of Justice was created in 1968 and is the principal research branch of the Department of Justice. While it does not directly support educational programs in mathematics and science, its activities have indirectly impacted these areas since its founding.

Research Grants
The Institute awards approximately $4 million annually to colleges and universities located nationwide to conduct studies on the prevention and control of crime. A number of these studies employ sophisticated statistical and mathematical techniques. Approximately 70 undergraduate and graduate students each year, working under the supervision of senior project directors, are trained to understand and apply these techniques in the course of research. Several awards also are made annually to improve scientific approaches to the forensic investigation of crime. Students working on these projects are exposed to the application of biological and chemical techniques used in crime analysis.

Fellowships
The Institute also sponsors a Graduate Research Fellowship Program. The program provides approximately 50 doctoral candidates with stipends averaging $10,000 to support work on dissertations in the field of criminal justice. As with research grants, doctoral dissertations may employ a variety of mathematical and scientific techniques employed by students under the supervision of dissertation advisors.

For further information regarding NIJ research grants and fellowships, write to the Office of the Director, Room 846, 633 Indiana Avenue, N.W., Washington, D.C. 20531 (202) 307-2942.

The Federal Bureau of Investigation

In keeping with the commitment to provide exceptional training and research to law enforcement, the Federal Bureau of Investigation established the Forensic Science Research and Training Center (FSRTC) in June 1981. The FSRTC, a section of the FBI Laboratory Division, is located at the FBI Academy, 40 miles south of the FBI headquarters in Washington, D.C. FSRTC has 46,754 square feet of laboratory, classroom and office space and an inventory of over $4 million in state-of-the-art scientific equipment.

The FSRTC has established a research program concentrating in biochemistry, immunology, chemistry, physics and polygraphy. The program focuses on the development of new methods in forensic science. The research staff interacts with researchers from academia, private industry and other government and forensic science laboratories. The two general categories of research are long-term or original research projects, in which the newest theories or technologies are explored for applications that are years from actual implementation, and short-term research projects that evaluate current methods to determine their value and reliability in forensic analyses. The ultimate goal is to develop and establish procedures to be used by both the FBI laboratory and other Federal, State and local crime laboratories. The results of completed research projects are published in forensic science journals and other appropriate scientific journals.

FBI Firearms Examiner inspecting a rifle shell casing for marks made by the weapon's firing pin and other mechanical functions.

The FSRTC research staff consists of 29 staff and visiting scientists, including 11 Ph.D-level research scientists with graduate degrees in biochemistry, genetics, analytical chemistry, material science, soil science, biomedical engineering and psychology. The analytical instrumentation resources of the FSRTC include gas, liquid, ion and gel-permeation chromatographs, scanning electronic microscopes, and mass spectrometers (MS), including a quadrapole tandem MS/MS, atomic absorption, and infrared and ultraviolet visible spectrophotometer and electrophoresis equipment.

Visiting Scientists Program

To assist in the research effort, the FSRTC operates the Visiting Scientists Program (VSP). The VSP is administered under the auspices of the Intergovernmental Personnel Act of 1970. This act authorizes the exchange of scientists between participating entities and the government. The FSRTC has utilized scientists from academia as part of this program. The current thrust of the VSP is in the forensic DNA research area. Additionally, there have been visiting scientists in other research areas, such as infrared analysis of soil evidence, organic trace analysis by chromatography, and single fiber research by Fourier transform infrared analysis. The FSRTC has hosted visiting scientists from George Washington University, University of Montana, Gonzaga University and Virginia Polytechnic Institute. Generally, the sponsoring agency or university provides the salary.

However, on occasion, the visiting scientist's salary has been supplemented by the FBI. The FBI provides all laboratory space, equipment and supplies to support the research.

Candidates for the VSP program must have at least a Bachelor's level degree in a chemical, physical, life or computer science. Preference is given to scientists with advanced degrees. Scientists must be available to work in the FSRTC for a minimum period of three or four months.

Summer Intern Program

The FSRTC also operates a summer student intern program (SIP). The purpose of the SIP program is to provide the opportunity for well-qualified upper-level undergraduate or graduate students to participate in short-term, high-priority forensic research projects. The students assist Ph.D-level FBI research scientists in research projects in biochemistry, chemistry, and physics. The three-month employment has several benefits: establishing a liaison between the FBI research program and a wide range of university science departments, providing technical training to the students on high technology scientific equipment, and expediting the Bureau's forensic research projects.

Student participants have science backgrounds and must have completed at least two years of college-level study. The FBI provides full support, including salaries, supplies, equipment and research space. Generally three to five student interns participate in the program each summer. Following a short orientation and familiarization with the FSRTC research program, the students begin their research. The students make oral presentations on selected current scientific research topics and visit the FBI Headquarters Laboratory to learn how their research will eventually be incorporated into case examinations. Near the end of their three months of research the students prepare a report of their results for eventual publication in scientific periodicals.

Other Activities

In addition, FSRTC staff scientists are frequently asked to lecture at scientific meetings, conferences and seminars. During calendar year 1989, the FSRTC staff made over 80 scientific presentations. Although no formal program for the exchange of information has been established, FSRTC staff have also been frequently asked to speak at universities, high schools and other educational activities.

The Drug Enforcement Administration

The DEA laboratory system is composed of a headquarters management function and eight forensic laboratories across the country employing approximately 200 chemists. DEA laboratories directly support the DEA and FBI drug investigations by: (1) performing qualitative and quantitative chemical analyses of purchased and seized controlled drug evidence; (2) providing expert scientific testimony for prosecutive purposes under the Controlled Substances Act; (3) participating in clandestine drug laboratory seizures and vacuum sweeps for traces of drugs; and (4) providing other technical assistance such as forensic photographic capabilities and examinations for latent fingerprints.

Through laboratory analysis of evidence, DEA also derives intelligence for tactical purposes including making information available to special agents for undercover operations, linking suspects to achieve conspiracy indictments, and obtaining strategic intelligence on the nature of

illicit traffic and the origin of controlled drugs. The seven field laboratories provide two basic types of support to state and local law enforcement agencies: (1) supplemental laboratory analyses for drug evidence that meet applicable State Speedy Trial Act provisions; and (2) technical assistance to encourage State and local agencies to become self-sufficient in forensic analyses. The seven DEA field laboratories are: Northeast Laboratory - New York, New York (26 chemists); Mid-Atlantic Laboratory - Washington, D.C. (35 chemists); Southeast Laboratory - Miami, Florida (17 chemists); North Central Laboratory - Chicago, Illinois (19 chemists); South Central Laboratory - Dallas, Texas (20 chemists); Western Laboratory - San Francisco, California (20 chemists); and Southwest Laboratory - San Diego, California (23 chemists).

DEA Forensic Chemist performing qualitative screening tests for multi-kilo seizure of cocaine.

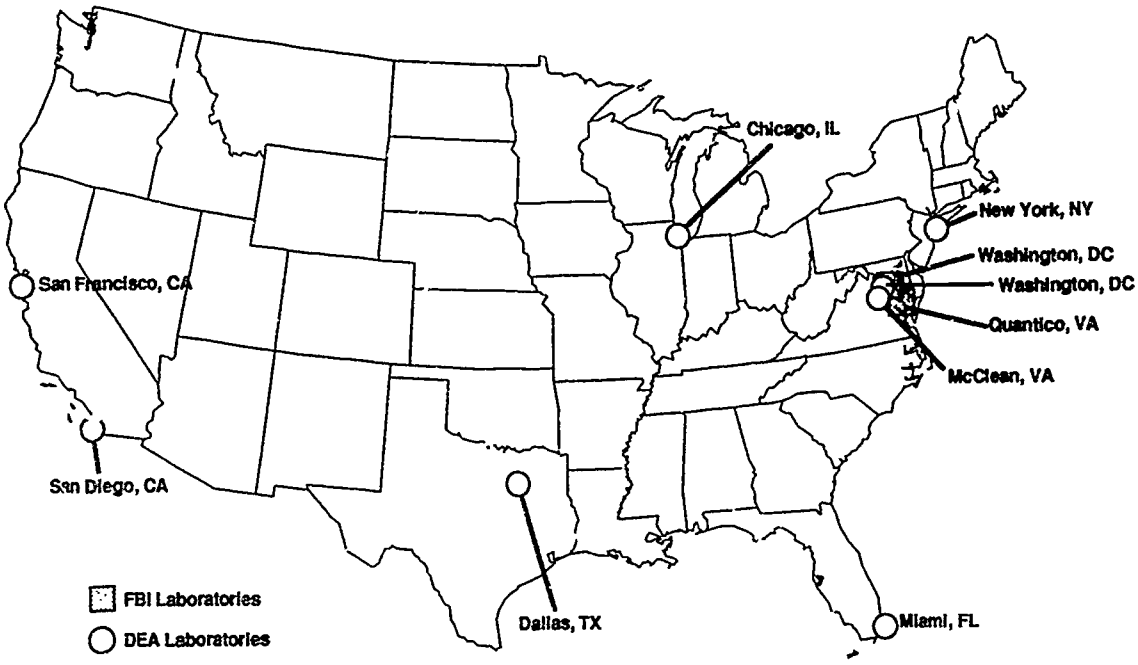
The Special Testing and Research Laboratory, located in McLean, Virginia (21 chemists), provides evidence analysis and scientific support to DEA's foreign regions; provides support to other forensic laboratories when specialized expertise or instrumentation is required; performs source examinations of tablets and capsules to assist in identifying manufacturing sources of drugs; assists international organizations, foreign governments, or other Federal and Stat agencies with scientific and technical support and training; and conducts forensic research and development activities for enforcement and intelligence purposes.

Professional chemists located in these facilities presently teach chemistry in colleges and junior colleges throughout the country. In addition, in order to help foster student interest in scientific fields, DEA chemists could give short presentations or participate in panel discussions concerning forensic science and career opportunities with the DEA laboratory system.

POSSIBLE NEW INITIATIVES

Opportunities for the active participation of students in the scientific endeavors of the FBI and DEA are necessarily limited by the confidential nature of investigations into illegal activity both prior to and following arrest of suspects. For instance, anyone working in a DEA laboratory must have a full-field background investigation and receive a security clearance. These requirements have caused problems in the past in having visiting scientists in DEA laboratories.

The FBI's Forensic Science Research and Training Center in Quantico, Virginia, could support two or three teachers in an eight-week Visiting Scientists Program during the summer



FBI and DEA Laboratories

months (June through August). All candidates for the Visiting Scientist Program would be required to complete an "Application for Employment" and be subject to a limited background investigation.

In addition, professional scientists from the FBI laboratory could be made available on a limited basis to provide lectures in the biological, chemical and forensic sciences at regional schools.

Finally, the FBI's Technical Services Division sponsors an extensive research and development program in engineering sciences. However, due to the secure nature of their research, it would not be appropriate to host teachers as visiting scientists in this division. The personnel who conduct and manage the research programs possess advanced degrees in engineering and mathematical and computer sciences and could provide lectures to regional schools in mathematics and computer sciences at the high school to precollege levels.

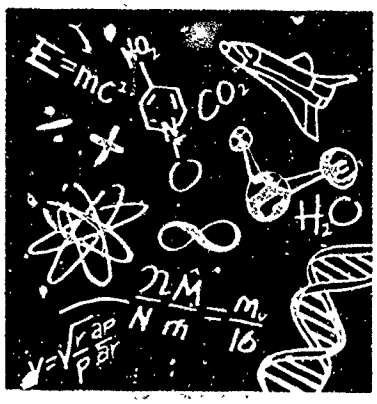
Additional information regarding these opportunities may be obtained from John Hicks, Assistant Director in Charge/Laboratory Division, Federal Bureau of Investigation, Room 3090, FBI Building, 9th & Pennsylvania Avenue, N.W., 20535.

One or two high school chemistry teachers could be accommodated during the summer months to work in the DEA's Special Testing and Research Laboratory assisting in projects specializing in analytical drug chemistry. Some of the profes-

sional chemist staff presently teaching chemistry in colleges and junior colleges throughout the country could be used to stimulate student interest in forensic sciences in high schools located near the eight DEA laboratories. Further contact regarding this opportunity and other information regarding the DEA lab program should be directed in writing to Aaron P. Hatcher, III, Deputy Assistant Administrator, Office of Forensic Sciences, Drug Enforcement Administration, Washington, D.C. 20537.

"The decade of the 1990s is filled with great opportunity and great challenge. The opportunity facing us is to enable every American that wants a job to have one. The challenge is to develop skills of our current and future workforce and provide a quality workplace to ensure America's productivity in the 1990s and beyond."

Roberts T. Jones
Assistant Secretary
of Labor



OVERVIEW

The U.S. Department of Labor was created by a law signed by President William H. Taft on March 4, 1913. Its purpose, read the act, "shall be to foster, promote and develop the welfare of the wage earners of the United States." Its primary role today is t protect and promote the interests of the American worker.

Today the Labor Department's activities affect every man, woman and child in the Nation. The Department protects workers' wages, health and safety, and pensions. It provides job training, unemployment insurance and workers' compensation.

From collecting labor statistics to strengthening collective bargaining to promoting equal employment opportunity, the Department's programs cover virtually every aspect of earning a living. These responsibilities are handled by several agencies and offices of the Department. Some of these offices and agencies are listed below:

The normal **executive direction functions** are handled out of the Offices of the Secretary, the Assistant Secretary for Administration and Management, the Assistant Secretary for Policy, the Solicitor and the Inspector General. These offices handle planning, policy, administration, management, legal assistance and audit functions.

Unique to the Department are the Bureau of International Labor Affairs (ILAB), the Women's Bureau and the Office of Small and Disadvantaged Business Utilization (OSDBU).

The primary function of ILAB is to assure that the interests of the American worker are given due consideration in the formulation and execution of United States economic and foreign policy. ILAB also provides information to DOL agencies on foreign experiences in the labor area, performs policy reviews and studies the impact of immigration-related legislative and regulatory initiatives.

The Women's Bureau promotes the welfare of women working. Its interests include training for better jobs for women and employee-sponsored child care for working mothers. The Bureau analyzes legislative proposals to determine their impact on women and coordinates intradepartmental efforts to advance the status of women.

The OSDBU is the primary advocate within the Department for small and disadvantaged business concerns.

A major agency of the Department is the **Employment Standards Administration (ESA)**, which administers and enforces a variety of statutes prescribing certain standards of employment that must be met by covered employers. These standards are primarily concerned with nondiscrimination and affirmative action in the workplace, and wages and working conditions.

To accomplish these varied tasks, ESA has established the Office of Workers' Compensation Programs (OWCP), the Office of Federal Contract Compliance Programs (OFCCP) and the Wage and Hour Division.

OWCP administers and manages three major work-related disability compensation programs. The purpose of these programs is to protect the interests of an injured worker, the employer and the Federal Government throughout all stages of a covered employee's workers' compensation

HIGHLIGHT In Program Year 1990, over 2,223,000 participants will be served by JTPA programs.

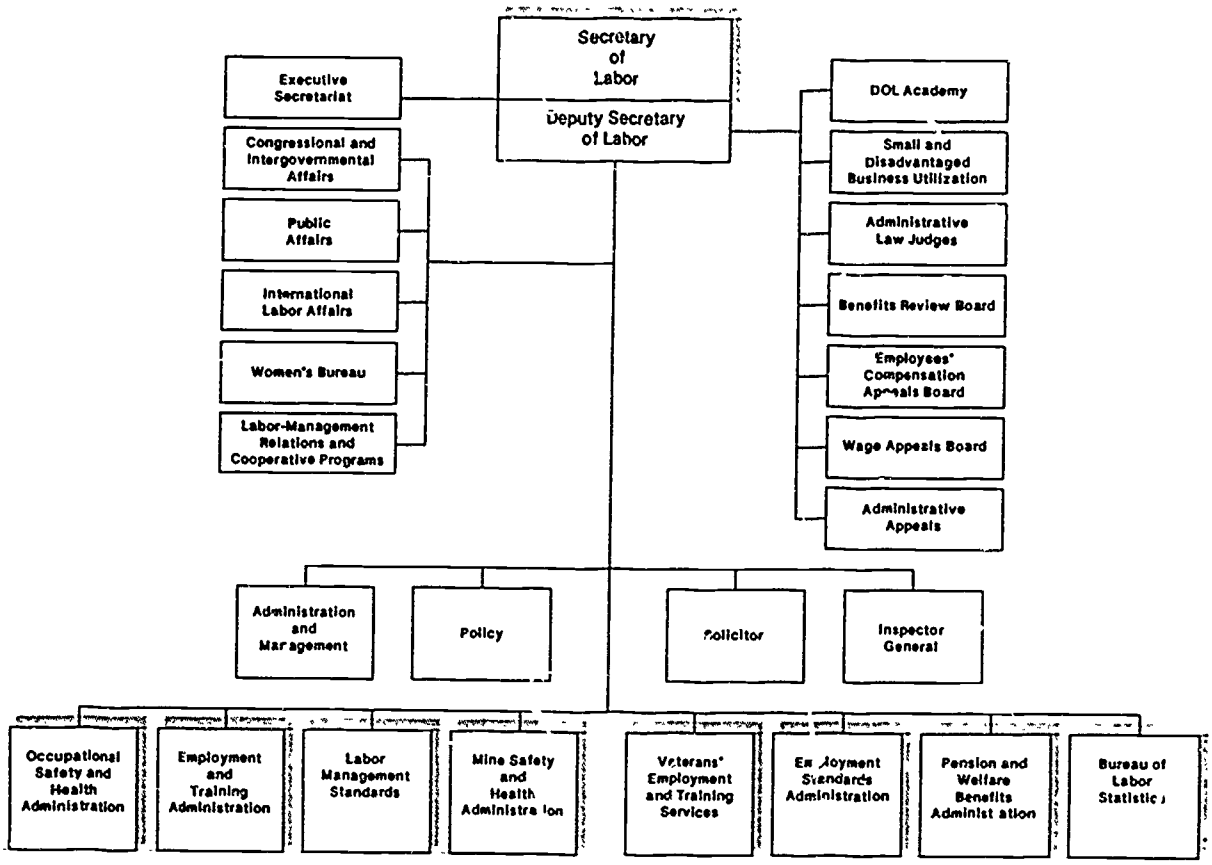


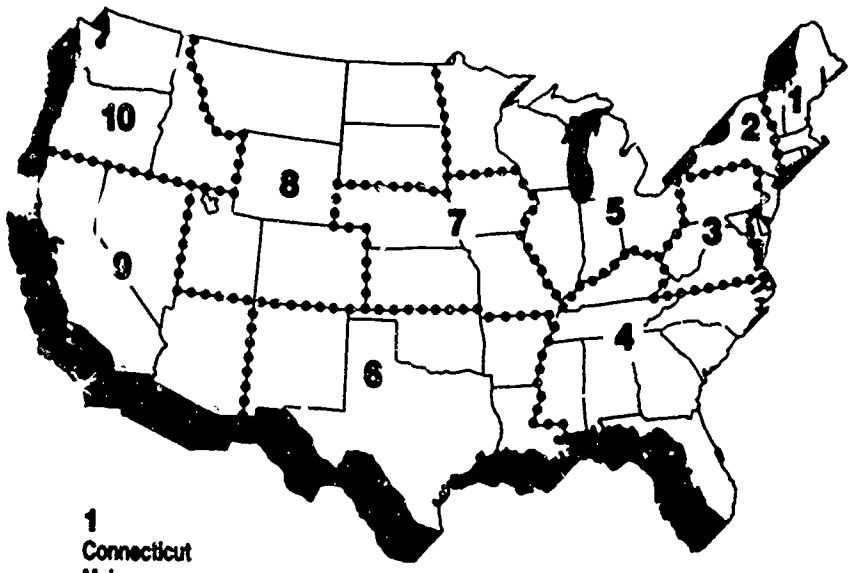
Table of Organization - Department of Labor

claim. The programs are the Federal Employees' Compensation Act Program, the Longshore and Harbor Workers' Compensation Act Program, and the Black Lung Benefits Act Program.

OFCCP enforces the provisions of Executive Order No. 11246 and certain other statutes which require that Federal contractors not discriminate because of race, color, religion, sex or national origin, and that affirmative action is taken to assure equal opportunity in employment.

The Wage and Hour Division administers and enforces a variety of statutes that establish standards for wages and working conditions in the private and local government sectors. The major statute of these is the Fair Labor Standards Act (FLSA), which promulgates standards on minimum wage, overtime, child labor, record keeping and special minimum wage standards in the private and local government sectors. Voluntary compliance with the FLSA is promoted; however, compliance with labor standards statutes is also achieved through the enforcement activities of investigation, complaint resolution and the assessment of civil penalties.

HIGHLIGHT Sixty-six thousand migrant and seasonal farmworkers will be served by the JTPA migrant and seasonal farmworker program in Program Year 1990.



1
Connecticut
Maine
Boston Massachusetts
New Hampshire
Rhode Island
Vermont

2
New Jersey
New York New York
Puerto Rico
Virgin Islands

3
Delaware
District of Columbia
Philadelphia Maryland
Pennsylvania
Virginia
W. Virginia

4
Alabama
Florida
Georgia
Atlanta Kentucky
Mississippi
N. Carolina
S. Carolina
Tennessee

5
Illinois
Indiana
Chicago Michigan
Minnesota
Ohio
Wisconsin

6
Arkansas
Louisiana
Dallas New Mexico
Oklahoma
Texas

7
Iowa
Kansas City Kansas
Missouri
Nebraska

8
Colorado
Montana
Denver N. Dakota
S. Dakota
Utah
Wyoming

9
Arizona
California
San Francisco Guam
Hawaii
Nevada

10
Alaska
Seattle Idaho
Oregon
Washington

Department of Labor Regions and Regional Office Cities

HIGHLIGHT Over 45,000 Native Americans will be served in Program Year 1990 by the JTPA Native American program.

The Wage and Hour Division also enforces the provisions of several other statutes that collectively provide certain labor standards for workers employed on Federally-assisted contracts for construction and for the provision of goods and services.

The **Office of Labor-Management Standards** administers and enforces provisions of the Labor-Management Reporting and Disclosure Act of 1959 (LMRDA), similar provisions of the Postal Reorganization Act, and related legislation. Primarily, this involves the structured monitoring of private sector labor organizations to protect union assets and the rights of union members. Major OLMS enforcement activities include investigation of union officer elections (initiated only on a complaint basis) and the proper utilization of union funds.

The **Bureau of Labor Management Relations and Cooperative Programs (BLMRCP)** is one of the Department's agencies that delivers labor-management services to the American workforce. The purpose of BLMRCP is to aid improved labor-management relations and productivity in both the private and public sectors. This is accomplished through encouragement of voluntary labor-management cooperative programs, research training and technical assistance to influential decision makers, and mediatory and technical assistance to employee and employer organizations of urban mass transportation systems and other Federal assistance programs.

The **Mine Safety and Health Administration (MSHA)** administers the Mine Safety and Health Act of 1977. The major activities of MSHA are enforcement, standards development, assessment of civil penalties, educational policy and development, and technical support.

Day care services, a need for the 1990s, and an opportunity for early math and science education.

MSHA works to prevent injuries and illness in mines. Its programs include inspections, training and technical assistance.

The **Occupational Safety and Health Administration (OSHA)** administers the Occupational Safety and Health Act of 1970.

OSHA develops, reviews and promulgates occupational safety and health standards to assure, as far as possible, safe and healthful working conditions for the American worker. Compliance with standards is obtained, in part, by fostering the voluntary cooperation of employers and employees and, in part, by the physical inspection of plants and facilities.

OSHA provides 50% matching grants to 25 States to assist in administration and enforcement activities for these OSHA-approved State operated occupational safety and health programs.

HIGHLIGHT Sixty-six thousand disadvantaged youth between the ages of 16 and 21 years of age will be served by the JTPA Job Corps program in Program Year 1990.

Technical support is provided to agency programs in the form of safety engineering, regulatory studies, chemical analysis and others. OSHA utilizes a variety of employer and employee assistance activities including consultative services, competitive grants, Voluntary Protection Programs and the OSHA Training Institute. The agency also collects and publishes statistics concerning the incidence, severity and causes of occupational illnesses and injuries, which are utilized in many facets of agency operations.

Computer skills, a demand for the 1990s.

The **Bureau of Labor Statistics (BLS)** gathers data on labor economics, including employment, unemployment, wages, occupational outlook, process productivity, and job safety and health. It is the principal fact-finding agency for the Federal Government in the broad field of labor economics. BLS has a mission to provide general purpose statistics for use in decisions on economic and social policy, the business and labor communities, legislation, research, and administration of government programs.

The **Pension and Welfare Benefits Administration (PWBA)** administers the Employee Retirement Income Security Act of 1974, which regulates certain aspects of the Nation's private sector pension plans and welfare benefits plans. It enforces standards to protect more than $1.7 trillion in assets of over 200 million workers participating in private pension and other fringe benefit plans. PWBA has similar responsibilities under the Federal Employees' Retirement System Act of 1986 (FERS), which established the Federal Retirement Thrift Board to manage and invest contributions by Federal employees to the Thrift Savings Fund created by the Act.

In the agencies and offices listed above, the major training activity is directed toward Federal staff and in some cases State and local staff to help them carry out their responsibilities.
The agencies of the Department that are most involved in broad basic math and science education and training of the type to be included in the universe of the FCCSET-CEHR are the Veterans Employment and Training Service (VETS) and the Employment and Training Administration (ETA).

The **Veterans Employment and Training Service (VETS)** ensures that veterans receive the employment preference and training to which they are entitled by law and enforces veterans' reemployment rights laws.

VETS supervises the execution of veterans' counseling, training, and placement policies of the State Employment Security Agencies (SESAs) and other employment and training programs. VETS administers the Disabled Veterans' Outreach Program (DVOP), which funds, through grants to States, positions to provide intensive employment and employability development services to disabled veterans, especially the most educationally or economically disadvan-

HIGHLIGHT Over 800,300 disadvantaged youth will be served by JTPA programs in Program Year 1991.

taged. VETS also administers the Local Veterans' Employment Representatives (LVER) program, which oversees the provision of services to veterans at the local level.

The **Employment and Training Administration (ETA)** funds training programs enabling workers to gain the skills they need for employment; it oversees State employment services that help people to find jobs and employers to find workers; and it offers income maintenance programs for workers who lose their jobs through no fault of their own. It also administers a number of statutes related to employment for the unemployed and underemployed that are directed to the present and future employment needs of the Nation.

The U.S. Employment Service (USES) of ETA provides leadership, policy guidance, technical assistance and training, and oversight for the administration and operation of the State-managed national public employment service system. States also administer certain Federal responsibilities such as interstate job clearance, alien labor certification and migrant housing inspections.

The Unemployment Insurance Service (UIS) of ETA oversees a nationwide unemployment compensation program whereby States collect taxes from employers, determine eligibility for benefits, and pay compensation benefits to eligible unemployed workers. States also administer certain Federal programs for payments of unemployment compensation to Federal employees.

ETA also administers and manages a decentralized system of skill training and related services directed toward increasing the employment and earnings of economically disadvantaged, under

Health support skills, a need for the 1990s.

and/or unemployed persons. These goals are accomplished both through grants to States and through Federally-administered programs.

States have primary responsibility for the administration and oversight of employment and training programs funded through the Job Training Partnership Act (JTPA) block grant program, the Dislocated Worker Assistance Program and the Summer Youth Employment and Training Program. The primary activities that these programs provide to participants are skill training, related educational training, employment services and supportive services. These activities, supplemented under the provisions of the Economic Dislocation and Worker Adjustment Assistance Act (EDWAA - Title III of JTPA),

HIGHLIGHT Over 369,000 dislocated workers will be served in Program Year 1990 by JTPA dislocated workers programs.

Technology support skills will be in demand in the 1990s.

Trade Adjustment Assistance (TAA), and the Bureau of Apprenticeship and Training (BAT) programs, support work-based training programs, both publicly and privately sponsored, that are designed to upgrade the skills of the work force and provide alternative paths from school to work.

ETA also administers National Programs designed to meet the training and employment needs of specific population segments. The major national programs are the Job Corps program, Native American programs, Migrant and Seasonal Farm Worker programs and Veterans' programs. In addition, activities and programs such as research and evaluation, pilots and demonstrations, labor market information, training and technical assistance, and others, are administered by ETA. Training and employment programs funded under the Community Service Employment for Older Americans programs and the McKinney Homeless Job Training Act are also administered by ETA.

MAJOR DEPARTMENT OF LABOR INITIATIVES

The Department of Labor, in playing a pivotal, dynamic role on behalf of American workers, has established six major objectives for the last decade of this century.

First, to improve the quality of the work force by ensuring that American workers are the world's best trained and most highly skilled—placing special emphasis on the disadvantaged among us to ensure their full participation in the opportunity that lies ahead.

Second, to ensure that the American work place is as safe, as healthy, and as secure as we can make it.

Third, to develop a sound and comprehensive pension policy that brings a measure of rationality to the demographic and social changes now upon us.

Fourth, to ensure fair and vigorous enforcement of labor laws.

Fifth, to empower the individual employee by encouraging employers to enhance flexibility in their work place leading toward increased productivity and efficiency.

HIGHLIGHT In Program Year 1990, over 538,000 disadvantaged youth will be served by the JTPA summer programs.

And last, to ensure that relationships between management and labor continue to move beyond the tradition of confrontation toward productive and affirmative cooperation on behalf of interests held in common.

As we approach the end of this century, America faces a work force crisis. The nature of the workplace is undergoing very basic changes. Many members of the labor force do not have the skills that will be demanded in the new jobs that are predicted to occur. To confront this problem, the Department of Labor has embarked on a Work Force Quality Agenda to narrow the skills gap, improve the preparedness of the work force, and increase opportunities for those who, thus far, have been left behind.

A primary focus of this agenda is an emphasis on school to work transition. In April, the Secretary appointed a 25-member Commission on Achieving Necessary Skills (SCANS), composed of business, education and labor leaders and chaired by former Secretary of Labor William Brock, to recommend national competency guidelines on the basic skills high school students need for entry into the world of work.

The Department is very concerned about the lack of a clear pathway from school to jobs for many young people, particularly for those who are not in an intensive vocational program and who do not plan to go to college. Since, by and large, this country lacks a formalized structure for school-to-work transition, the Department is convening a National School-to-Work Conference involving educators, employers, unions and training professionals to review current national and international examples of school-to-work programs and to consider options for improving school-to-work transition, especially for work-bound students. The Department will also explore and demonstrate school-to-work models that utilize business/education partnerships and work-based learning programs, combining academic skills learning with applied learning in workplace settings.

To further encourage business/education partnerships, the Department also initiated "LIFT Awards" (Labor Investing for Tomorrow) for outstanding business-school partner-ships and innovative school-to-work programs. The LIFT awards will also be responsive to lifelong learning by recognizing businesses with an outstanding commitment to employee training and outstanding employee worklife programs.

The Department is establishing a National Advisory Board on Workplace Training, with representatives from industry, labor, education and government, to promote the expansion of the apprenticeship concept to new industries and occupations. The development of occupational skill standards will enable workers to carry portable credentials from State to State or job to job and encourage quality training programs.

The Department also moved to convene meetings between the Employment and Training Administration (ETA) and grantees and subgrantees for the purpose of discussing issues related to improving the management and operation of job training programs.

ETA has established an Office of Work-Based Learning (OWBL) to coordinate many of ETA's activities for workers. These include Trade Adjustment Assistance programs under the Economic Dislocation and Worker Adjustment Assistance (EDWAA) Act, the Worker Adjustment and Retraining Notification

HIGHLIGHT A minimum of 626,450 JTPA Block Grant participants will be female in Program Year 1990.

(WARN) Act, and Federal responsibilities under the National Apprenticeship Act. OWBL is also the focal point for many initiatives on work force quality, particularly those regarding school-to-work transition and work-based learning. The office is also responsible for establishing a Training Technology Data Base which will provide information on a variety of private sector work-based training activities.

A series of pilot and demonstration projects known as "Job Corps II" has been implemented to build on the past success of the Job Corps program, improve performance and reduce operating costs. Many of the Job Corps II projects focus on enhancing services to corps members through the establishment of linkages with other Federal, State and local programs. A number of centers have forged successful links with State or local agencies to provide child care services for enrollees. Other centers have been designated by school boards as alternative high schools, enabling them to obtain additional resources such as staff, equipment and curriculum. A unique linkage project involving enrollment of homeless New York City youth in Job Corps is also underway. Two non-residential urban centers in Job Corps II demonstration projects are testing whether a non-residential Job Corps Center can benefit youth who cannot leave home for reasons such as family responsibilities.

Another Job Corps concept tests the extended training day. These modifications are intended to improve attendance rates and include local agreements with employers for part-time jobs for corps members, child care arrangements, and use of case workers to assist corps members with housing, public assistance and similar programs.

Three Job Corps centers are completing pilot tests to determine (a) whether more in-depth services and programs during corps members' first 30 days on center can promote better understanding and commitment to the program; (b) how to identify youth who cannot benefit from Job Corps and can be better served through referrals to other types of programs; and (c) ways to improve overall retention and completion rates.

In order to provide graduates with the skills, knowledge and attitudes needed for employment and career advancement, the curricula for 17 Job Corps vocational training clusters were rewritten. The curricula include Trainee Achievement Records (TARs), a list of tasks students need to accomplish to be employed in the occupation, and Student Activity Guides (SAGs), which provide information, steps and evaluation criteria for performance of tasks. Industry Advisory Groups (IAGs) consisting of employers and instructors are being utilized to confirm the tasks and select training materials to insure that the training provided is appropriate to industry needs and standards.

On March 29, 1990, the Secretary signed a final rule revising the regulations for the Job Corps Program. The document streamlines and updates the regulations and establishes a Policy and Requirements Handbook to cover day-to-day functioning of the program.

A Training Resources Catalogue of Job Corps vocational and academic curricula, along with administrative and support materials, was published and distributed to persons and agencies that might be able to use these materials in their own programs. Annotations of the materials were included, along with ordering information.

HIGHLIGHT Fifty percent of JTPA summer program participants (269,000) will be female in Program Year 1990.

Workgroups have been formed and convened to revise and develop curricula in the following areas: Parenting, Intergroup Relations, Social Skills Training, Drug Education, GED, Reading, Writing, Math, World of Work, Computer Assisted Instruction, and an automated education tracking (records) system. Groups consist of 6 to 15 Job Corps personnel from the 107 centers throughout the United States.

A national Annual Academic Olympics is being established for the Job Corps. Students will compete at the dorm, classroom and center level. Winners will compete at the regional and national level. The Olympics program is designed to inspire students to greater achievement in academic areas identified by employers as prerequisites to employment. These projects to test the efficacy of new approaches to organize and deliver education and training have relevance for the traditional education system.

Research, Demonstration and Evaluation Projects

Over the past four years, ETA has invested substantial resources in research, demonstration and evaluation (RD&E) projects in the area of workplace literacy. Currently, ETA is spending close to $6 million on approximately 16 projects in this area. Future RD&E activities will continue to be aimed at increasing the workplace literacy skills of youth and adults and center on ways to improve the efficiency and effectiveness of literacy and basic skills training.

Specially Targeted Programs

In addition to the Job Corps program, an ETA JTPA Native American Programs' Advisory Committee was formed under the provisions of the Federal Advisory Committee Act and currently has a membership of knowledgeable people in Indian and Native American affairs. The committee will advise the Department specifically on matters pertaining to the administration of Section 401 of JTPA, which provides comprehensive training and employment programs for Indian and other Native American communities to help reduce economic disadvantage among individual members of those communities and to advance economic and social development in the communities consistent with their goals and lifestyles.

ETA has funded three pilot projects to increase farmworkers' access to farm labor market information and growers' ability to recruit farmworkers. ETA's goal is to involve farmworker organizations and grower representatives at every step, including project design and implementation, and to use an advisory committee composed of growers, JTPA Section 402 organizations, and State Employment Security Agencies.

ETA has been conducting Older Worker Regional Conferences stressing the need for and means to improve linkages and coordination among the various agencies involved in older worker employment concerns, particularly in view of the aging of the Nation's work force.

Apprenticeship

ETA has proposed revisions to regulations under the National Apprenticeship Act to increase the effectiveness and efficiency of the current apprenticeship program. These revisions would:

- increase the minimum term of apprenticeship from one to two years:

HIGHLIGHT Forty percent of the participants in the dislocated workers program will be female (approximately 147,600) in Program Year 1990.

- remove current limitations on reciprocity of program registration and provide for a high degree of portability of program registration among the States;

- improve sponsor and registering agency accountability in program registration, denial, or withdrawal of registration;

- require periodic renewal of program registra tion and provide for ensuring program quality; and

- eliminate the requirement that apprenticeship program standards require a numeric ratio of apprentices to journey workers, except for work under the Davis-Bacon Act.

The Veterans' Employment and Training Service in 1990 will launch a major new initiative called the Transition Assistance Program (TAP) to assist military service members who are about to leave active duty. The TAP initiative will provide service members with sufficient vocational guidance to make informed career choices and the necessary array of employment assistance and training services to carry out those choices. The Department of Labor is the lead agency in the TAP initiative. which also includes the Departments of Defense and Veterans Affairs. Resources to administer this pilot effort for five sites and three military hospitals have already been committed. This program will be expanded in FY 1991 to a total of 16 sites and 12 hospitals.

The TAP effort will provide enhanced service to disabled and other veterans and be better able to prevent potential long-term unemployment problems. In addition, this program will help the Department of Defense to achieve greater retention of personnel and reduce unemployment compensation payments to ex-service members.

See the light! Trainee learning how to electrically wire in a home or commercial property.

A list of ETA currently funded workplace literacy projects follows:

Workplace Literacy Training Models

Cuyahoga Community College Workplace Literacy Project
This project provides basic skills training to increase literacy levels of welfare recipients, out-of-school youth, ex-offenders, handicapped persons and severely disadvantaged public housing residents with subsequent referral to occupational skills training and job placements.

HIGHLIGHT The Job Corps program expects to serve over 21,700 females in Program Year 1990.

Quinsigamond Community College Workplace Literacy Project
This project provides custom-designed instruction in work-related skills includ-ing reading, writing, communication, computation and problem-solving for hourly workers.

A Rural Demonstration: Basic and Occupational Skills in The Workplace
The U.S. Departments of Labor and Commerce are jointly sponsoring a national demonstration, conducted by the American Association of Community and Junior Colleges, to improve the basic and occupational skills of workers in rural areas.

SER-Jobs For Progress
This project provides comprehensive computer-assisted literacy instruction for Hispanic youth and adults through neighborhood Family Learning Centers.

Wider Opportunities For Women (WOW) Training Project
6,500 low- income single mothers receive literacy instruction and employment training at four community-based organizations located in Washington, D.C., Chicago, New York and Dallas.

Jackson State University
This project aims to develop an interactive videodisc prototype designed to relate learner interests, aptitudes and learning styles to specific literacy skills encountered in the workplace.

The Center For Advanced Learning Systems (CALS)
This center will track new developments in training technology —video disc, compact disk, computers and satellite TV—conduct workshops and provide technical consultation to ETA offices regarding technology and its application to training and other workforce activities. Occupational literacy and basic skills are key areas of interest.

Research, Assessment and Evaluation

Adult Education Study
Under joint sponsorship of the Departments of Education, Labor and Health and Human Services, COSMOS Corporation is conducting a congressionally-mandated study of the Federal funding sources and services that are available for adult education to (a) collect and synthesize information about all adult training and education programs within the Federal Government that support literacy, basic skills, English as a Second Language and adult education, including JTPA; and (b) provide recommendations about the need for program coordination and facilitation at the Federal, State and local levels.

ETS Workplace Literacy Survey
The Educational Testing Service (ETS), building on the work done for the Department of Education, is conducting a two-phased project to (a) survey JTPA program participant and Unemployment Insurance and Employment Service beneficiary applicant populations in order to profile their workplace literacy levels; and (b) produce a workplace literacy testing instrument for use by job training programs, schools and the State

Employment Security Agencies in evaluating individuals clients' literacy levels.

Center For Adult Literacy
The Employment and Training Administration (ETA), the Office of Education, Research and Improvement (OERI) in the Department of

HIGHLIGHT Almost 24,000 migrant and seasonal farmworker program participants will be female in Program Year 1990 and 22,000 Native American participants will be female.

Education, and the U.S. Department of Health and Human Services are jointly sponsoring a National Center for Adult Literacy, located at the University of Pennsylvania in Philadelphia. This five-year collaborative effort began November 1, 1990.

The purpose of this center is to improve the quality of literacy and basic skills services by conducting basic and applied research and dissemination activities in the area of adult literacy and basic skills training. Research topics to be addressed in the center's activities will include:

- Research and Adult Learning
- Research on Basic Skills Instructional and Support Programs
- Development of Assessment and Accountability Systems
- Research on the Organization and Delivery of Services

Multicultural Training For The Industrial Workplace

The American Society for Training and Development and UAW-Chrysler National Training Center in Detroit, Michigan, building upon the work done by the Hudson Institute and others, will assess the multicultural needs of the national emerging workforce and conduct a survey of current strategies and practices designed to meet these needs.

Seattle-King County PIC Workplace Literacy Project

The Seattle-King County PIC will provide literacy services to limited English speakers at selected employer sites. This project proposes to improve employer sensitivity and understanding of cultural backgrounds of limited English speaking employees and develop competencies that are industry-specific for a variety of electronic and service occupations.

Tradeswomen Retention Policy Project

Chicago Women In Trades (CIWT), a support and advocacy organization for tradeswomen and women seeking employment in the trades and non-traditional jobs, will study retention of trades-women and develop policies to improve retention.

Workplace Basics: Building Tomorrow's Skills Today

The Education and Training Corporation is to design, implement and evaluate a literacy training program based on the model recommended in Workplace Basics: The Skills Employers Want, developed by the American Society for Training and Development (ASTD) under DOL sponsorship. In collaboration with the local PIC and the Adult Education program, the ASTD model will be tested in two organizations in the Shenandoah Valley of Virginia, including Corning, Inc., a manufacturing plant undergoing a shift to a service and distribution facility.

The Long-Term Impact of the National Supported Work Demonstration on Participants' Earnings

This study will re-examine the earning effect of the National Supported Work demonstration (NSW) on its participants. The study will utilize a new data set, which contains five years of previously unavailable post-program earnings information, to investigate whether the initial impact of the NSW on participants' earnings is sustained in later years.

HIGHLIGHT Over 535,330 JTPA Block Grant participants are expected to be minority group members in Program Year 1990. In the JTPA Summer Program, 365,840 minority participants are expected to be served in Program Year 1990.

Technical and Basic Skills Effectiveness Training for Workplace Literacy

Cumberland Hardwoods will implement a 12-month, multi-faceted approach to learning in the workplace by adopting and integrating the personal and social needs of industry employees (e.g., child care, counseling and tutoring services) in the basic skills context of the work environment.

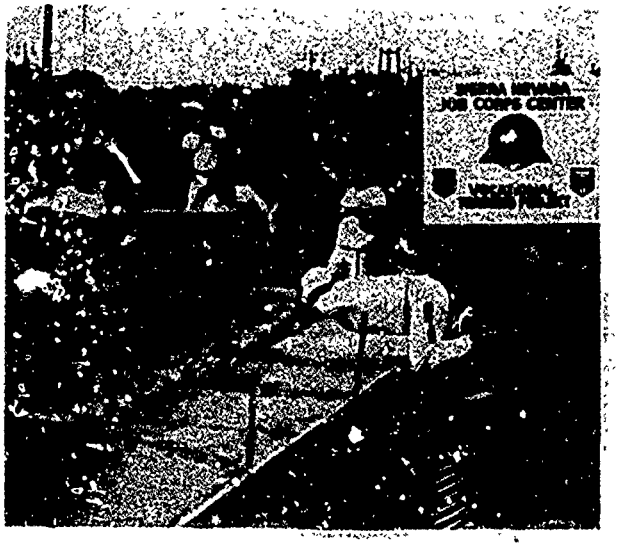
School-To-Work Program For Youth With Disabilities

The Research and Training Institute of Albertson, N.Y., will demonstrate and evaluate a comprehen-sive community-based transition program that incorporates into one model the best practices of a variety of exemplary programs. These are a few of the new initiatives that ETA is involved with for the 1990s.

ONGOING DOL/ETA PROGRAMS FOR THE FCCSET-CEHR PROGRAM INVENTORY

Most of the DOL programs that are relevant to the FCCSET-CEHR effort fall under the ETA and are authorized by the Job Training Partnership Act (JTPA).

JTPA is designed to provide a full range of educational and supportive services to underemployed and unemployed persons. The Act authorizes the establishment of programs to prepare unskilled youth and adults for entry into the labor force and to afford basic education and job training to economically disadvantaged individuals and other individuals facing serious barriers to employment, who need training to obtain productive employment.



Masonry skills training. They learn by doing in Job Corps.

Title II-A of the Act provides for a system of block grants to States to support local training and employment programs. It is the responsibility of the States to further allocate funds to service delivery areas (SDAs) in their States and to oversee the planning and operation of local programs. Services are targeted to the economically disadvantaged, but 10% of an SDA's participants can be nondisadvantaged individuals who face other employment barriers. Programs are designed to train participants for productive, unsubsidized employment. Funds are available for basic and remedial education, vocational and technical training, institutional job search and on-the-job training, work experience programs, counseling and supportive services. Title II-B of JTPA, the Summer Youth Employment and Training Program (SYETP), provides economically disadvantaged youth with employment and related training and educational services during the summer months. As with the Title II-A programs, SYETP provides grants to States, which allocate funds to SDAs.

HIGHLIGHT In Program Year 1990, 107,010 JTPA dislocated worker program participants are expected to be members of a minority group.

Title III of JTPA provides employment and training assistance for dislocated workers who have been displaced from their jobs or are about to be laid off; are ineligible for or have exhausted their entitlement to unemployment compensation; and are unlikely to return to their previous occupation or industry. In addition, the dislocated workers category includes individuals who have lost or are about to lose their jobs because of permanent plant or facility closings, or long-term unemployed persons with limited employment potential in their field in the area where they live, including older workers whose age is a barrier to re-employment. Dislocated worker programs provide job search assistance, training, early intervention programs, support services and relocation assistance.

Title IV of JTPA authorizes Federal programs for Native Americans, migrant and seasonal farm workers, and veterans. This title also authorizes the Job Corps program, which provides not only basic and vocational education but also residential living as a direct service. Other programs are authorized by this title.

Authorized by the McKinney Act, the Homeless Job Training program makes available funds for demonstration and evaluation activities under the Job Training for the Homeless Demonstration and the Homeless Veterans Reintegration Projects. The bulk of these funds will be used to continue to provide basic educational and vocational training to the homeless and to evaluate the operation of existing demonstration training programs serving the homeless.

In reviewing these DOL/ETA training programs, it became readily apparent that a portion of the training elements, particularly the basic math and the vocational technical offerings, fall within the purview of the FCCSET-CEHR proposed data base. The great majority of DOL/ETA expenditures for science, engineering and technology education will consist of comprehensive and direct student support in the mathematics and vocational/technical area.

The Department of Labor is proud of the record of JTPA and is constantly trying to improve and build on that solid success. Even now, the accomplishments of the program speak for themselves.

JTPA is reaching disadvantaged individuals who face special barriers to employment and offering hope to the disadvantaged. Overall, JTPA is exceeding the Act's requirements for serving the economically disadvantaged. Of those served, 95% disadvantaged—the law requires 90%. By most key indicators, JTPA is serving those economically disadvantaged individuals who face special barriers to employment. This is clear from a comparison of those served in JTPA with the eligible population.

JTPA is reaching youth: 45% of those served are under 22, compared with 18% of the eligible population. Youth have higher unemployment rates and are less likely to be employable than adults. The current law targets youth.

JTPA is reaching minorities: 50% of those served are minorities, compared with 40% of eligibles. As in the case of youth, minorities have a higher incidence of employability problems. JTPA is reaching Aid to Families with Dependent Children (AFDC) recipients, who make up 22% of those served compared with 18% of eligibles. AFDC recipients typically have child care and other dependency-related problems, which pose special barriers to employment. Their high repre-

HIGHLIGHT In the Job Corps program, over 46,464 participants are expected to be minority group members in Program Year 1990.

sentation in JTPA reflects the system's responsiveness to the current law's targeting provisions. Nearly 30% of those in Title II-A are welfare recipients. Nearly two-thirds are placed in jobs, and six months after termination, two-thirds of those are off welfare.

The program has exceeded JTPA performance standards and the record of previous job training programs in placing participants in competitive employment. The entered employment rate exceeded performance standards for adults and for youth. When comparing JTPA and CETA (its predecessor program), the entered employment rate for JTPA is substantially higher (60% for JTPA compared with 41% for CETA). The entered employment rate was uniformly high: approximately 60% or over for most target groups, including minorities, handicapped, dropouts and older workers, and only slightly below 60% for others. Recent follow-up data indicate that approximately 63% of adults are employed 13 weeks after program completion. For Title II-A, there was a 60-cent wage gain for those aged 22-44, a 72-cent wage gain for those 19-22, and a 44-cent wage gain for those 16-18. A large majority of JTPA participants receive training, while only a small proportion receive job search assistance alone.

Summer programs require quality work experience and basic skills remediation. All summer program participants must be assessed to determine their basic skills competency.

In addition to the block grant, summer, and dislocated worker programs, the Job Corps program is a major training and employment program related to science, engineering and technology, which is administered by the Department of Labor to alleviate the severe employment problems faced by disadvantaged youth throughout the United States. It was originally established by the Economic Opportunity Act of 1964. Current authorization for the program is under Title IV-B of JTPA.

The Job Corps program is designed to assist young people who both need and can benefit from the wide range of services provided in the residential setting of a Job Corps center. These services include basic education, vocational skills training, work experience, on-the-job training, counseling, residential living, health care and related support services. Enrollees are impoverished and unemployed young people between the ages of 16 and 21 who have volunteered for the program. These youth are typically from such debilitating environments that they must be relocated to residential centers in order to benefit from the intensive type of services provided through the Job Corps program. The typical youth served by the Job Corps program is an 18-year-old high school dropout who reads at the elementary school level, comes from a poor family, belongs to a minority group, and has never held a full-time job. The unique combination of training and support services provided in the program is intended to prepare these youth to obtain and hold gainful employment, pursue further education or training, or satisfy requirements for entrance into the Armed Forces.

The program operates through a partnership of the Federal Government, labor and the private sector. The Government provides the facilities and equipment for Job Corps centers and the funding for recruitment of enrollees, center operations and placement of enrollees upon termination. Major corporations and nonprofit organizations manage and operate 77 Job Corps centers under contractual agreements with the

HIGHLIGHT In Program Year 1990, 43,560 participants in the JTPA migrant and seasonal farmworker program and 45,000 participants in the Native American program are expected to be members of a minority group.

Department of Labor. The Departments of Agriculture and Interior operate 30 Job Corps centers on public lands called civilian conservation centers.

Job Corps center directors manage and administer Job Corps centers on 7-day-a-week schedules. This includes the hiring and training of staff, procurement of materials and supplies, provision of basic educational and vocational skills instruction, student supervision, fiscal management, maintenance of center facilities and equipment, security, safety, and community relations. All of these functions support the basic purpose and design of the Job Corps program—to provide education and training to disadvantaged youth.

Job Corps enrollees are recruited and screened for eligibility by outreach and screening contractors and are assigned to Job Corp centers. Labor unions and trade associations conduct vocational training at many Job Corps centers, and placement contractors provide assistance to former enrollees by helping them find a job, return to school or enter the Armed Forces.

The Job Corps program is ETA's most comprehensive and complete major program, in that it contains program elements that can be found individually and in groups in other ETA programs, plus one component that is unique to Job Corps, the residential living component. Because of this, the following description of the Job Corps program elements is designed to illustrate most of the elements that may be found in ETA training programs. All training programs have intake. Most programs include one or more of the following: orientation, technical assistance, screening, assessment, counseling, basic education and vocational training, work experience and on-the-job training. All programs have termination or placement.

The acceptance of youth into the Job Corps program begins with the intake process. Potential enrollees must submit applications through outreach and screening contractors. These contractors include State Employment Security Agencies, nonprofit organizations and private for-profit firms. Outreach and screening contractors make a preliminary determination of eligibility based on information received from the applicant. In order to be eligible for Job Corps, an applicant must be at least 16 and not yet 22 years of age; economically disadvantaged; living in an environment so disruptive that the prospects for successful participation in a non-residential program are substantially impaired; free of serious medical or behavioral problems; and not on probation, parole or under the supervision of any agency without written assurance from the court that no personal supervision by a correctional official is required. Enrollment of applicants with previous medical or behavioral problems must be approved by the Department of Labor.

Once an applicant has been determined to be eligible for the program, he or she is assigned to a center and provided with a date for enrollment. Transportation is provided for the enrollee to the assigned Job Corps center.

Upon arrival at the assigned Job Corps center, enrollees (students) enter an orientation program that provides them with an introduction to center life, including the center's rules and regulations, discipline system, education program, vocational offerings, recreational activities, health services and counseling. All new arrivals are provided with a complete physical examination to ensure that they do not have any serious medical prob-

HIGHLIGHT In Program Year 1990, 170,850 program participants in the JTPA Block Grant program, 22,140 in the dislocated worker program and 91,460 in the summer program will be classified as disabled.

lems that would impair their ability to participate in the program.

During the orientation program, new students are given diagnostic screening tests in reading and math to establish their educational levels and permit their placement in the appropriate level of the basic education program. In addition, students participate in an occupational exploration program to assess their interests and aptitudes for future assignment to a specific vocational training program. It is at this point in the program that an initial determination is made as to whether the individual will benefit from vocational and basic math training. Based on the results of the testing and assignment phase, an individualized employability development plan is developed for each student. The plan establishes goals for each student and provides a means for tracking the student's progress in reaching the agreed-upon goals.

The competency based education program design calls for students to spend 50% of their time in basic education and 50% in vocational technical skills training. While students prefer vocational training classes to basic education classes, the requirement to attend basic education is essential to complement vocational skills.

After completing the center's orientation program, students are assigned to classes based on the results of diagnostic tests in reading and math. The Job Corps basic education program is designed to improve students' skills in reading, mathematics, personal health, work attitudes and consumer awareness through participation in these subject classes. High school equivalency classes are available to assist students who do not have high school diplomas in obtaining their equivalency, or GED, certificates. Driver's education classes and behind-the-wheel training are provided for students enrolled in vocations where a driver's license is essential for employment or for transportation to and from work.

The Job Corps basic education program is flexible enough to accommodate students with a wide range of skills and aptitudes, from non-readers to high school equivalency levels. Since most students have experienced failure in the traditional school environment, Job Corps does not utilize traditional classroom instruction approaches. Job Corps education programs are open-entry, so that new students can enroll at any point and progress at their own pace through each area. Competition is deemphasized and individual growth encouraged through the specification of learning goals, needs and proficiencies. Instruction is broken down into small sequential steps, followed by progress checks, so that frequent and immediate feedback is provided to each student. Job Corps basic education classes have much lower student/teacher ratios than traditional public schools to permit this individualized approach to remedial learning.

In addition, Job Corps centers must structure their education programs to support the vocational training program, primarily through establishing work-related reading requirements. The World of Work program provides students with job readiness information and emphasizes job attitudes, sources of job information, employment applications, job interviews and consumer education.

During the Occupational Exploration Program phase of the orientation program, students determine the type of vocational training they wish to take, with the assistance of center counselors. Once assigned to a specific vocational trade, most

HIGHLIGHT One hundred percent of the participants in the JTPA summer, dislocated worker, Job Corps, migrant and Native American programs will be economically disadvantaged.

students spend approximately half of their time in basic education classes and half in vocational training.

As noted above, Job Corps vocational programs are open-entry and open-exit, providing flexibility for students to progress at their own pace. Each Job Corps center offers training in several vocational areas, typically from among the following areas: business occupations, automotive trades, construction trades, welding, building and apartment maintenance.

Vocational training provided to students generally consists of instruction, demonstration and practice, shop-type classes, and "hands-on" experience. All programs are based on a series of competencies through which students must progress. Competency-based curricula are used for most of the vocational training programs, and each student has an individual training achievement record that documents each competency or skill level attained.

National labor and business organizations play an important role in Job Corps vocational training by developing curriculum and providing vocational training at many centers. These organizations also supervise vocational skills training projects, particularly in the construction trades, in which students have an opportunity to work on actual construction or rehabilitation of buildings at the center or in neighboring communities.

As students near completion of their vocational training they are assigned to work experience programs. The work experience program provides an opportunity for students to apply their new skills and knowledge in an actual work setting, either on or off-center, for a period of four to six weeks. The work experience supervisor monitors the performance of these students and recommends additional training, work experience or completion as appropriate.

The residential aspect of the Job Corps program is what distinguishes it most from other Federal training and employment programs. The residential living program is based on the idea that Job Corps enrollees need a new environment and a variety of support services in order to make the most of their training opportunities. The program is designed to help students learn to get along with different types of people, to accept responsibility for their own actions, and to understand what it means to be a good citizen. Approximately 10% of all students live off-center; except for sleeping accommodations, they receive the same supportive services as other students.

Immediately prior to termination, students go through the final phase of the world of work program and update their resumes, review job search procedures, practice interviewing techniques, and discuss budgeting and related needs. A student may be terminated upon completion of the Job Corps program as a maximum benefits completer, because of medical conditions that impair further participation, for disciplinary reasons, or by resignation.

The following characteristics of the Job Corps students demonstrate the program's target population and degree of need. Approximately 70% of the students are minority youth and over 80% are high school dropouts. While the average entry reading level is at the 6th grade level, approximately 30% of the students enter with a reading level below 5th grade. Approximately 38% of the students come from families on public assistance.

In its 25th year, the Job Corps Program continues to provide intensive training in vocational skills, academic achievement, and social skills training to disadvantaged youth ages 16-21.

As we look at the types of FCCSET training provided by DOL/ETA, we find that the focus is on basic literacy education and vocational/technical training skills which to a large degree are provided outside the traditional K-12, precollege and junior college systems. Rather than focusing on a score on a written test or multiple choice test, the emphasis in ETA programs is for the trainee to become familiar with a set of job skills that will lead to a job. With some 27 million Americans in the U.S.A. said to be illiterate, with the levels of unemployment increasing daily and with greater sophistication of today's jobs and job descriptions, the over two million people served by DOL/ETA type programs constitute only a small amount of the need that presently exists in this area. DOL/ETA type programs clearly match the requirements needed to assist selected FCCSET type clients by helping them obtain the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.

DOL/ETA AGENCY CONTACTS

Raymond Uhalde, Administrator
Office of Strategic Planning and Policy Development
Room N-5637 Francis Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210
(202) 535-0659

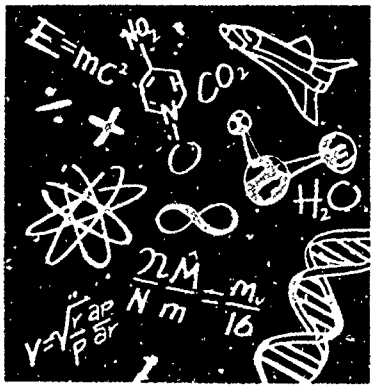
Dolores Battle, Administrator
Office of Job Training Programs
Room N-4459 Francis Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210
(202) 535-0236

David T. Duncan, Comptroller
Employment and Training Administration
Office of Assistant Secretary for Employment and Training
Room S-5207, Francis Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210
(202) 535-8760

James D. Van Erden
Director, Office of Work-Based Learning
Room N-4649 Francis Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210
(202) 535-0540

"America's young people are falling behind their counterparts the world over in math and science. The stakes are high. If we don't produce, I don't see how America will be able to sustain economic growth at home or compete in the world economic arena abroad."

Samuel K. Skinner
Secretary of Transportation



OVERVIEW

Since 1967 the U.S. Department of Transportation has been helping to keep the Nation's transportation system running. The Department is responsible for ensuring the safety and reliability of all forms of transportation; protecting the interests of consumers; conducting planning and research on future transportation needs; and assisting cities and States to meet local transportation goals.

The Department of Transportation functions through nine operating administrations, each of which oversees a different aspect of transportation (See Figure 1). Each operating administration runs its own programs directly, reporting to the Secretary of Transportation. A General Counsel and five Assistant Secretaries advise the Secretary, who also has a number of small staff offices to monitor topics of special interest. At present the Department has more than 100,000 employees and a budget of more than $30 billion.

The majority of the Department's employees support the operational programs of the Federal Aviation Administration and the U.S. Coast Guard, its two biggest operating administrations. Other employees include highway engineers, pipeline experts, emergency medical service authorities, traffic specialists, Merchant Marine personnel, and other technicians and professionals. Skilled transportation scientific, engineering and technical professionals are critical to the functioning of the Department and to the transportation community at large.

The Department's *Statement of National Transportation Policy*, issued in March 1990, emphasizes the need for effective technical education programs:

> "The President's thrust to improve U.S. education has special meaning for transportation. The "education gap" affecting all sectors of American life, and specifically the shortage of trained professionals to handle high-technology jobs, represents a serious obstacle to the current strength and future outlook for the U.S. transportation system."

The document also notes that particular attention must be given to attracting and retaining minorities, women, and socially and economically disadvantaged individuals, who have not been well represented in undergraduate and graduate-level educational programs and among transportation professionals. To address these needs, the Department supports a range of educational activities with the following purposes: fostering awareness of transportation as a potential career; encouraging improved transportation education programs; making maximum use of the Department's Maritime and Coast Guard academies and other training institutions the Department runs, educating transportation professionals through cooperative programs with universities, the private sector and public agencies; and encouraging minorities and women to pursue transportation careers.

MISSIONS AND STRUCTURE

The *Statement of National Transportation Policy* builds on mandates given to the Department in the Department of Transportation Act of 1966. The Policy sets out six major themes or responsibilities for the Department:

HIGHLIGHT The President's thrust to improve U.S. education has special meaning for transportation.

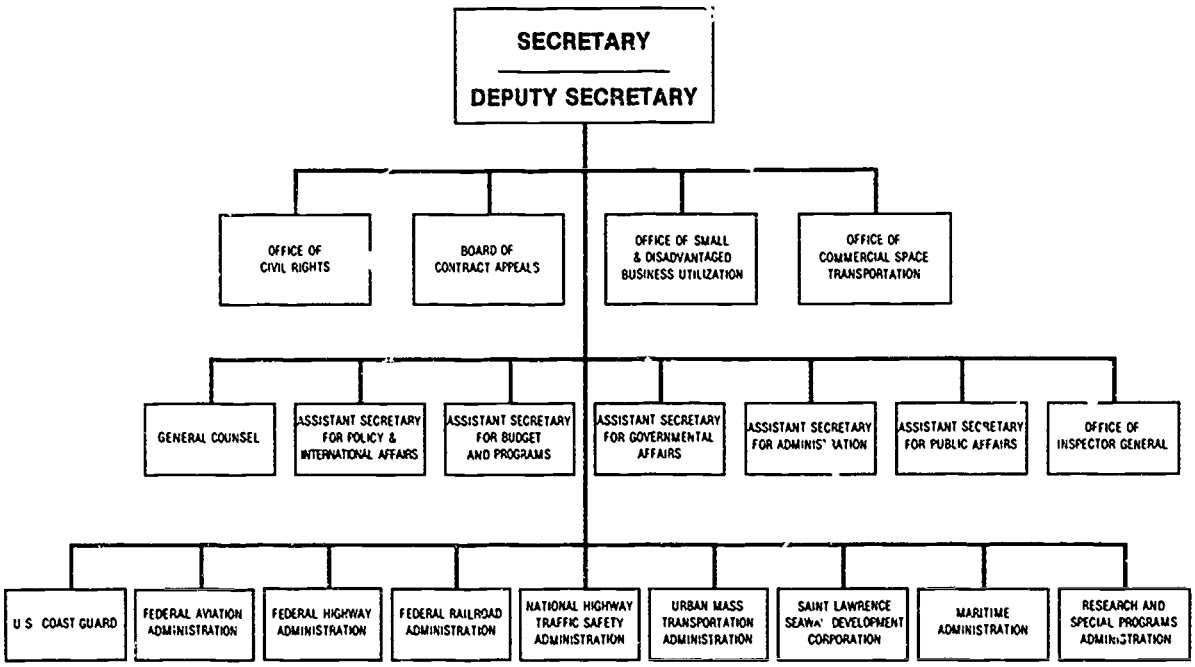


Table of Organization - Department of Transportation

1. Maintain and expand the Nation's transportation system.

2. Foster a sound financial base for transportation.

3. Keep the transportation industry strong and competitive.

4. Ensure that the transportation system supports public safety and national security.

5. Protect the environment and the quality of life.

6. Advance U.S. transportation technology and expertise.

DOT accomplishes its responsibilities in three ways. First, the Department directly operates some key elements of the transportation system. In particular, the Federal Aviation Administration operates the Nation's airport/airways system, and the U.S. Coast Guard's patrol and other activities provide a variety of services to the maritime community.

Second, the Department regulates a variety of elements of the transportation system to assure its safety and effectiveness. Especially notable among these are the safety standards of the National Highway Traffic Safety Administration and the environmental regulations administered throughout the Department's operating administrations.

Third, the Department administers formal formula or discretionary grant programs to help

HIGHLIGHT Education is needed to convey new technical skills to professionals already in the transportation community, and to develop a pool of trained technical talent to move into jobs in the transportation sector.

State and local governments provide necessary transportation facilities and services to their citizens. Especially notable are the assistance programs of the Federal Highway Administration, the Urban Mass Transportation Administration and the Federal Aviation Administration.

Math and science education is an absolutely critical support activity to the ongoing DOT programs. Education is needed to convey new technical skills to professionals already in the transportation community and to develop a pool of trained technical talent to move into jobs in the transportation sector.

Math and science education or similar training is also treated as a support activity for ongoing transportation programs outside the Department. Because of the discretion State and local governments and the private sector have in the use of their funds to provide transportation services, it is difficult to establish the total funding being applied in any of the support areas. This chapter describes the key Departmental programs, as well as DOT programs that support research and graduate studies. With the exception of entry-level programs resulting in degrees, internal employee training programs are not included in this summary.

Most of the education activities described have been in operation for some time, so "initiatives" are actually improvements to ongoing activities.

PRECOLLEGE PROGRAMS

DOT's Federal Aviation Administration runs an active aviation education program, with the added benefit of cultivating student interest in mathematics and the sciences. These activities include even the youngest of students. A good example of this is the Air Bear Program, co-sponsored by the FAA, the National Association of State Aviation Officials, the Ninety-Nines, and the Illinois Division of Aeronautics. The Air Bear Program stimulates an early interest in math and science, introduces exciting career choices to young boys and girls, and helps eliminate the fears children often have about flying.

"Air Bear Goes to School" is designed for children in grades K-2. A person in costume as Air Bear visits a classroom and helps the students travel on a make-believe flight to Disneyland. Experience with "Air Bear Goes to School" shows that children remain excited about aviation and remember Air Bear long after the bear has left the classroom.

In addition, FAA and the National Aeronautic Association, in cooperation with the Federation Aeronautique Internationale in Paris, France, sponsors an annual art contest, featuring aviation and space themes. Hundreds of entries are received each year from children throughout the United States. The top three artworks in each age category (5-8, 9-12 and 13-16) receive national awards and compete for international awards.

To support the development of effective aviation education programs at all levels, FAA maintains a network of aviation education resource centers around the country. They distribute FAA aviation education materials and resources to the media, the public and the educational community. Resource centers maintain and provide quantities of FAA printed materials, slides, videotapes and computer educational software.

A particularly notable software package is the Aviation Science Instruction Program, designed

HIGHLIGHT DOT's Federal Aviation Administration runs an active aviation education program, with the added benefit of cultivating student interest in mathematics and the sciences.

for school systems as a supplement to the established school curriculum. The instructional series, which runs on personal computers, seeks to motivate students to study mathematics and science by showing their importance to aviation-related subjects and careers. Modules in the series deal with navigation and flight planning, principles of flight, and aviation and the environment.

For older students, the Federal Aviation Administration, the Reserve Officers Association, and other organizations cosponsor the Aviation Career Education "ACE" Academy. This summer aviation education program is designed for students, aged 15 years or older, who are interested in aviation, electronics and air traffic control. The program offers a two-week aviation ground school and courses in communications, electronics and introduction to air traffic control. The students also make field trips to FAA facilities.

Another opportunity for older students is the International Science and Engineering Fair. The "World Series" of science fairs, it is held annually with nearly 700 student contestants from affiliated fairs in the United States and several other nations. Finalists at the event say that one of the most enjoyable and beneficial aspects of the Fair is the opportunity to be interviewed by the scientists, engineers, doctors and mathematicians who are the judges. FAA cosponsors provide the top students with special scholarships and awards that recognize these young scientists for their excellence in high school science and engineering projects.

The FAA also supports over 300 teacher workshops annually. The workshops provide teachers, youth leaders and parents with the knowledge and skills to interest students in aviation and other subjects. It is also an active participant in, and co-sponsor of, the National Conference on Aviation and Space Education, which draws some 1,000 aviation and space educators each year.

It should also be noted that the FAA Auditorium is available to teachers for approved aviation education programs.

In addition, DOT's Office of Commercial Space Transportation is planning its own education initiative. The focus of this effort is on promoting greater participation in science, engineering and math studies, particularly by women and minorities. This work will hopefully communicate the challenges, excitement and rewards of participation in the commercial space launch industry, and thereby stimulate interest in math and science education.

The Department's Research and Special Programs Administration (RSPA) has also encouraged awareness of transportation careers through efforts in stay-in-school programs and grammar school visitations at RSPA's Volpe National Transportation Systems Center.

Also, DOT has had a partnership agreement with Hine Junior High School since 1983. Ongoing volunteer programs include tutoring of Hine students in mathematics and English by DOT employees; a Friendship Program, which provides one-on-one relationships with children who have problems staying in school, and establisment of a Principal's Fund to provide whatever financial aid is needed to help children attend school regularly and participate in city-wide scholarship activities. Activities for students conducted by DOT's modal administrations and the Office of the Secretary expose the students to cultural activities, the workings of DOT and the transpor-

HIGHLIGHT The focus of DOT's Office of Commercial Space Transportation education effort is on promoting greater participation in science, engineering and math studies, particularly by women and minorities.

tation industry, and help them understand what to expect when they leave school to enter the workplace.

UNDERGRADUATE PROGRAMS

The FAA, in cooperation with the University Aviation Association, sponsors the Airway Science Curriculum Program. This program is part of the Airway Science Curriculum Demonstration Program approved by the Office of Personnel Management and the Congress and recognizes institutions of higher education that establish specific aviation-related curricula. The performance of graduates from these curricula will be compared with that of employees hired through normal recruiting channels. This will help establish the potential of aviation curriculum-educated graduates for supervisory and managerial positions in future high-tech aviation operations. All four-year accredited institutions are encouraged to seek recognition.

In addition, any institution that has been recognized by FAA as meeting at least one of the five Airway Science Curriculum Components (Airway Science Management, Airway Computer Science, Aircraft Systems Management, Airway Electronic Systems or Aviation Maintenance Management) is qualified to submit grant proposals to the Airway Science Grant Program for the acquisition of facilities and equipment used in direct support of the recognized curriculum.

In 1982, the FAA assumed official responsibility from the Secretary of Transportation for the development and implementation of the Historically Black Colleges and Universities (HBCU) Program. The FAA Administrator has issued policy directives that solicit the cooperation of all managers and supervisors to be aggressive and creative in looking for ways to involve and increase the participation of HBCUs in all FAA funded programs and activities that are suitable for higher education institutions. Special emphasis has been placed on involving HBCUs in FAA's competitively awarded Airway Science Grants Program; research, engineering and development projects; training projects; and cooperative education agreements and student assignments. Current plans call for making available some $1.94 million to the HBCUs during FY 1991. The FAA is also currently pursuing plans to restructure its HBCU Program and expand it into the FAA Minority University Program. Such an arrangement is designed to address the higher education needs of all agency minority groups.

In addition to the HBCU Program, the FAA anticipates that similar efforts can be made with the Hispanic Association of Colleges and Universities (HACU) organization. HACU is a recently recognized nonprofit organization concerned with colleges and universities in the United States that serve significant numbers of Hispanic post-secondary students.

Additionally, the FAA has an aggressive cooperative education (co-op) program offering training in several administrative, technical and professional career fields, including air traffic control, computer science, electronics technology and engineering technology. The FAA anticipates a significant expansion of its co-op program because of a recent governmentwide decision to exempt co-op students from agency employment ceilings. This expansion is expected to result in increases in the numbers of students employed, the number of occupations covered, and the numbers and types of schools from which students will be recruited. Greater emphasis has been placed on the recruitment of students and

HIGHLIGHT Special emphasis has been place on involving the Historically Black Colleges and Universities in the Federal Aviation Administration's competitively awarded Airway Science Grants Program; research, engineering and development projects; training projects; and cooperative education agreements and student assignments.

The FAA's Air Bear Program stimulates an early interest in math and science, introduces exciting career choices to young boys and girls, and helps eliminate the fears children often have about flying.

graduates of minority educational institutions and other educational institutions with large minority and female enrollments. While the exemption will alleviate the constraint of employment ceilings, the extent of the increases will be contingent on sufficient funds to cover payroll costs and benefits and on the availability of human resources to provide effective training. FAA human resource management divisions are working closely with various program offices involved in cooperative education, in an effort to enhance the effectiveness of the cooperative education program as a means of recruiting and retaining qualified individuals.

In the highway area, the Federal Highway Administration (FHWA) administers the Grants for Research Fellowships Program to acquaint the academic community with the capabilities of its Turner-Fairbank Highway Research Center and to encourage bright under-graduate and graduate students to choose a career in highway transportation. Each year this program offers students the opportunity to conduct research projects for college credit at the Research Center in a work environment and make use of facilities not available at their own universities. Since 1984, 118 students have received these grants.

FHWA also runs a College Curriculum Program, administered by its National Highway Institute (described under Continuing Education, below). FHWA develops the materials, text and audio-visual aids for its own short courses. Once the curriculum materials have been proven effective with practitioners, they are shared with colleges and universities. Started in 1975, this program has provided about 150 schools with about 2,000 curriculum packages. Additionally, special abbreviated (one- to two-week) courses of the National Highway Institute's 4- to 12-week graduate level courses, described later, are conducted for college and university engineering faculty to better enable them to incorporate these course materials into their own curriculum.

In the maritime field, the Merchant Marine Academy at Kings Point, New York, offers a four-year full scholarship undergraduate program leading to a Bachelor of Science degree and to a merchant marine officer's license. In addition, the students are enrolled as midshipmen in the U.S. Navy Reserve and, if eligible, are commissioned upon graduation as ensigns in the U.S. Navy Reserve. The Academy graduates about 200 new officers annually. Operating costs for the Merchant Marine Academy are anticipated to be $24.1 million in FY 1991.

In addition, DOT's Maritime Administration cooperates with six State maritime academies that prepare students for service in the U.S. Merchant Marine. Six States participate in this program: California, Maine, Massachusetts, New

HIGHLIGHT In the maritime field, the Merchant Marine Academy at Kings Point, New York, offers a four-year full scholarship undergraduate program leading to a Bachelor of Science degree and to a merchant marine officer's license.

York and Texas (whose curricula are oriented toward "deep sea" or "oceangoing" merchant marine officers licenses), and a specialized, three-year program at the Great Lakes Academy in Traverse City, Michigan, focusing on service to those waterways. Operating costs for this support of the State maritime schools are anticipated to be some $8.9 million in FY 1991.

The U.S. Coast Guard operates its own Academy in New London, Connecticut. Its purpose is to graduate educated young men and women who become Coast Guard officers. It is the only service Academy that tenders appointments solely on the basis of an annual nationwide competition. The Academy recognizes that the majority of Academy graduates must have an engineering or scientific background to meet the needs of the Coast Guard. Each graduating cadet earns a Bachelor of Science degree in one of seven designated majors: civil engineering, electrical engineering, naval architecture and marine engineering, marine science, mathematical/computer science, government or management, and a commission as an ensign in the U.S. Coast Guard. Some 200 cadets graduate and become officers each year. Present goals are to graduate at least seventy-five percent in the technical majors: engineering, sciences and mathematics. Women officers who graduate from the Academy are afforded career opportunities identical to those of their male counterparts. Today, Coast Guard women work in all missions areas, including serving aboard and commanding Coast Guard vessels and aircraft. Coast Guard officers are encouraged to apply for postgraduate education or specialized training. In conducting its postgraduate education program, the Coast Guard enrolls its officers in some of the leading colleges and universities throughout the country. Operating costs for the Coast Guard Academy are anticipated to be $42.8 million in FY 1991.

In addition, the Officer Candidate School Preparatory Course (taught by the Navy) is made available to some Coast Guard members. It is targeted toward helping minorities qualify for Officer Candidate School. The Minority Officer Recruitment Effort (MORE) is also designed to help prepare Coast Guard members for career advancement. MORE participants receive college tuition for two years, as well as enrolling in a preparatory course designed to help them pass the Officer Aptitude Rating test necessary to enter Officer Candidate School.

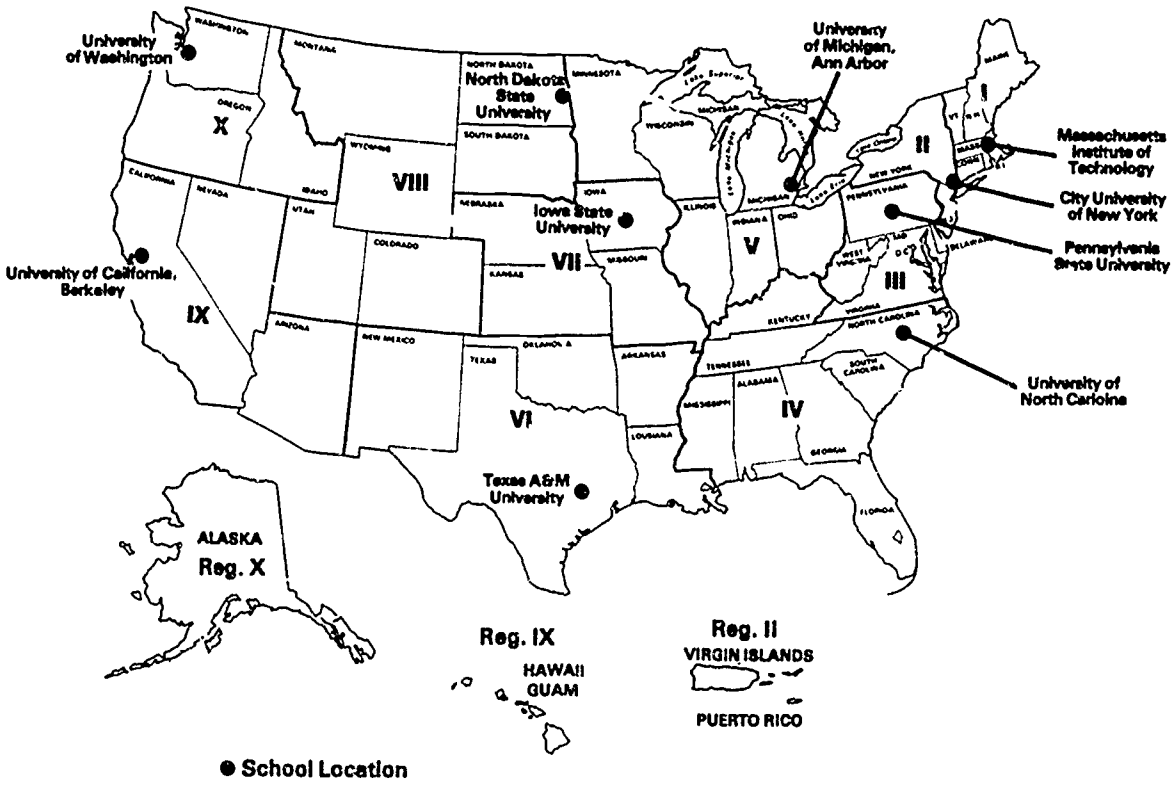
RSPA has encouraged awareness of transportation careers through efforts in cooperative educational programs at RSPA's Volpe National Transportation Systems Center.

GRADUATE PROGRAMS

A recent key initiative for universities with transportation programs is the Department's University Transportation Centers Program. The centers were authorized by the Surface Transportation and Uniform Relocation Assistance Act of 1987 (P.L. 100-17). The purpose of this program is to establish and operate transportation centers in each of the 10 standard Federal regions to conduct research and training concerning the transportation of people and goods.

The centers are intended to attract each region's best talent, resources and facilities and promote individual initiatives and scientific innovation across transportation modes and disciplines. The ultimate goal is to establish centers that through their own success and momentum will be self-sus-

HIGHLIGHT The U.S Coast Guard of DOT operates its own Academy in New London, Connecticut. Each graduating cadet earns a Bachelor on Science degree in one of seven designated majors, designated majors, and a commission as an ensign in the Coast Guard. Present Goals are to graduate at least seventy-five percent in the technical majors: engineering, sciences and mathematics.



DOT University Transportation Centers - Location of Lead Schools

taining and secure a broad base of support from industry and regional governments.

The legislation authorized $10 million per year for these centers for FY 1988 through FY 1991. Active centers now exist in each Federal region, consisting of a lead school and a consortium of affiliated schools. The centers provide specific research products of value to their own region and to the Nation; provide educational opportunities for the graduate students involved in the research projects; and expand public knowledge through technology transfer and research application activities.

In addition to the research conducted at the centers, the schools have formed 15 advanced institutes dealing specifically with graduate education. Education areas include urban mobility, transportation systems rehabilitation, truck and bus transportation, intelligent vehicle/highway systems, rural transportation, strategic planning, and traffic and transit operations. Some 180 students will be participating in the advanced institutes each year.

In addition, the Department's Urban Mass Transportation Administration (UMTA) makes grants to public and private nonprofit institutions of higher learning on matters related to the design, management and operation of urban and

HIGHLIGHT DOT's Urban Mass Transportation Administration makes grants to public and private non-profit institutions of higher learning on matters related to the design, management, and operation of urban and rural transportation systems.

rural transportation systems. This program specifically encourages a high degree of student participation. It also encourages higher education institutions to establish cooperative arrangements with transit agencies for the placement of graduate students to enhance their awareness and business knowledge about transportation system operations.

In FY 1990, the UMTA University Research and Training Program awarded six grants to six universities totaling $400,000, one of which included an HBCU. The grants covered such topics as improved suburban mobility, increased non-Federal share of capital funding, innovative financing, public/private partnerships and safety and security. These projects will provide challenging opportunities for graduate students to explore transportation issues as part of UMTA's research efforts.

In addition, most DOT operating administrations operate technical laboratories. Typical of these are the Research and Special Programs Administration's Volpe National Transportation Systems Center in Cambridge, Massachusetts; the U.S. Coast Guard's Research and Development Center in Groton, Connecticut; the Federal Aviation Administration's Technical Center in Atlantic City, New Jersey; and the Federal Highway Administration's Turner-Fairbank Highway Research Center in McLean, Virginia. These laboratories are members of the interagency Federal Laboratory Consortium. Because these facilities have advanced technology materials and are required to engage in research application and technology transfer activities under the Stevenson-Wydler Innovation Act, they may be a particularly important resource to graduate-level researchers. The possibility of fellowship programs at one or more of the laboratories is also under discussion. The Graduate Research Fellowship Program at FHWA's Turner-Fairbank laboratory is one such existing program. Also, RSPA plans to involve graduates of undergraduate schools and graduate degree programs on term appointments at the Volpe National Transportation Center.

CONTINUING EDUCATION

RSPA's Transportation Safety Institute (TSI), located at the Mike Monroney Aeronautical Center in Oklahoma City, is the focus of transportation safety and security training within the Department. Training may be conducted for personnel of all types at all levels of transportation involvement, including Federal, State, and local governments, industry, the private sector and representatives of foreign governments. More than 160,000 transportation professionals have attended classes and seminars conducted by TSI.

TSI has for example, served as a major training resource for State and community traffic safety officials managing safety initiatives recommended by the National Highway Traffic Safety Administration (NHTSA). Consequently, State and local program performance has improved in efforts to detect and deter impaired drivers, increase police enforcement of speed laws and increase usage of occupant protection systems such as safety belts.

TSI's functions are conducted on a fully reimbursable basis, including funding and personnel, from those groups for which it conducts training. TSI's comprehensive safety training programs help develop much needed public awareness and skills in the transportation community, reduce the risk of accident, and strengthen active safety programs

HIGHLIGHT Most DOT operating administrations operate technical laboratories. One such laboratory is the Research and Special Program Administration's (RSPA) Volpe National Transportation Systems Center in Cambridge, Massachusetts. RSPA plans to involve graduates of undergraduate schools and graduate degree programs on term appointments at the Center.

Another component of DOT providing continuing training to technical professionals is the National Highway Institute (NHI). NHI was authorized by the Federal-Aid Highway Act of 1970 and is located at the Turner-Fairbank Highway Research Center in McLean, Virginia. It has a staff of 11 and a budget of approximately $2.5 million. Half of this budget is from FHWA operating funds, and half is collected from student fees.

NHI's State Programs Office develops and presents technical training to State highway agencies that is not readily available from other sources and that State agencies would not ordinarily develop themselves. Approximately 75 different short courses are available at any given time, and some 5,500 presentations have taken place since the program's initiation in 1971.

NHI also offers a special graduate level program for State highway employees, which provides graduate level training on highway topics in need of high emphasis. Courses usually run from 4 to 12 weeks and are conducted on a university campus. Some 598 students had participated in this program through 1990.

The unique needs and problems of America's rural areas are addressed by the FHWA Rural Technical Assistance Program (FHWA/RTAP). Working through each State's highway department, this program established centers at colleges and universities in 46 States and Puerto Rico. These Centers may apply each year for Federal funding, which they must match dollar for dollar with State, university or local funds. For FY 1990, $3.68 million was provided, enough for each center to receive up to $100,000. The FHWA/RTAP has developed into a major continuing education resource for local highway employees. The Centers compile and maintain mailing lists; publish a quarterly newsletter; provide technology transfer materials; provide information services; and conduct or arrange at least 10 seminars or training sessions per year. Actually many more than the 10 required workshops are conducted annually. In FY 1990, approximately 1,200 workshops were held under this program for approximately 43,000 student participants.

In addition, the Urban Mass Transportation Administration now operates its own Rural Transit Assistance Program (UMTA/RTAP). Since its inception in late 1986, Congress has appropriated approximately $5 million per year to UMTA/RTAP. Out of this annual appropriation, UMTA funds an RTAP State program and a national program. The national program supports the State program with services that are more efficiently provided on a centralized basis, such as developing training materials. To date training packages have been developed on the capabilities and needs of special transit passengers, substance abuse awareness and emergency procedures.

Under the UMTA/RTAP State program, funds are provided directly to States on a formula basis. The funds are available for a wide range of activities to meet each State's self-identified needs for training, technical assistance, and research. Many States use these funds for scholarships for rural transit system managers and employees to attend national conferences and training courses. Every State has initiated an UMTA/RTAP State program, and several States have taken advantage of their FHWA/RTAP center in developing their program.

In a creative public/private partnership, NHTSA is working with major corporations to

HIGHLIGHT The unique needs and problems of America's rural areas are addressed by DOT's Federal Highway Administration Rural Technical Assistance Program. This program established centers at colleges and universities in 46 states and Puerto Rico.

put anti-drunk driving programs in place. Under this effort, which is called the Network of Employers for Traffic Safety (NETS), NHTSA provides the organization and materials for corporate traffic safety programs, and the corporate NETS members deliver the program directly to their employees.

NHTSA also trains law enforcement officials in drug impairment screening. The Drug Evaluation and Classification (DEC) program has increased apprehensions and convictions for alcohol and drug offenses in sites where it is implemented. The program teaches non-DEC trained police officers (and non-police personnel such as probation officers, industry and school security officers) to recognize key signs of potential drug impairment that would warrant a full DEC investigation by DEC-trained officers.

CONCLUSION

Although specific to aviation education, the following remarks by DOT Secretary Samuel K. Skinner reflect the Department's attitude towards, and commitment to, math and science education as a whole. The remarks were delivered to the Youth Aviation Academy graduation in Washington, D.C. on August 17, 1989:

It is important that quality aviation education be encouraged. Unless we successfully foster aviation career awareness and instruction, and promote community volunteerism, America faces significant projected shortages of civilian and military pilots, air traffic controllers and aviation electronics technicians. These are shortages we cannot afford, and we can avoid. What it takes is "the right stuff"—commitment, cooperation and hard work among our outstanding youth, and our dedicated aviation community.

KEY CONTACTS

General:

Al Linhares
Director, Office of Research Policy and Technology Transfer Research and Special Programs Administration
U.S. Department of Transportation
400 Seventh Street SW
Washington, D.C. 20590
(202) 366-4208

Aviation:

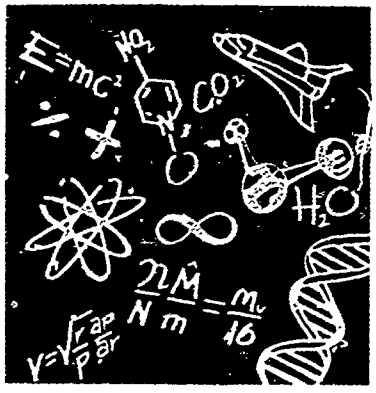
Philip Woodruff
Aviation Education Branch (APA-120)
Office of Public Affairs
Federal Aviation Administration
800 Independence Avenue SW
Washington, D.C. 20591
(202) 267-3476

Highways:

George Shrieves
National Highway Institute (HHI-20)
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, Virginia 22101
(703) 285-2770

"The President's education agenda is ambitious, yet realistic. The VA is proud of its continuing participation, through the GI Bill and through our programs in health care education. We look forward to making even greater contributions toward achieving the President's education goals for the year 2000."

Edward J. Derwinski
Secretary of Veterans Affairs



OVERVIEW

The Department of Veterans Affairs (VA) was elevated to Cabinet level on March 15, 1989. The Department's predecessor, the Veterans Administration, had been established as an independent agency under the President in 1930 by executive order that consolidated and coordinated the U.S. Veterans Bureau, the Bureau of Pensions and the National Home for Volunteer Soldiers.

The Department's mission is to serve America's veterans and their families with dignity and compassion, and to be their principal advocate in ensuring that they receive the care, support and recognition earned in service to this Nation. The 27.3 million living veterans and the estimated 47.1 million dependents and survivors of veterans total 74.4 million potential beneficiaries of VA benefits and services.

VA is the second largest Federal department and has nearly 246,000 employees. About one of every ten Federal employees works for VA. Among the many different science and technology-related professions represented in the vast VA work force are physicians, nurses, statisticians, architects and computer specialists.

The Department of Veterans Affairs has three main components that administer veterans' programs: the Veterans Health Services and Research Administration, the Veterans Benefits Administration, and the National Cemetery System. Each administration has field facilities and a Central Office component. The Central Office also includes separate staff offices that provide support to the administrations' operations and to top VA executives.

With its FY 1992 appropriation request of $32.3 billion, VA is continuing its vital mission of providing quality service to those who have served this country in the Armed Forces.

VA COMPONENTS WITH CEHR-RELATED MISSIONS

Two of VA's three administrations are involved in educational activities: the Veterans Health Services and Research Administration and the Veterans Benefits Administration.

Veterans Health Services and Research Administration

The Department of Medicine and Surgery (DM&S) was established by Public Law 79-293, which was signed into law on January 3, 1946. On March 15, 1989, DM&S was renamed as the Veterans Health Services and Research Administration (VHS&RA).

Title 38, U.S. Code, provides that VHS&RA is to be headed by the Chief Medical Director and specifies that its functions are to include those necessary for a complete medical and hospital service, including medical research and a program of training and education of health service personnel, acting in cooperation with schools.

VHS&RA provides hospital, nursing home, and domiciliary care, and outpatient medical and dental care to eligible veterans of military service in the Armed Forces. VHS&RA operates 172 medical centers, 29 domiciliaries, 233 clinics, 119 nursing home care units and 196 Vietnam Veterans Outreach Centers in the United States, the Commonwealth of Puerto Rico, and the Republic of the Philippines. VHS&RA also provides for similar care under VA auspices in non-

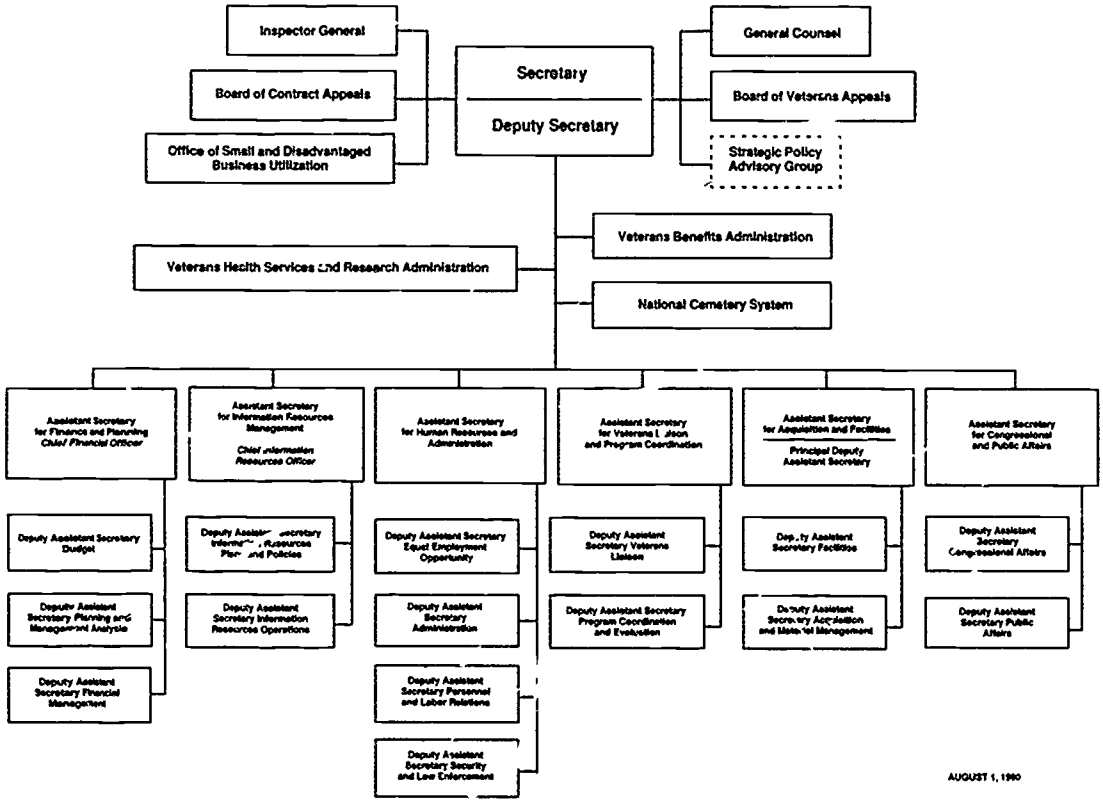


Table of Organization - Department of Veterans Affairs

VA hospitals and community nursing homes and for outpatient visits by veterans to non-VA physicians and dentists.

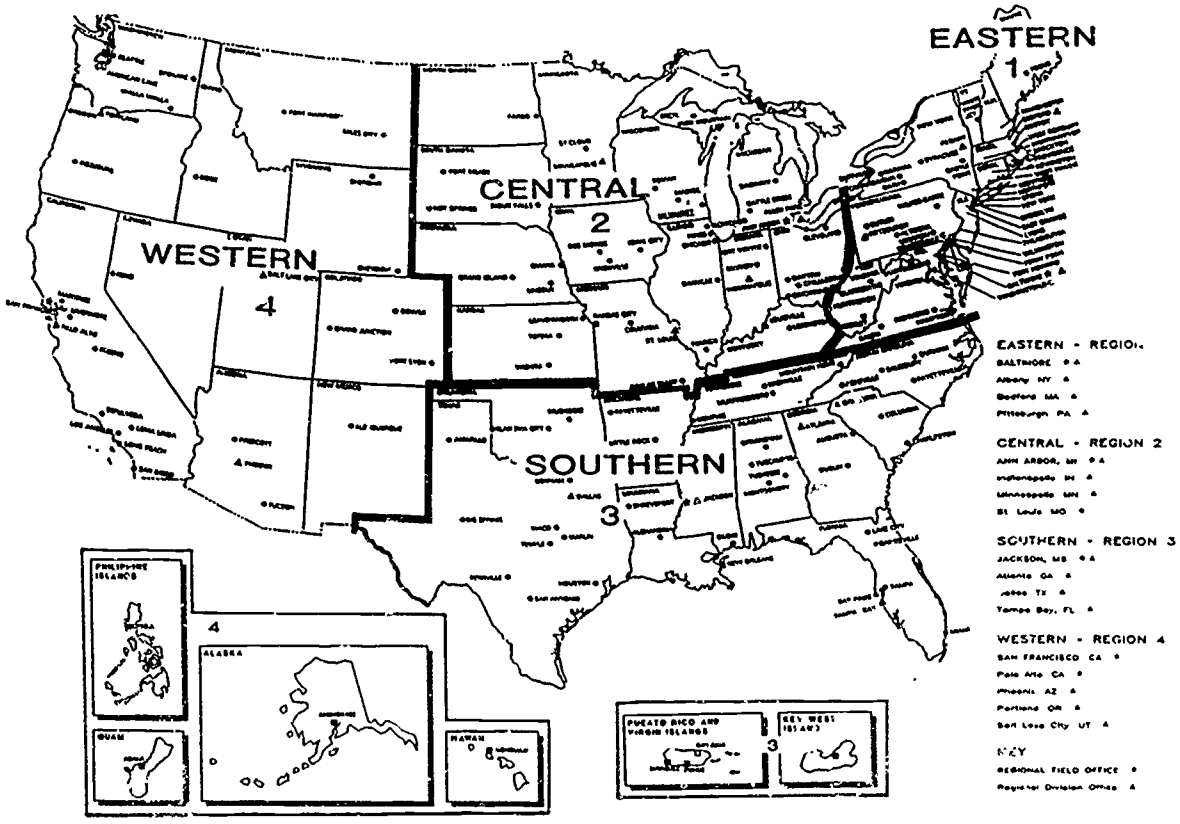
VHS&RA conducts individual medical and health care delivery research projects and a multi-hospital research program. VHS&RA assists in the education of physicians and dentists and in the training of many other health care professionals, through affiliations with educational institutions and organizations.

Within VHS&RA, several offices are involved with science, education and technology.

Office of Academic Affairs

VHS&RA conducts the Nation's largest coordinated education and training effort for the health professions. The purpose of Academic Affairs is two-fold:

To assist in recruiting and retaining sufficient numbers of all categories of professional health service and administrative personnel to meet the needs of a high-quality VA health care



Department of Veterans Affairs - VHS&RA Regional Offices & Regional Division Offices

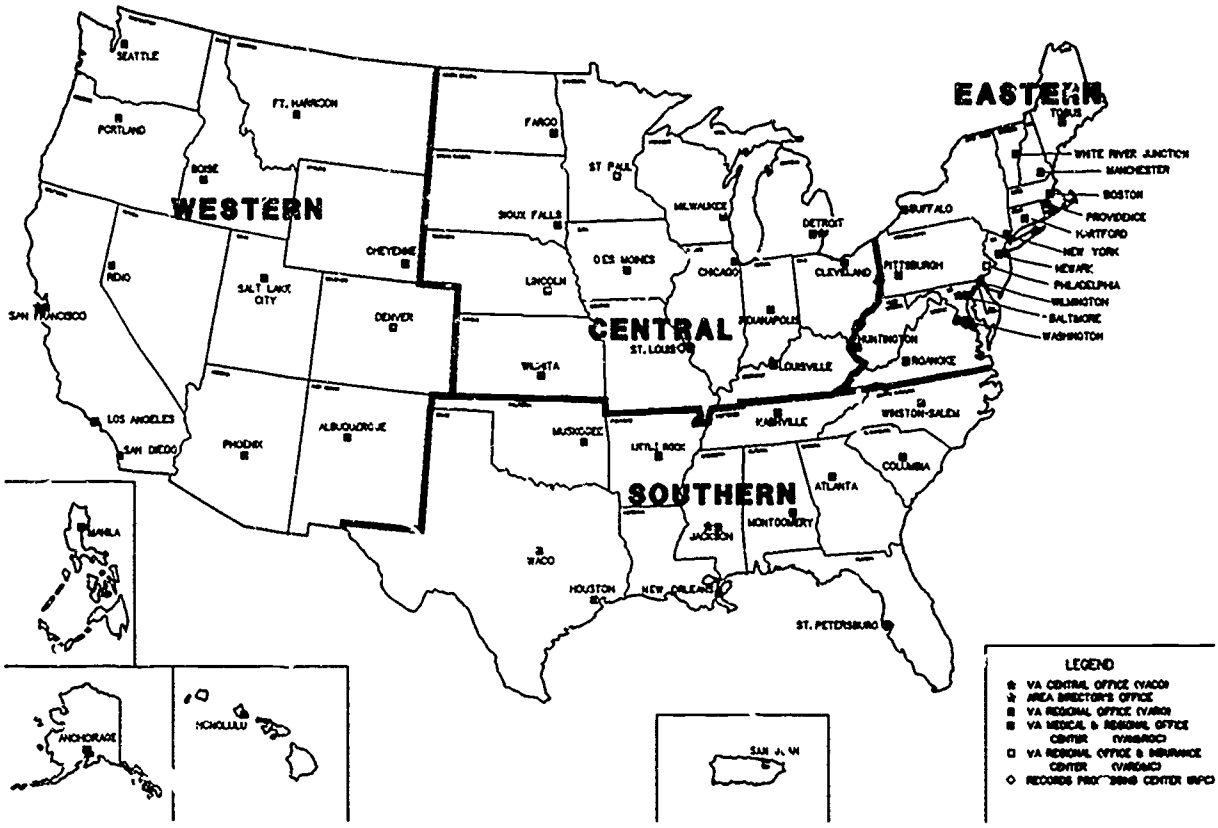
system and contribute to the Nation's health workforce. Each year, approximately 100,000 students receive some or all of their clinical training in VA facilities through affiliation with over 1,000 educational institutions.

To provide continuing education for VHS&RA employees to maintain and learn new skills and knowledge at VA health care facilities or at VHS&RA's 19 continuing education field units.

The **Medical/Dental Education Programs Service** develops, monitors and manages education and training programs for all VA medical, dental, podiatry and optometry professionals through affiliations with U.S. schools of medicine, dentistry and other schools.

The **Learning Resources Service** provides and manages education, training, learning and information resources for the VHS&RA health care system.

The **Associated Health Professions Education Programs Service (AHPEPS)** develops, supports and monitors quality education and training programs that will improve client care and contribute to the recruitment, retention and professional growth of VA health care staff.



Department of Veterans Affairs - Veterans Benefits Administration Area & Field Offices

The **Continuing Education Service** ensures that the continuing education and training needs of VHS&RA staff are met efficiently, effectively and economically.

Research Activities

The primary purpose of the VA health care system is the provision of high-quality health care to eligible veterans. Yet a viable, quality care system cannot exist without research and education to accompany the provision of care. Of the 172 VA hospitals, 137 are affiliated with medical schools.

Approximately 7,000 VA physicians and some 2,000 other hospital personnel held faculty positions in 1990. During the past 30 years, VA has compiled a list of accomplishments far exceeding its budget outlay.

The VA's research program is divided among three services, each with its own area of responsibility.

The **Medical Research Service** program has evolved into an internationally recognized major contributor to medical science and to the advancement of the practice of medicine.

The **Health Service Research and Development Service** encompasses an interdisciplinary field of inquiry concerned with the measurement and evaluation of health care systems and with testing

new methods of health care delivery and management.

The mission of the **Rehabilitation Research and Development (Rehab R&D)** program is to improve the quality of life of impaired, disabled and handicapped veterans by making them more independent.

Veterans Benefits Administration

The Veterans Benefits Administration (VBA) is the organization primarily responsible for administering the Department's nonmedical programs that provide financial and other forms of assistance to veterans, their dependents and survivors. The major benefits are veterans' compensation, veterans' pension, survivors' benefits, burial benefits, rehabilitation assistance, education benefits, home loan benefits and insurance coverage.

The Veterans Benefits Administration is headed by the Chief Benefits Director and operates through a network of 58 regional offices with at least one in each State and in the District of Columbia, Puerto Rico and the Philippines. Eight regional offices are combined with VA medical centers. The Records Processing Center in St. Louis, Missouri, stores over 15 million veterans' records that are not immediately required at the regional offices.

The **Vocational Rehabilitation Service** within the VBA provides educational benefits to disabled veterans. Under the vocational rehabilitation program, known as chapter 31, eligible veterans are evaluated and, if found entitled, are assisted in developing an individualized written rehabilitation plan and achieving the goal of employment. VA pays for tuition, fees and books for the planned program. Entitled veterans may also receive medical, dental, psychological or independent living services; a subsistence allowance; equipment; supplies; other assistance to ensure satisfactory progress in the program; and assistance in obtaining and adjusting to employment.

VA provides rehabilitation services to thousands of disabled veterans.

The VBA's **Education Service** administers several basic educational programs for veterans, service persons and eligible dependents. These programs include the new GI bill programs for veterans, service personnel and members of the Selected

Reserve, as well as educational assistance for eligible spouses and children.

The VBA's **Veterans Assistance Service** is responsible for providing information, advice and assistance to veterans, their dependents and beneficiaries, representatives and others, in connection with health care and benefits administered by the Department of Veterans Affairs. In addition, the Department of Veterans Affairs, through the Veterans Assistance Service, cooperates with the Department of Labor and other Federal, State and local agencies in developing employment opportunities for veterans, including on-the-job and apprenticeship training programs. This service is also responsible for ensuring compliance by schools and training institutions with VA directives and ensuring compliance with legislation that prohibits discrimination on the grounds of race, color, national origin, sex, age or disability.

VHS&RA EDUCATION AND TRAINING RESOURCES

Through the **Office of Academic Affairs (OAA)**, the VHS&RA conducts the Nation's largest coordinated education and training effort for the health professions. OAA has several subcomponents.

The **Medical/Dental Education Programs Service** develops, monitors and manages education and training programs for all VA medical, dental, podiatry and optometry professionals through affiliations with U.S. schools of medicine and dentistry and other schools. Among other things, the service:

Formulates and recommends policies concerning the principles and management of affiliations between VA health care facilities and academic educational institutions.

Centrally allocates and monitors the use of over 8,000 residency positions.

Collects, coordinates and evaluates data on all education and training programs for physicians, dentists, podiatrists and optometrists in the VA, and maintains close informational relationships with corresponding interest groups in the private sector and in other government agencies.

Monitors all Deans' Committees and evaluates the impact of the recommendations of these bodies on the VA medical centers.

Approves the initiation and continuation of all funded affiliated education and training programs after review for educational soundness and resource needs.

Reviews, negotiates and determines approval of new or revised memoranda of affiliation for medical and dental education programs, 2A agreements (institutional), 2B agreements (programmatic), and 2C agreements (VA residents at a non-VA facility).

Centrally allocates and monitors fellowship positions in medical and dental fields. Graduates of these programs are expected to be the academic leaders of tomorrow, contributing as principal investigators to the cutting edge of knowledge in their respective fields. All of these programs are selected through nationally competitive reviews.

The **Learning Resources Service** provides and manages education, training, learning and information resources for the VHS&RA health care

system. Its resources include (a) the medical and patients' library program; (b) the medical media production program; (c) the regional learning resources program; (d) the print and nonprint materials production program; (e) the television receive-only satellite program; and (f) the educational space and facilities program.

Medical and Patients Library Program
VA's Library Network (VALNET) is a network of national significance staffed by approximately 300 professional librarians and 300 support staff. VALNET collections include over 1,350,000 books, 73,000 periodical subscriptions and 145,000 audiovisual programs. Unique holdings are estimated to be 100,000 book titles, 3,000 journal titles and 30,000 audiovisual programs.

Services provided routinely include reference, bibliographic, interlibrary loan and circulation; special services may include computer-assisted instruction, clinical librarianship, LATCH (literature attached to charts), end-user data base searching, bibliotherapy, patient health education support and services to blind and physically handicapped patients.

Medical Media Production Service Program
Nationally, the service is staffed by over 400 media specialists, including photographers, illustrators and audiovisual production specialists. Services provided routinely include medical photography; illustration and graphic support; video sound and audiovisual support; and provision and maintenance of audiovisual presentation equipment. Medical Media, linked nationally through CISN (Computer Information System Network), is the largest network of its kind in the world. During the past year, over 180,000 images supporting local graphics needs were transmitted, imaged and delivered via eight core imaging sites.

Regional Learning Resources Program
There are seven Regional Learning Resources Services (RLRS) throughout the country. This program is designed to enhance, extend and focus the educational support available from Library and Medical Media Production Services.

Print and Nonprint Materials Production Program
Certain RLRS's have been designated as National Audiovisual Production Centers. These locations have state-of-the-art automated typesetting, animation, presentation, word processing, video production, multi-image and audio equipment. Pilot projects are in progress to design, produce and evaluate interactive videodisc training, computer-based training, and computer assisted instruction. Programs are characteristically self-contained, stand-alone packages consisting of workbooks, facilitation guides and videotapes created to address urgent VA-wide educational or informational initiatives.

Television Receive Only (TVRO) Satellite Program
Live, interactive educational programming via the TVRO satellite system began in January 1990. The network consists of receive-only equipment at approximately 200 VHS&RA field locations. Programming is expected to originate internally at the national and regional levels, as well as externally from a wide variety of commercial, institutional, educational and government sources.

Education Space and Facilities Program
Space and equipment are major VA resources. Annually, each field facility must review local program needs and prepare a "Five-Year Facility Plan" which identifies space and functional deficiencies and describes corrective measures need-

ed. These plans are reviewed closely by Learning Resources Service staff. To ensure that state-of-the-art educational and training facilities are designed and constructed, Learning Resources Service develops and implements standards, guidelines and directives for the allotment, configuration, furnishing and equipping of education and training spaces at VA facilities (library, medical media, conference rooms, learning laboratories, classrooms, auditoriums, quarters-on-call, and others). Further, all floor plans, equipment lists, furnishing lists and other specifications for construction projects affecting educational space must be approved by Learning Resources Service.

The **Continuing Education Service** ensures that the continuing education and training needs of VHS&RA staff are met efficiently, effectively and economically. The service identifies continuing education requirements, then provides educational resources to meet those needs. Continuing Education Service's functions are to:

(1) Administer funds that support all levels of VHS&RA's continuing education activities.

(2) Manage and coordinate the activities of the 20 continuing education field units.

Seven regional medical education centers provide continuing education opportunities for the staff of the medical centers in their regions.

Two continuing education centers coordinate and develop continuing education activities to address systemwide needs, for example, national training programs.

Eight cooperative health manpower education programs located at remote VAMCs work through consortium arrangements with local health and educational institutions to meet training needs of VA and community health care practitioners.

Two dental education centers provide continuing education opportunities for dental personnel.

The Engineering Training Center develops and conducts training programs for VA engineering personnel, primarily biomedical engineers.

(3) Coordinate, develop and evaluate special education programs; respond to VA and VHS&RA health care priorities that involve training, provide educational assistance, consultation, design, development and logistical support; initiate special studies relating to field needs; develop and implement career development systems for education and training; and promote, support and utilize new educational technologies (for example, computer-assisted instruction or satellite broadcasting) when appropriate.

(4) Administer programs that support quality patient care through continuing education. In particular, continuing education assistance to medical centers includes annual continuing education financial support, as well as some specialized training funds to support medical centers' costly, one-time training needs.

The Hospital Administrative Residency Program supplements the didactic component of accredited graduate programs in health services administration by providing graduate students with the opportunity to apply their knowledge and skills through a period of structured experiences within the VA health care system.

The residency is conducted under the supervision of a selected preceptor at a VAMC over a period of approximately 12 months.

Management education provides academic and preceptor-guided entry-level training for potential VAMC service managers, as well as ongoing systemwide activities for supervisors and service chiefs. These programs emphasize management principles in a health care environment. Ongoing training is conducted through workshops and at VAMCs using trained facilitators.

National training programs encompass systemwide training needs generated by legislation or mandated changes, Department and VHS&RA initiatives, new technology, and high priority concerns having systemwide impact.

The Patient Health Education Program promotes the health of veteran beneficiaries through the provision of patient health education services. Patient health education in VA consists of combinations of educational activities designed to improve and maintain the health status of veterans. The activities typically focus on keeping veteran patients informed about their health status, helping them follow their treatment regimens, and developing skills in self care.

ONGOING MULTILEVEL (SECONDARY/UNDERGRADUATE/GRADUATE) PROGRAMS

Veterans Health Services and Research Administration

The Office of Academic Affairs' **Associated Health Professions Education Programs Service** (AHPEPS) develops, supports and monitors quality education and training programs that will improve client care and contribute to the recruitment, retention and professional growth of VA health care staff. AHPEPS initiates policy and provides guidance and direction to all VA facilities for the development, implementation, coordination and evaluation of program activities. Also, the service maintains ongoing dialogue with colleges and universities about OAA's programs. Finally, the service administers and coordinates the distribution of funds provided in support of these programs. Some of the AHPEPS' programs are:

The Health Professional Scholarship Program (Direct aid to students - FY 1992 (est.): $12,430,000)
This program, authorized by P.L. 96-300, provides awards to nursing, physical therapy and occupa-tional therapy students for the final one to two years of study in a baccalaureate, professional master's or specialty master's program. Scholarship benefits are provided in return for a minimum service obligation of one year for each year or portion of year for which the scholarship is provided. Benefits, not to exceed 24 months, are exempt from Federal taxation and include payment of tuition and fees, reasonable educational expenses and a monthly stipend. Selection factors include academic performance, career goals, recommendations and work/volunteer experience. Service obligations are carried out in VA health care facilities with the greatest retention or recruitment needs.

Tuition Reimbursement Program (Employees only - FY 1992 (est.): $5,305,000)
Established in 1989 through P.L. 100-322, this program provides funding support for full-time VA employees enrolled in an accredited nursing

degree program at the associate to doctoral degree levels. Prerequisite courses required for acceptance into a degree program can be funded. Participants may receive up to $2,000 yearly and have a one-year service obligation upon course completion. The program can be designed as a group contract with an educational institution. It is managed at the VA health care facility in coordination with AHPEPS.

Tuition Support Program
(Employees only - FY 1992 (est.): $10,662,000)
This program assists VA health care facilities in their efforts to recruit and retain personnel in designated shortage categories. Support funds can be used for conferences, continuing education, or academic course work related to an employee's job. VA health care facilities may also initiate direct contracts with educational institutions to provide courses of study for groups of employees.

Veterans Benefits Administration

Summary of Education Programs
The VBA administers basic programs for veterans and servicepersons seeking assistance for education or training. Disabled veterans may receive rehabilitation services under chapter 31. Veterans and servicepersons who entered the military from January 1, 1977, through June 30, 1985, may receive educational assistance under a contributory plan. Individuals entering on active duty after June 30, 1985, may receive benefits under the Montgomery GI Bill. The different forms of direct aid to students administered by the VBA will total almost $900 million in FY 1992.

Types of Educational Programs
The Education Service administers a number of basic programs for veterans, servicepersons and eligible dependents seeking assistance for education or training at various levels. These programs include:

(1) Montgomery GI Bill—Selected Reserve (10 U.S.C., ch. 106);

(2) Montgomery GI Bill—Active Duty (38 U.S.C., ch. 30);

(3) Dependents' Educational Assistance Program (38 U.S.C., ch.35);

(4) Post-Vietnam Era Veterans' Educational Assistance Program (VEAP) (38 U.S.C., ch. 32);

(5) Educational Assistance Pilot Program, commonly referred to as "Noncontributory VEAP," (P.L. 96-342 S. 903, 10 U.S.C. 2141 note);

(6) Educational Assistance Test Program, (P.L. 96-342 S. 901, 10 U.S.C.2141-2149);

Rehabilitation programs (38 U.S.C., ch. 31) are administered by the VBA's Vocational Rehabilitation Service.

Synopses of Education and Rehabilitation Programs

Montgomery GI Bill—Selected Reserve
(Direct aid to students - FY 1992 (est.): $122,600,000)
The Montgomery GI Bill—Selected Reserve provides educational assistance to persons who enlist, reenlist or extend an enlistment in the Selected Reserve for a period of at least six years after June 30, 1985. Approximately 140,900 reservists are expected to receive educational assistance in FY 1992. A steady increase in the

number of trainees is anticipated in future fiscal years. Educational assistance is payable for the pursuit of an undergraduate degree, noncollege degree program, apprenticeship or on-the-job training program, correspondence training, cooperative courses and flight training.

Montgomery GI Bill—Active Duty (Direct aid to students - FY 1992 (est.): $429,256,000)

The Montgomery GI Bill—Active Duty provides assistance to individuals entering military active duty after June 30, 1985. Also included are persons eligible for old GI Bill benefits on December 31, 1989, who served three years continuously on active duty after June 30, 1985, as well as those who serve two years on active duty followed by four years satisfactory participation in the Selected Reserve after June 30, 1985. During FY 1992, 214,200 persons are expected to receive educational assistance.

Benefits are payable for attendance at institutions of higher learning, noncollege degree programs, apprenticeship programs, on-the-job training, pursuit of correspondence training, cooperative courses and flight training. Veterans may pursue refresher, remedial and deficiency courses, qualify for tutorial assistance, or receive work-study benefits.

Dependents' Educational Assistance (Direct aid to students - FY 1992 (est.): $103,487,000)

More than 38,000 children and surviving spouses will take advantage of the program during FY 1992. Over 90% will have used their entitlement to acquire college-level training.

Eligible persons may enroll in approved secondary level schools, colleges, universities, technical institutions, vocational schools, business schools and facilities providing apprenticeship or other on-the-job training, cooperative training program and farm cooperative. Refresher, remedial and deficiency courses also are provided when necessary to enable the individual to pursue an approved program of education.

Post-Vietnam Era Veterans' Educational Assistance (Direct aid to students - FY 1992 (est.): $138,425,000)

During 1992, more than 56,500 individuals will participate in the post-Vietnam era veterans' educational assistance program.

An eligible person may attend any educational institution offering courses approved for benefits, including an elementary, high school, vocational, business college, college or university. Remedial, refresher and deficiency training may be pursued also.

Vocational Rehabilitation (Direct aid to students - FY 1992 (est.): $106,000,000)

Approximately 20,000 disabled veterans will receive rehabilitation services during FY 1992.

In the educational or vocational training phase of a rehabilitation program, veterans may (a) enroll in trade, business or technical schools or in college-level institutions; (b) train on-the-job or in an apprenticeship program; (c) take on-farm training; (d) enter programs that combine school and on-job training, or (e) train in special rehabilitation facilities or at home when this is necessary because of service disability.

VHS&RA GRADUATE-LEVEL PROGRAMS

Associated Health Trainees

The OAA's AHPEPS supports graduate-level education through the associated health trainees programs.

Associated Health Trainees
(Direct aid to students - FY 1992 (est.): $12,029,000)
There are several programs under this umbrella.

Clinical Affiliation and Fellowships are offered in more than 40 different associated health professions. Ninety-five percent of students participate without compensation.

Support for **clinical nurse specialists** was initiated in 1981 to attract master's nursing students to VA for clinical training in specific clinical areas such as critical care, geriatrics, rehabilitation, psychiatric mental health and adult health.

Begun in 1984, the **Nurse Administration Practicum Program** provides a structured learning experience in executive nursing and health care administration for graduate students enrolled in master's degree programs in nursing administration. Students are jointly precepted by the Chief, Nursing Service and the medical center Director.

The **Gerontology Nurse Fellowship Program** is a two-year fellowship for registered nurses who are doctoral candidates initiating clinical research in geriatrics and gerontology. The program is designed to prepare expert gerontological educators, administrators and researchers for leadership positions in the delivery of long-term care.

The **Interdisciplinary Team Training in Geriatrics** was initiated in 1979. It provides a systematic educational program of didactic and clinical instruction for VA faculty practitioners and affiliated students from three or more health professions. It emphasizes the knowledge and skills needed to provide interdisciplinary team care to meet the needs of aged veterans.

The Geriatrics Expansion Program, developed in 1983, provides geriatric education and training for associated health professions at certain medical centers.

Research

The VA's research and development program not only responds to the perceived needs of the veterans, but also identifies needs that might require a research response. Thus, many of the current research projects deal with complex, special problems such as those of Vietnam veterans as well as those of older veterans.

Research has engendered tremendous progress in medicine since World War II. Biomedical advances, for example, have revolutionized the practice of medicine. Progress has been rapid and spectacular, and the list of VA research accomplishments is long: effective drug therapy for tuberculosis and mental illness; organ transplants; the cardiac pacemaker; and the CAT scan, to name only a few.

In 1977, two VA researchers shared the Nobel Prize for Medicine. They are Rosalyn S. Yalow, Ph.D., of the Bronx VA Medical Center, for her work with radioisotopes, and Andrew V. Schally, Ph.D., of the New Orleans VA Medical Center, for his work on the endocrine system.

Research activities have been vital to the VA's mission since 1946. During the past 30 years, VA has compiled an impressive list of accomplishments, both in terms of cost-effectiveness and in terms of lower mortality and higher quality of life. Since the problems of the veteran population are similar to those of the general population, VA's achievements are beneficial to the health care system as a whole.

VA's research program is divided among three services, each with its own area of responsibility.

Medical Research Service

The Medical Research Service, through VA-appropriated funds, supports the research of approximately 2,400 VA scientists, over 70% of whom are physicians committed to the pursuit of patient-oriented research across the entire spectrum, from basic science to clinical application of new knowledge. An equal number of VA researchers is supported by funds from other Federal agencies, foundations and private industry.

VA provides quality medical care to millions of veterans every year

The VA research program contributes to a professionally attractive and stimulating intellectual environment that is critical to the recruitment, retention and professional growth of a high-quality patient care staff. The presence of an active medical research program creates a spirit of intellectual enterprise that contributes to the provision of the highest quality medical care to veterans.

Within the framework of the Medical Research Service are five major programs: merit review awards, career development awards program for clinical researchers, research advisory groups, research scientist programs for nonclinical researchers, and cooperative studies. In addition, special emphasis programs and research centers supplement the full range of activities. All medical research programs are peer reviewed.

The majority of VA funds are directed to investigator-initiated research projects given as merit review awards, which span the breadth of disease problems and reflect the clinical interests of VA staff. All these awards are intramural. However, their impact is widespread, since VA scientists are encouraged to collaborate with non-VA scientists and hold dual VA-university appointments.

The career development program offers protected research time to over 230 clinicians annually. It is open at all levels to clinicians with higher degrees. The program is designed for applicants seeking careers, as with the VA clinician-researchers, as well as for established VA clinician-investigators seeking a period of concentrat-

ed research activity. Implicit in all career development applications is the understanding that the applicant plans a career in the VA and, particularly for the more advanced levels, that the medical center has a long-range plan for the applicant's VA career. Career development appointments are full-time; terms are time-limited.

By design, VA's research program is targeted to the support and training of physician investigators. VA supports about one-third of all physician investigators in the nation. VA also has become a major contributor to the training of physician researchers through the career development program. For FY 1992, the estimated outlays in these programs are $16,700,000.

There are several career development appointment levels

Associate investigator appointments provide research training for VA clinicians with little or no research experience who wish to develop their capability as independent investigators. Applicants must have at least two years of clinical training. At least 75% of the associate investigator's time must be devoted to training and research experience; the remaining time should be used in appropriate clinical and teaching activities.

Research associate appointments are designed to extend the research training of new clinical-investigators and to develop creative and independent investigators. Applicants for this position must have had previous research training in the area of the proposed research. At least 75% of the research associate's time must be used in research.

Clinical investigator appointments provide independent clinician-scientists with an opportunity to expand their scientific background and augment their biomedical research careers with an intensive research experience. Applicants must have research experience in the scientific area of the proposed research and must show evidence of ability to function as independent investigators. They must document consistent and recent research productivity through publications in high quality peer reviewed journals. At least 75% of the clinical investigator's time must be applied to research.

Medical investigator appointments provide established VA investigators with clinical and administrative freedom to pursue research activities for 50-75% of their time. Applicants must have demonstrated a continuing and high degree of productivity, independence and originality in research. The excellence of the applicant's research should be recognized at the local and national levels. No VA facility may have more than two active medical investigators funded at any one time.

Senior medical investigator appointments are restricted to VA's most distinguished investigators and provide these scientists the opportunity for a continuing VA research career. Applicants must have national and international recognition as leaders in their scientific disciplines. Only VA employees with at least 10 years of service are eligible to apply.

The **research advisory group program** provides awards for scientists starting at VA. It is designed to encourage recruitment and rapid start-up or continuation of research efforts. Awards are for one or two years and generally are for limited

amounts of funded support. Approximately 150 new awards are made each year.

The **research scientists program** supports VA nonclinician, higher degree (usually Ph.D.) scientists in a modified career track. Associate Research Scientists awards are given for a period of six years; Research Scientist awards are for seven years. This program is limited to persons located in the VA medical centers and serving as full-time VA employees. Joint appointments with affiliated university programs are common. Research scientists enrich the research environment by their skills, intellect and experience, and so contribute to the research efforts.

Cooperative studies involve multiple institutions which coordinate their efforts in therapeutic studies requiring relatively large numbers of participants to obtain valid data.

Health Service Research and Development Service

Health services research is an interdisciplinary field of inquiry concerned with the measurement and evaluation of health care systems and with testing new methods of health care delivery and management. The Health Services Research and Development Service (HSR&D) is charged with supporting health services research in VA. It is divided into three program areas: investigator-initiated research, field programs, and special initiatives and studies.

In investigator-initiated research, projects focus on areas such as care of the aging veteran, preventive health care, rehabilitative services, and evaluation of the cost-effectiveness of patient care technologies.

Field programs are comprised of a network of core VA staff who collaborate with managers, providers and community institutions. These interactions help integrate health services research with VA proactive health care delivery settings. Local projects and pilot studies designed to meet locally identified needs are supported by field programs. Locally identified programs have been conducted in such areas as diagnostic approaches for post-traumatic stress disorder, quality assessment and health status measures, and reduction of polypharmacy and medication morbidity in the elderly.

In its third major program area, the HSR&D Service conducts special initiatives and studies designed to respond to systemwide needs identified by VA managers or Congress. Examples include implementation of a five-site collaborative evaluation of adult day health care as an alternative to nursing home care, and development of a protocol to evaluate VA's pilot program of chiropractic care. The service also emphasizes dissemination of research results through publications and presentations at national professional meetings.

Rehabilitation Research and Development Service

The mission of the Rehabilitation Research and Development (Rehab R&D) program is to improve the quality of life of impaired, disabled and handicapped veterans by making them more independent. Rehab R&D's highest priority areas are prosthetics/amputations/orthotics, spinal cord injury; and communication, sensory and cognitive aids, including aids for the blind, the deaf and those afflicted with speech and communication disorders.

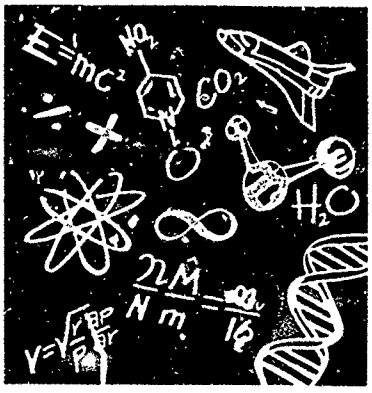
The O ce of Technology Transfer located at the Prosthetics R&D Center in Baltimore, Maryland, promotes VA scientific and engineering projects among scientists, engineers, clinicians and consumers in the United States and abroad. This office publishes the VA Journal of Rehabilitation Research and Development and Clinical Supplements to the journal.

CONTACT INFORMATION

The Honorable D'Wayne Gray, VA's Chief Benefits Director, is the Department's representative on the CEHR. Further information on this chapter can be obtained from Mr. David Laprade of the VBA's Executive Secretariat, 202-233-5052.

"In the end, environmental education boils down to a simple yet profoundly important imperative: preparing ourselves for life and all its surprises in the next century. When the 21st century rolls around, it will not be enough for a few specialists to know what it going on while the rest of us wander around in ignorance."

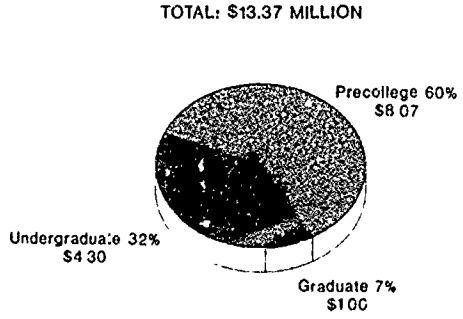
William K. Reilly,
Administrator
U.S. Environmental Protection Agency



INTRODUCTION

EPA is the lead Federal science agency for addressing national and international environmental issues. As political leaders and the public continue to recognize the urgency and global nature of environmental challenges, EPA will be required to respond with still higher quality research, innovative analysis, and sound strategies for public involvement.

For the last ten years over one-third of EPA's employees have been scientists and engineers. Their expertise ranges from disciplines in biology, chemistry, and earth sciences to environmental engineering. Approximately 80% of the Agency's research supports programmatic and regulatory activities, with the remaining research efforts focusing on core or basic environmental areas. The demands for highly educated and talented staff will only increase as the scientific complexity of environmental problems increase. Clearly, the Agency has a vested interest in assuring that students emerging from the Nation's education system are math and science literate, and that America produces an adequate supply of world-class scientists and engineers.



in millions of dollars

EPA Education Budget FY 1992

On June 15, 1990, Administrator Reilly underscored the Agency's commitment to science, engineering, and technology education by announcing the creation within EPA of a new Office of Environmental Education. This move was taken with the full knowledge of the legislation then pending in Congress to mandate such an office. Establishing the office put EPA in an excellent position to move quickly to implement this bill passed in late October 1990.

For FY 1992, the President requested a total of $13.4 million for education-related programs within EPA. These funds were targeted for the precollege, undergraduate, and graduate levels as shown in the chart.

AGENCY MISSION AND STRUCTURE

The U.S. Environmental Protection Agency's mission is to protect the public from environmental hazards, enhance the quality of our natural environment, and expand our knowledge of the environment. The Agency believes that an environmentally educated public is the best means to bring about voluntary changes in personal behaviors that affect the environment.

Among the resources available to implement educational programs are the Agency's ten regional offices and the widely dispersed laboratories and research facilities. A description of the mission and function of each of the EPA laboratories is provided below.

Risk Reduction Engineering Laboratory-Cincinnati, OH

The mission and function of the Risk Reduction Engineering Laboratory is to provide an author-

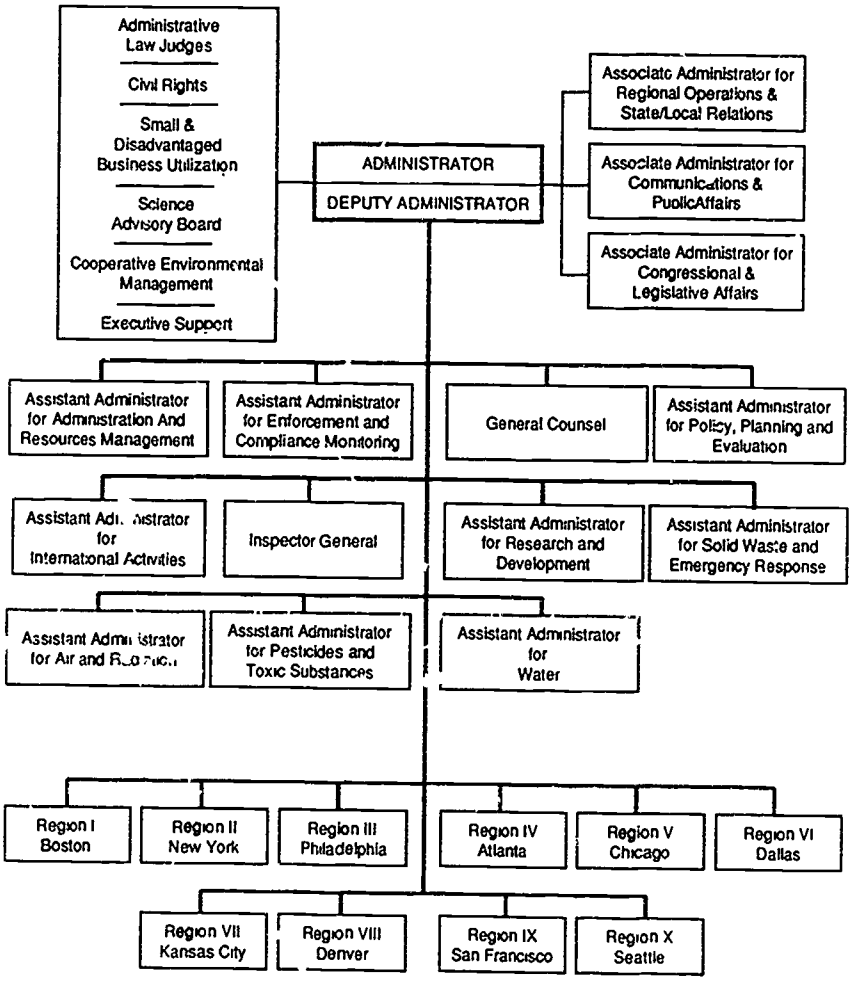


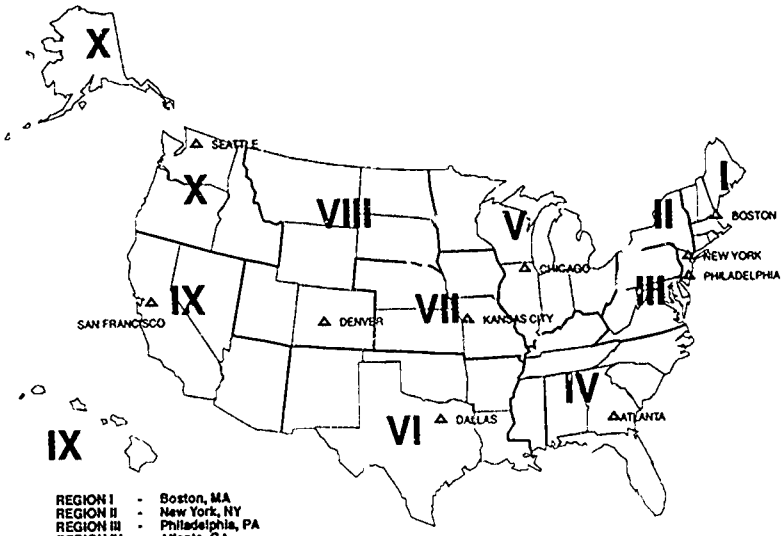
Table of Organization - Environmental Protection Agency

itative, defensible, engineering basis for the Agency's policies, programs, and regulations for drinking water, hazardous wastes, pesticides, Superfund, toxic substances, and wastewater.

Air and Energy Engineering Research Laboratory-Research Triangle Park, NC

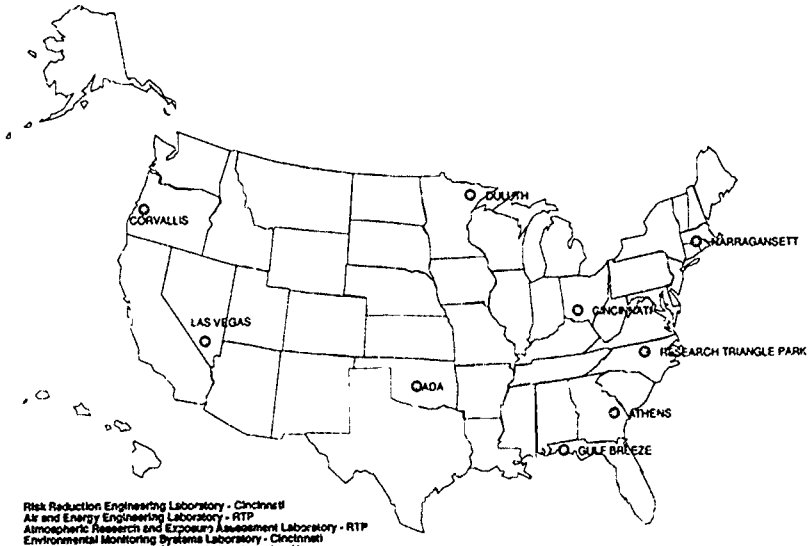
The Air and Energy Engineering Research Laboratory researches, develops, and demonstrates methods and technologies for monitoring and controlling air pollution from stationary sources. Among these stationary sources are electric power plants, manufacturing and processing industries, and incinerators. Staffed primarily by engineers, the Laboratory tests and improves air pollution control equipment, seeks means of preventing or reducing pollution through changes in industrial processes, develops predictive models, emissions inventories, identifies and assesses the importance of air pollution sources, and conducts

THE U.S. ENVIRONMENTAL PROTECTION AGENCY



REGION I - Boston, MA
REGION II - New York, NY
REGION III - Philadelphia, PA
REGION IV - Atlanta, GA
REGION V - Chicago, IL
REGION VI - Dallas, TX
REGION VII - Kansas City, KS
REGION VIII - Denver, CO
REGION IX - San Francisco, CA
REGION X - Seattle, WA

Environmental Protection Agency · Regional Offices



Risk Reduction Engineering Laboratory - Cincinnati
Air and Energy Engineering Laboratory - RTP
Atmospheric Research and Exposure Assessment Laboratory - RTP
Environmental Monitoring Systems Laboratory - Cincinnati
Environmental Monitoring Systems Laboratory - Las Vegas
Robert S. Kerr Environmental Research Laboratory - Ada
Environmental Research Laboratory - Athens
Environmental Research Laboratory - Corvallis
Environmental Research Laboratory - Duluth
Environmental Research Laboratory - Gulf Breeze
Environmental Research Laboratory - Narragansett
Health Effects Research Laboratory - RTP

Environmental Protection Agency Laboratories

fundamental research to define the mechanisms by which processes, equipment, and fuel combustion produce air pollution.

Atmospheric Research and Exposure Assessment Laboratory-Research Triangle Park, NC

The Atmospheric Research and Exposure Assessment Laboratory at Research Triangle Park, North Carolina conducts research on many aspects of human and environmental exposure to air pollution; characterizing, quantifying and modeling air pollutant levels on local, regional, and global scales. In addition, laboratory staff provide support to Program and Regional offices and to state and local groups for risk assessment and regulatory purposes.

Environmental Monitoring Systems Laboratory-Cincinnati, OH

The Environmental Monitoring Systems Laboratory in Cincinnati has as its primary mission to conduct research in development, evaluation and standardization of chemical and biological methods for environmental assessments; to conduct research for detecting, identifying, and quantifying microbial pathogens found in environmental media; and to operate the Agency's quality assurance program for maintaining the scientific credibility of the Agency's water, wastewater and solid wastes and Superfund toxics data bases.

Environmental Monitoring Systems Laboratory-Las Vegas, NV

The Environmental Monitoring Systems Laboratory in Las Vegas develops methods, systems, and strategies for monitoring the environment with the primary purposes of assessing the exposure of man and other receptors in the environment to polluting substances, characterizing the status of environmental quality, and identifying the trends of environmental quality.

Under a Memorandum of Understanding with the Department of Energy, the Laboratory collects radiological surveillance data and performs pathways research to determine the actual and potential human and environmental exposure to radiation from past and present testing of nuclear devices.

Robert S. Kerr Environmental Research Laboratory-Ada, OK

The Robert S. Kerr Environmental Research Laboratory serves as U.S. EPA's center for groundwater research, focusing its efforts on studies of the transport and fate of contaminants in the sub-surface, development of methodologies for protection and restoration of groundwater quality, and evaluation of the applicability and limitations of using natural soil and subsurface processes for the treatment of hazardous wastes. The Laboratory has a long history of research responsibilities related to the use of soils and subsurface for waste treatment and to the protection of the soil, ground water, and surface water.

Environmental Research Laboratory-Athens, GA

The Environmental Research Laboratory at Athens conducts and manages fundamental and applied research to predict and assess the human and environmental exposures and risks associated with conventional and toxic pollutants in water and soil. The research focus is predictive ecological science; identifying and characterizing

the natural biological and chemical processes that affect the environmental fate and effects of specific toxic substances such as pesticides or metals. The results are applied in state-of-the-art mathematical models for assessing and managing environmental pollution problems.

EPA's Center for Exposure Assessment Modeling, an internationally recognized center of modeling expertise located at the Athens Lab, provides models, training, and support in exposure evaluation and ecological risk assessment.

Environmental Research Laboratory-Corvallis, OR

The Corvallis Laboratory conducts research and assessment on the effects of pollutants and other human stresses on inland ecological systems that include: plant and wildlife populations; soils and other microbial systems; forests, grasslands, and agricultural systems; wetlands; watersheds; and regional landscapes. It also develops and evaluates methods for mitigating effects on and restoring inland ecological systems. The Laboratory provides the Agency's primary scientific expertise in terrestrial ecotoxicology, watershed, and regional ecology.

Environmental Research Laboratory-Duluth, MN

The Environmental Research Laboratory at Duluth conducts research to advance our fundamental understanding of aquatic toxicology and freshwater ecology. Its mission is to develop a scientific basis for the Agency's policies concerning the use of freshwater resources.

Environmental Research Laboratory-Gulf Breeze, FL

The Environmental Research Laboratory at Gulf Breeze develops and analyzes scientific data on the impact of hazardous materials released in marine and estuarine environments. Scientific investigations primarily involve chemical compounds and biological products regulated by EPA's Office of Pesticides and Toxic Substances, the Office of Water Programs, and the Office of Solid Waste and Emergency Response.

Information from laboratory research is used to establish guidelines, standards, and strategies for management of hazardous materials in the near-coastal marine environment, to define and predict its ecological health, and describe cause(s) of aberrant conditions or changes in its ecological status.

Environmental Research Laboratory-Narragansett, RI

The Environmental Research Laboratory at Narragansett, Rhode Island, along with its Pacific Coast Laboratory in Newport, Oregon, is one of the Agency's National Marine Environmental Quality Research Laboratories. The Laboratory's efforts respond to legislative requirements of the Clean Water Act, the Marine Protection, Research and Sanctuaries Act, and the Superfund Reauthorization Act. Major emphasis is placed on providing the scientific base for environmental criteria, waste disposal practices, environmental analysis/impacts, assessments, and marine and estuarine risk assessments for regulatory activities of the Agency's program offices.

Health Effects Research Laboratory-Research Triangle Park, NC

The Health Effects Research Laboratory (HERL) implements a comprehensive research program to investigate human health effects resulting from exposure to environmental pollutants. Staffed by health scientists with recognized expertise in a variety of disciplines, HERL is the focal point for toxicological, clinical, and epidemiological research within the Agency. This research program develops and applies state-of-the-science biological assays, predictive models, and extrapolation methods which serve as the basis for the Agency's health risk assessments.

EDUCATION OFFICE MISSION

The mission of the Agency's Office of Environmental Education is to provide leadership in fostering environmental education. The Environmental Education Program will emphasize two cross-cutting themes: man's impact on the environment, and pollution prevention through wise use of resources and environmentally sensitive decision-making.

By working through existing institutions — media, elementary and secondary schools, museums, libraries, parks and recreation areas, and environmental groups and professional organizations — this Office will stimulate, facilitate, and enhance environmental education of all segments of our society.

The Office will oversee a new precollege program and several existing programs within the Agency as well as coordinate these programs with similar activities in other federal agencies, state and local governments, and the private sector.

NEW INITIATIVES

Precollage Environmental Education ($7 million)

The National Environmental Education Act was signed into law by the President on November 16, 1990. As a result of the passage of this legislation, the Agency will focus on two broad areas of Environmental Education: improving basic science literacy as the core of environmental education for students in grades K-12 and colleges; and informing the general public about the environmental consequences of their individual and collective actions and motivating them to address environmental problems.

EPA believes that a critical goal is to assure that all children in grades K-12 receive instruction in the sciences (including the social sciences of economics and government) which are the core components of environmental literacy. This education can, and should, occur in both formal and informal educational settings. Teachers should take full advantage of available opportunities to excite interest in science and mathematics by presenting those subjects in the context of environmental problems.

Toward that end, the Agency established an Office of Environmental Education with the mandate to foster an enhanced environmental ethic in society by improving student environmental literacy and increasing public awareness of environmental problems. The Office will provide national leadership in these areas, and will build upon the ongoing work of public, non-profit, and private sector groups already pursuing these goals. The Agency's efforts are being coordinated and will fully support CEHR's National Education Priority Framework, which stresses the need to

HIGHLIGHT In FY 1992 the Agency will expand its role in Environmental Education through the recently authorized National Environmental Education Act.

improve the overall quality of scientific and technical training in our Nation's schools. The Program will develop the two broad themes through four areas: wise use of natural resources, prevention of environmental problems, importance of environmentally sensitive personal behavior, and need for additional action at the community level to address environmental problems.

The Environmental Education Program, authorized by the National Environmental Education Act, will focus on education and public awareness. Education includes both formal training in scientific and technical disciplines in grades K-12 and college, and educational activities such as experiential learning in informal settings. The Program's approach will emphasize improving our youth's literacy in environmental sciences, developing a greater understanding of man's impact on the environment, and increasing the number of environmental professionals. The public awareness part of the Program will target the general public, with initiatives to promote a more informed and environmentally responsible citizenry. Central to this effort will be an effective media strategy that communicates the program's themes and a sound coordination strategy that enlists the help of public, nonprofit, and private sector organizations in reaching and actively involving the public. The intent is to stimulate strong grassroots interest in the environment and understanding of how individuals can contribute to maintaining a healthy environment.

Graduate ($.4 million)

Predoctoral Fellowships and Traineeships
This program will be expanded in FY 1992 to include a new traineeship program to attract students in engineering and other disciplines supporting Resource and Recovery Act (RCRA) issues in participating Historically Black Colleges and Universities (HBCUs). RCRA was enacted to deal with a major environmental problem associated with the disposal of large volumes of municipal and industrial waste. Participating HBCUs can make a significant contribution by helping to solve some of the technical problems associated with implementation of RCRA. The planning phase of the traineeship program is still under development.

ONGOING ACTIVITIES

Precollege and Undergraduate ($5.4 million)

Environmental Youth Awards
This program will be part of the new Office of Environmental Education (OEE) in FY 1992. The program promotes elementary and secondary student participation in environmental projects in all 50 states. The program offers students individual and collective opportunities to become an environmental force within their community.

The program has two components: the regional certificates program and the national awards competition. Regional certificates are awarded by the 10 EPA Regional Offices to all entrants, and one winner per region is selected. These winners come to Washington and receive recognition by the President in a White House ceremony. This year's awards ceremony was held on November 14, 1990.

Youth Environmental Action Forum
This program will be part of the OEE in FY 1992. The EPA Environmental Education Task Force organized the first Youth Environmental

Education Forum in co-sponsorship with the National Governors' Association. The Forum was held in Washington in April 1990: approximately 300 individuals attended, including high school students, teachers, and environmental education coordinators from around the world. Student participants developed proposals for environmental projects that they could lead in their communities. Adult participants learned about available educational resources and discussed ideas for future initiatives at the state, national, and international levels. EPA will sponsor this national event again in 1992, and will encourage Regional offices to sponsor regional forums in the intervening years.

EPA Region 8 winner and sponsor of 1990 President's Environmental Youth Award

Pollution Prevention Education Grants
EPA's pollution prevention program includes grants to local and State groups to develop primary and secondary school curricula and other environmental education efforts that emphasize pollution prevention.

Minority Research Apprentice Program
EPA's laboratory centers in Cincinnati and North Carolina conduct summer programs whereby local high school and college students gain paid research experience and are exposed to careers in environmental science and engineering. This program involves about 40 students annually.

"2+2" Education Programs
Under this program, EPA supports two years of high school and two years of community college work in environmental sciences. Upon completion, students are offered entry-level employment at EPA. This pilot program currently operates in New York and Iowa.

National Network for Environmental Education Centers
EPA, in cooperation with the Tennessee Valley Authority (TVA) and the Alliance for Environmental Education, supports an expanding network of regional environmental education centers for teacher training, research and community outreach.

Partners in Education
In 1988, EPA established a partnership with Bertie Backus Junior High School in Washington, D.C. to stimulate students' interest in pursuing the study of math and science, and to educate students about environmental careers. The program relies on EPA volunteers to assist with classroom presentations, field trips, science fair judging, and an annual Environmental Day at the school. Many EPA regional offices also participate in the "Adopt-a-School" program.

Cooperative Education Program
EPA has cooperative education agreements with 64 colleges and universities, including many with predominantly minority student bodies. Up to 200 students a year work at EPA as part of degree programs, primarily in EPA regions and

laboratories. In addition to contributing to the education of the participating students, the Co-op Program is seen as an integral part of EPA's strategy to attract the best science and engineering students.

Federal Junior Fellowship Program
This program, which employs the Cooperative Education Agreement approach, provides a work-study program for baccalaureate and associate degree students who need financial aid. About 150 students receive Fellowships each year.

Minority Faculty Fellows Program
Under this program, EPA provides research and other practical experiences for faculty from Historically Black and Hispanic Colleges and Universities. This program now involves about 15 participants each year. Efforts are underway to expand it to include Asians, Native Americans, women, disabled and other minorities.

Graduate ($6 million)

Predoctoral Fellowships and Traineeships
The current fellowship program, initiated in 1981, encourages students attending HBCUs to develop careers in environmental research through advanced study in the environmental sciences, computer sciences, biological sciences, physical sciences, engineering, and mathematics. As stated earlier, this program is slated for expansion through the addition of a traineeship program. An estimated 12 to 15 students are expected to receive support in FY 1992 through this component of the fellowship program.

The fellowship and new traineeship program allows these historically underfunded institutions to become more competitive as a result of greater federal support through student tuition payments. Also, the program accrues future environmental benefits from the more diverse population of environmentalists participating in solving critical environmental problems. Finally, EPA stands to benefit from support of HBCUs, not only from broader participation in environmental protection, but also from the expanded, more diverse population of environmental professionals from which its employment needs can be met.

Postdoctoral Fellowship
This program was designed to assist EPA's Office of Research and Development (ORD) in its responsibility for identifying and assessing the significance of long-range environmental issues, and to enhance the ability of ORD to improve communication of the results of its strategic assessments and studies outside of the agency and to the professional community concerned with environmental issues.

The American Association for the Advancement of Science administers the fellowship program for ORD through a competitive selection process whereby the top 10 fellows are chosen based on the quality of their project proposals. The fellows help ORD develop processes and methods for identifying and evaluating future environmental problems and opportunities, analyze and evaluate current and anticipated environmental issues, communicate the results of strategic assessments and studies to a wide range of individuals, groups, and agencies; and provide outreach and education to the professional community concerned with environmental assessment.

HIGHLIGHT In 1992 approximately 12 15 students attending HBCUs will receive support from the graduate fellowship program.

CONTACTS:

Precollege

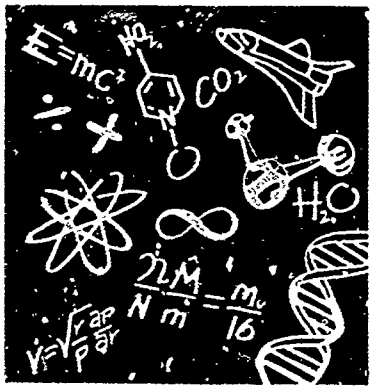
Lewis S. W. Crampton
Associate Administrator for Communications
and Public Affairs
202-382-7963

Graduate and Postgraduate

Erich W. Bretthauer
Assistant Administrator for Research and
Development
202-382-7676

"Aeronautics and space activities are unique in their ability to capture the interest of young people. This natural curiosity, when properly nurtured, fosters unparalleled educational achievement. NASA is working hard to use its research at the cutting edge of technology to inspire the creative genius of young Americans. Ours is a special responsibility—to encourage children to believe in themselves, to challenge the bounds of knowledge, and to turn their dreams into the accomplishments of tomorrow."

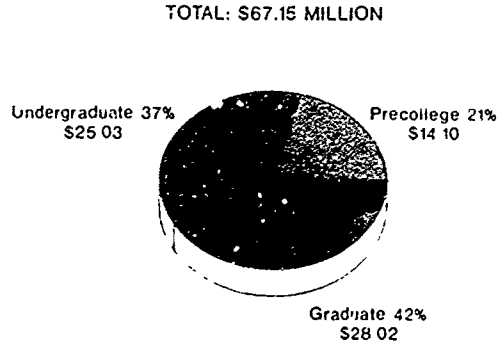
Richard H. Truly
Administrator
National Aeronautics and Space Administration



OVERVIEW

As the agency responsible for the Nation's civilian aerospace program, NASA has a major role in fostering American technological and scientific advances in the 21st century.

On July 29, 1958, President Dwight D. Eisenhower signed into law P.L. 85-568, the National Aeronautics and Space Act of 1958, which created NASA to conduct the United States of America's civilian aeronautics and space program. In addition to building and operating the world's most advanced aircraft and spacecraft, NASA conducts a coordinated program of basic and applied research in virtually all areas of natural science and engineering, from the biological effects of space flight to the development of advanced materials for aircraft. The agency's diverse activities range from training astronauts, to operating satellites in Earth orbit, to planning President Bush's Space Exploration Initiative that will send humans to explore the Moon and Mars. Along with the academic researchers and industry that support the agency's efforts, NASA helps build the Nation's scientific and technological base.



In millions of dollars

NASA Education Budget FY 1992

To do this work, the agency not only fosters but critically depends on a skilled and educated corps of scientists, engineers and technicians. Virtually every science and engineering discipline is represented in the NASA work force. At present the agency employs approximately 23,000 people, 55% of whom are scientists and engineers, and 68% of whom have college degrees. Another 33,000 people work as private contractors on NASA projects.

In FY 1990, NASA spent a total of $12.3 billion on the civilian aerospace program. Approximately $50.9 million was expended on aerospace education programs and projects. In addition, approximately $442 million went to institutions of higher education for procuring research under more than 5,000 grants, contracts and cooperative agreements. It is estimated that approximately 5,900 undergraduate and graduate students were supported under these NASA grants and contracts in FY 1990.

MISSION AND STRUCTURE

NASA is currently engaged in several major areas of activity: human spaceflight, space operations, aeronautics and space technology development, space science, and Earth science and applications. These broad categories include such ongoing missions as operating the space shuttle; exploring the Solar System with robotic spacecraft; investigating the rest of the universe with Earth-orbiting telescopes; planning for future projects such as space station Freedom and the Space Exploration Initiative; and planning an extended "Mission to Planet Earth" for the late 1990s and beyond.

HIGHLIGHT Funding increases in FY 1992 will enable an additional 11,000 teachers to participate in the Aerospace Education Services Program.

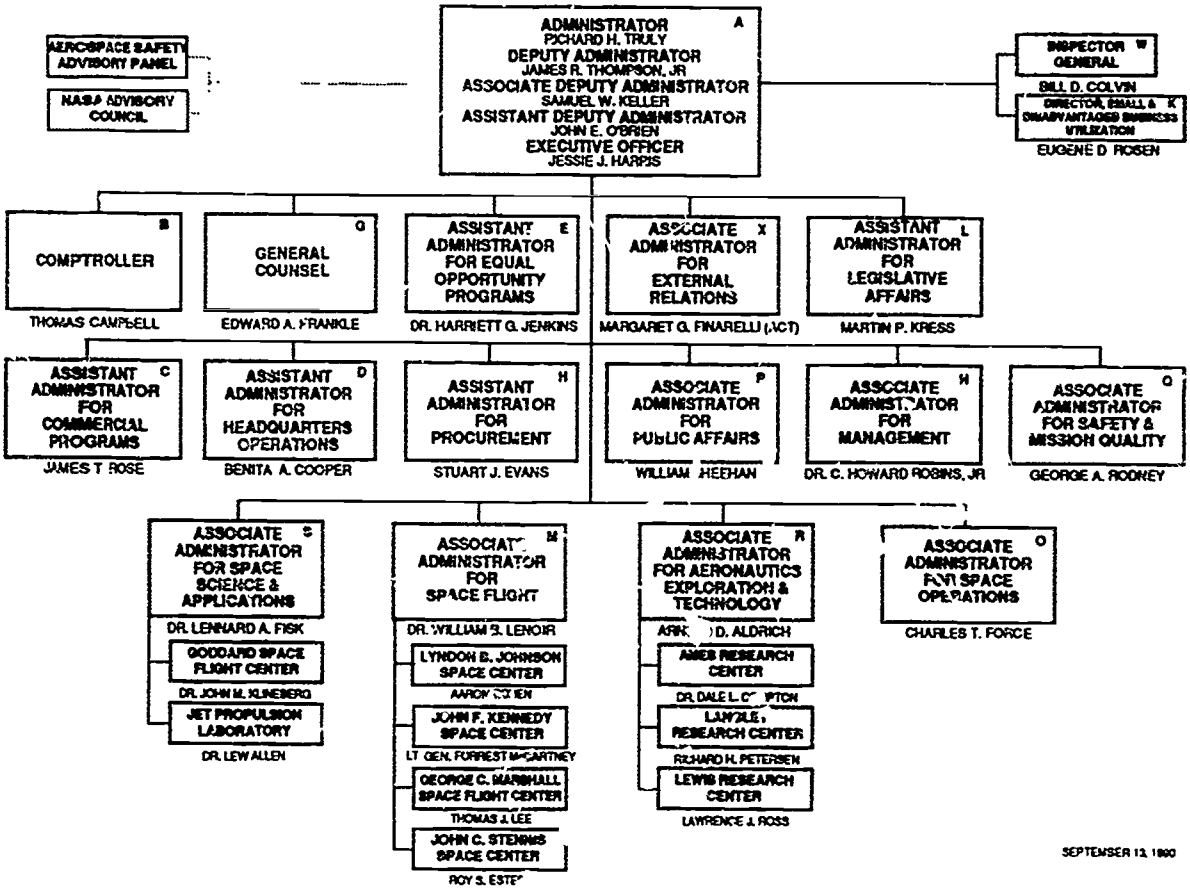
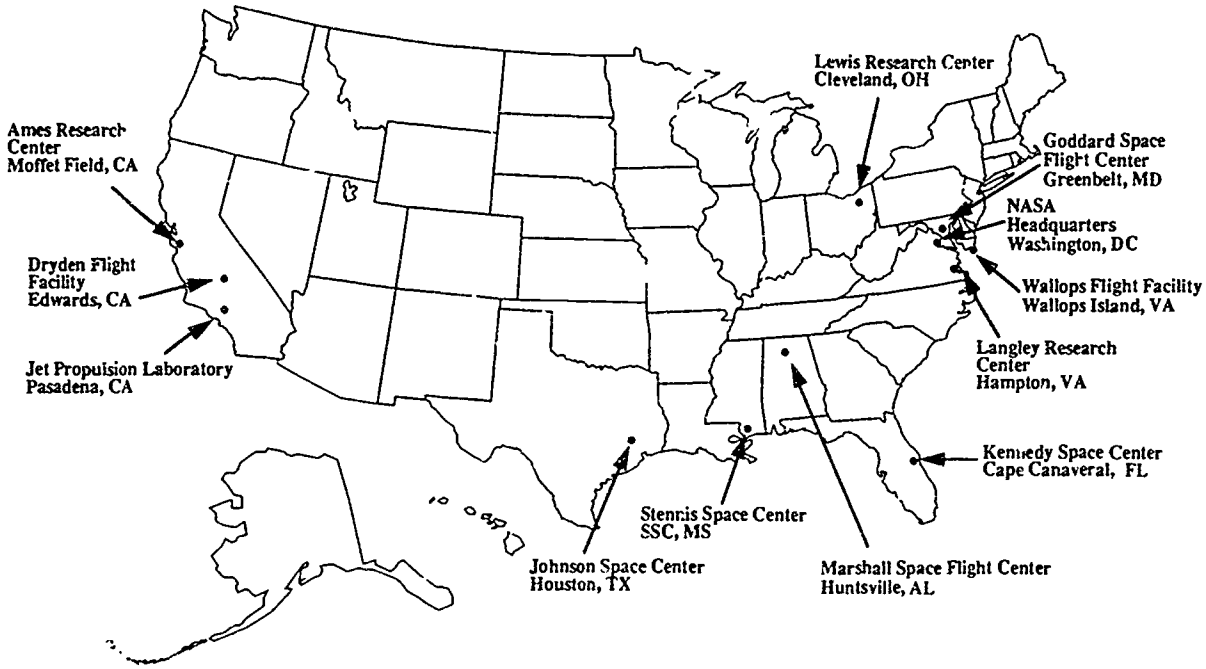


Table of Organization - National Aeronautics and Space Administration

Nine field centers around the country provide NASA with the expertise to conduct this research in all facets of aeronautics and space. The Lewis, Langley and Ames Research Centers are leaders in aeronautics research, while the Jet Propulsion Laboratory and Kennedy, Johnson, Goddard, Stennis and Marshall centers concentrate on space research and operations. Together, these field centers and other unique NASA facilities represent a national investment of approximately $16 billion in science and technology infrastructure.

The National Aeronautics and Space Act mandated that the agency share the technological and intellectual benefits of its research with the public. Since then, one of the primary benefits of the civilian aerospace program has been the new knowledge of the Universe it has given us. Consequently, education—the creation and dissemination of that knowledge—therefore has received strong emphasis at NASA since the earliest days of the space age.

HIGHLIGHT Funding increases in FY 1992 will expand NASA's efforts in providing inservice workshops to elementary and secondary math, science and technology teachers.



NASA Installations

In pursuing its educational programs, NASA is able to draw on a nationwide team of highly skilled researchers. All nine NASA centers have active educational outreach programs, serving teachers in every region of the country. NASA's unique mission to advance the peaceful exploration of space gives the agency an unparalleled capability to excite as well as inform teachers, students and the general public.

EDUCATION PROGRAMS

In September 1989, President Bush met with the Nation's Governors to develop a set of National Goals for Education. Of the six goals identified for the year 2000, four are served directly by NASA programs: increasing the high school graduation rate, enhancing student achievement and citizenship; making U.S. students first in science and mathematics achievement; and advancing adult literacy and lifelong learning.

NASA is developing a 10-year strategy to anticipate requirements for future science and technology education and ensure that the resources are there to meet those requirements. More than 160 individual education outreach programs coordinated and focused on this common goal are now in place nationally and at NASA field centers.

The 10-year strategy addresses the national crisis in scientific, technical and engineering education and also serves the agency's long-term interests. Perhaps more so than any other federal agency, NASA has a stake in making sure that the students of today are prepared for the challenges awaiting them in the next century. The primary goal of the NASA education effort is to ensure that a skilled and educated work force will be

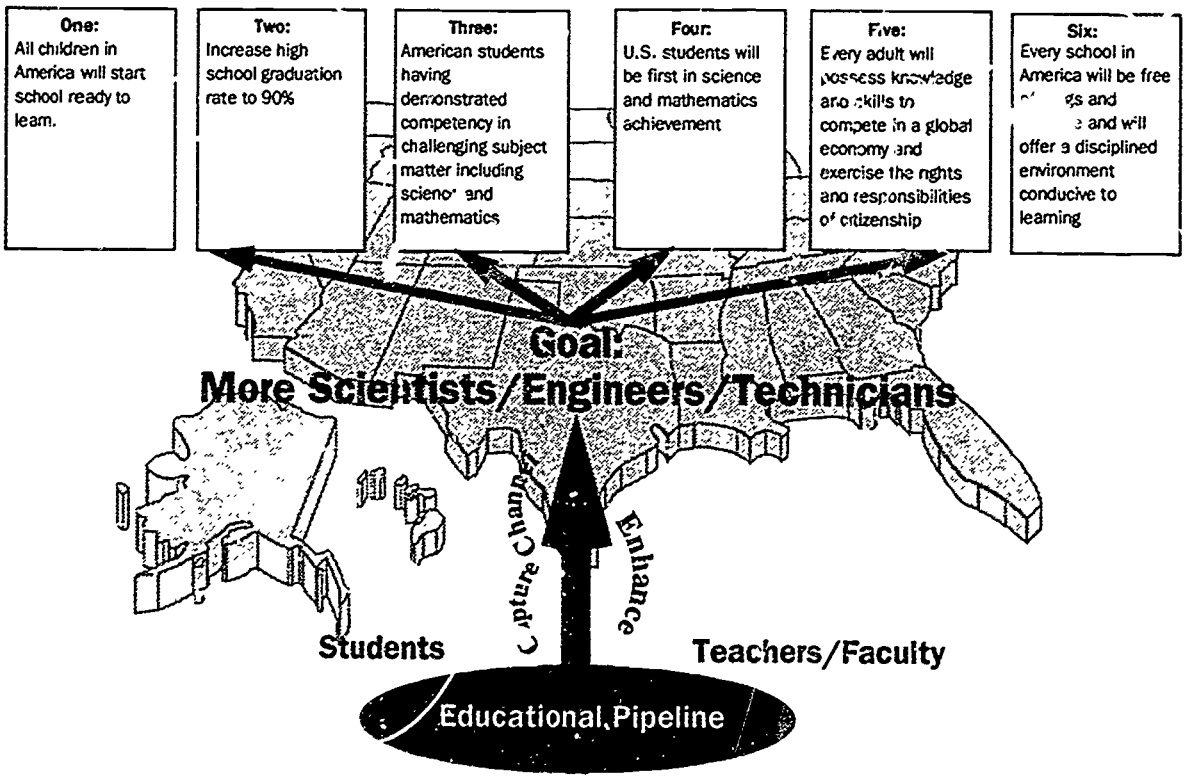
HIGHLIGHT Funding increases in Fy 1992 will establish new Teacher Resource Centers in approximately 10 additional states.

available to conduct the space and aeronautics projects of the next century.

NASA's strategy to encourage students to pursue careers in science and engineering is threefold: capture student interest in science and mathematics at an early age, beginning at the elementary level; channel that interest at the secondary, undergraduate and graduate levels, so that students pursue careers in science, engineering and technology; and enhance the knowledge, skills and experiences of precollege teachers and college and university faculty in order to provide the best possible training for tomorrow's civil servants, aerospace contractors and university researchers.

NASA education programs capture the elementary student's interest in science and mathematics through "spacemobiles," visits to school assemblies, and other outreach activities that take advantage of a child's natural excitement and interest in space exploration. By the year 2000,

NASA plans to double its outreach to elementary schools. Channeling that natural interest into science and engineering career paths is accomplished through internships, undergraduate fellowships and other programs that provide talented students with the intellectual and financial support to keep moving through the educational system, all the way up to the Ph.D. level.



National Goals for Education by the Year 2000

HIGHLIGHT Additional FY 1992 funding will provide for expanding NASA efforts at the Community College Level.

Through work study programs like the Advanced Design Project, NASA is helping to foster aerospace-related education in existing college and university curricula. At the same time, the new National Space Grant College network is creating institutional capability throughout the country. In both cases, students are able to continue their work in science and engineering fields as a result of direct financial support and research participation from NASA.

In recognition of the changing demographics expected in the 21st century—the period during which many of today's planned space projects will come to fruition—NASA also is working to develop an interest in mathematics, science and technology in minority groups that traditionally have been underrepresented in scientific and engineering fields. Through the Summer High School Apprenticeship Research Program (SHARP) and other outreach programs, minorities are encouraged and prepared to pursue careers in aerospace.

To enhance the knowledge, skill and expertise of teachers in the field of aerospace, NASA conducts workshops, invites faculty fellows to conduct research at NASA centers, and makes a wide variety of state-of-the-art resources—from videodiscs to satellite videoconferences—available to thousands of teachers every year. As a followup to its teacher workshops and other activities, NASA provides information and materials on a continuing basis to educators at all levels, from grade school through graduate school.

The agency also works with non-profit groups such as the Young Astronaut Council, the Challenger Center for Space Science Education, and the U.S. Space Foundation, as well as with private industry and local and State governments, to further leverage science, mathematics and technological education

ONGOING PROGRAMS

Capturing Student Interest

Aerospace Education Services Program (AESP) This outreach program to elementary and secondary schools, also known as the "Spacemobile" has been in operation since 1963. From September to June each year, AESP specialists—all former teachers themselves—visit schools throughout the United States, conducting student assemblies and teacher workshops. They also develop aerospace curricula that enhance the teaching of science, mathematics and technology. During the summer months, AESP specialists conduct teacher workshops at NASA field centers and college and university campuses around the country.

NASA "Spacemobile" demonstrations capture student interest in science and technology at an early age.

The AESP program reaches more than a million students and approximately 200,000 teachers each year, using aeronautics and space as a catalyst to foster interest in science, mathematics and tech-nology. Currently, there is a two- to three-year waiting list of schools wishing to participate in AESP. The program will be enhanced during FY 1990-92 by increasing the number of specialists at several NASA centers and by upgrading instruc-tional materials and vans.
(Precollege Informal — $6.0 million)

The excitement unique to NASA programs sparks an early interest in science, mathematics and technology.

Space Science Student Involvement Program (SSIP)
NASA also captures the middle and secondary student's interest in science and mathematics through the Space Science Student Involvement Program (SSIP). This annual program involves students in creating experiments, art projects, and newspaper articles on space and aeronautics-related subjects.

Space Exposed Experiment Developed for Students (SEEDS)
A cooperative venture with the Park Seed Company, the Space Exposed Experiment Developed for Students (SEEDS) program allows students to study tomato seeds flown in space onboard NASA's Long Duration Exposure Facility (LDEF), which was retrieved by the Space Shuttle in 1990 after nearly six years in orbit. Seeds distributed to classrooms around the country are then investigated for possible changes due to exposure to the space environment.

CHANNELING STUDENTS INTO SCIENCE AND ENGINEERING CAREERS

Direct Student Support

These programs provide paid, "real life" research experience in science, engineering and technology fields. Typically, students work part-time at a NASA center during the academic year (with alternating work and study periods) and full-time in the summer. Some programs offer only summer employment.

Some of these Direct Student Support programs give co-op students the opportunity to convert to permanent employee status. Others focus on reaching diverse populations.

The following programs offer employment as their primary feature:

Summer High School Apprenticeship Research Program (SHARP)
Provides opportunities for minority students in grades 10 to 12 to work as paid apprentices for eight weeks at a NASA field center.

- **Stay in School Program**
  Provides part-time jobs, including on-the-job training and experience, for disadvantaged secondary and undergraduate students.

- **Baccalaureate Cooperative Education Program**
  Alternates a semester of college-level course work with a semester of full-time work experience at a NASA field center. Graduates of the co-op program make up 40-50% of NASA's engineering and science trainee population each year.

- **Graduate Co-op**
  Alternates periods of work and study for students pursuing graduate degrees.
  (Precollege, Undergraduate and Graduate Informal — $7.4 million)

Targeted Programs
For approximately eight years, NASA has been funding minority undergraduate and graduate students to help them earn degrees in science and engineering. Internships and interactions with role models and mentors at NASA centers supplement the students' classroom work. Some 16 awards will be made in FY 1992, directly affecting 598 undergraduates, 10 graduate students and 50 college and university faculty members.
(Undergraduate and Graduate: Formal — $5 million)

NASA Teacher-in-Space designee Barbara Morgan explains Space Station Freedom to a group of students in Houston, Texas.

Advanced Design Program
This program allows students to earn university credit while working on advanced mission topics of interest to NASA. Universities with accredited engineering programs submit design topics in the fields of space and aeronautics to the Universities Space Research Association (USRA), which manages the program for NASA. Schools chosen are paired with a NASA field center and receive a modest grant. Aside from encouraging the teaching of engineering design at the undergraduate level, the program fosters cross-disciplinary projects with students from other fields. Now in its sixth year, the Advanced Design Program will involve several hundred undergraduate students from 45 universities in FY 1991. Over the last three to four years there has been increasing involvement from industry, which provides financial assistance and summer internships.
(Undergraduate — Formal — $1.6 million)

Graduate Student Researchers Program
Initiated in 1980, this program provides funds for graduate students to conduct thesis research at either a NASA center or their home institutions. Currently, approximately 500 students are supported at a level of $22,000 for a year's fellowship. This year more than 2,500 students applied. All NASA centers and headquarters participate in the program, which in the past ten years has helped more than 1,000 students from hundreds of universities earn advanced degrees in aeronautics and space-related fields.
(Graduate — Fellowships — $12.4 million)

Resident Research Associateships Program
Managed for NASA by the National Research Council, this program gives postdoctoral scientists and engineers the opportunity to conduct research at a NASA field center. Regular research associateships are awarded for one year to candidates who have held their doctorate for less than five years. Senior associateships, also usually awarded for one year, go to those who have held a doctorate for more than five years, and who have already made significant contributions in their field of research. Approximately 245 awards are made annually under this program, which has been in operation since 1964. Associates not only contribute to NASA mission research, but also strengthen the ties between the agency and academic institutions.
(Graduate — Postdoctoral Fellowships — $12.4 million)

National Space Grant College and Fellowship Program
Authorized by Congress and initiated in 1989, this program is designed to develop a national network of universities with capabilities in aeronautics, space and related fields. More than 100 universities are currently involved, and Space Grant Consortia have been designated in 21 States. The District of Columbia and all but one of the remaining States have applied to participate in the program in FY 1991. Designated institutions receive grants and fellowships in fields related to NASA's mission. The program fosters interdisciplinary research and encourages cooperation between universities, industry and state and local governments. Rather than directly supporting technical research, it aims to expand the nation's research and educational base in schools, institutes, laboratories and other nonprofit research organizations, and therefore complements other NASA research and development and education efforts.
(Undergraduate Informal and Predoctoral Traineeships— $12.1 million)

ENHANCING EXPERIENCES OF PRECOLLEGE TEACHERS AND COLLEGE AND UNIVERSITY FACULTY

Educational Technology

In order to reach large numbers of today's "high-tech" students most effectively, NASA is evaluating new technologies, such as computer networks and interactive video programs, for potential use in enhancing the knowledge, skills and experiences of precollege teachers and college/university faculty. The service has been in operation for four years, and increased use is scheduled to begin in FY 1992.

NASA Spacelink is a computer "bulletin board" that allows individuals to log on and receive news about current NASA programs, along with historical and astronaut data, lesson plans, educational publications and classroom activities.
Satellite Videoconferences are conducted by satellite four times a year to teachers across the

269

country. The content of the videoconferences varies, but all cover aeronautics or space science topics of interest to the educational community.

Laser Videodisc Technology is being used by teachers to develop interactive lesson plans on space-related topics. The videodiscs familiarize teachers with the materials available at NASA Teacher Resource Centers, and help them make the best use of those materials in the classroom.
(Precollege — Informal — $700,000)

Educational Mailings
NASA provides funds for printing and reprinting supplementary curriculum materials, lithographs and periodicals. These materials are used widely by both students and teachers, and are used to support in-service programs and workshops in schools and NASA centers. They also are disseminated through the agency's Teacher Resource Centers.
(Precollege — Informal — $1.7 million)

Innovative Education Programs
NASA is conducting a wide range of programs designed to use aeronautics and space themes as a means of motivating students to learn science, mathematics and technology. Collectively they reach thousands of precollege teachers and students each year, while stimulating interactions between practicing scientists, engineers, and technicians and the educational community. Specific programs include:

- **NASA Education Workshops for Mathematics, Science and Technology Teachers (NEWMAST)**

- **NASA Education Workshops for Elementary School Teachers (NEWEST)**

- **The Teacher Resource Center Network (TRCN)**, which offers publications, reference books, slides, audio and video cassettes, computer programs and other teaching tools to educators at all nine NASA centers located around the country

- For educators who do not have access to a **Teacher Resource Center**, the **Central Operation of Resources for Teachers (CORE)** is a nationwide,centralized mail-order library of publications, reference books, slides, audio and video cassettes, computer programs and other teaching tools.

Summer Faculty Fellowship Program
Created more than 25 years ago in cooperation with the American Society for Engineering Education (ASEE), this program provides funds for approximately 200 college and university faculty every summer to spend 10 weeks at a NASA field center, working on problems of mutual interest to the researcher and NASA. Besides exposing researchers not normally engaged in aerospace work to NASA facilities, the program fosters an exchange of ideas between NASA and university researchers. Traditionally, the fellowships are evenly divided between scientists and engineers. NASA expects to make 250 awards in FY 1991.
(Undergraduate — Informal — $3.8 million)

Targeted Outreach Programs
This is a focused effort to draw more under-represented minority youth into the scientific and engineering work force "pipeline," beginning at the elementary school level and continuing up to college admission. These targeted programs range from technological updates for teachers to special enrichment and career orientation programs for elementary and secondary students.

Through 12 different grants, these programs directly affect 5,639 students each year, along with 110 teachers, who reach another 3,300 students indirectly. NASA provides approximately 70% of the funding, with the rest coming from community organizations and the private sector.

Educational specialists from NASA field centers around the country conduct workshops for elementary school teachers to enhance their skills and knowledge of aerospace-related subjects.

The programs include: UDC Urban Coalition Urban Renewal; UDC Saturday Academy; Aises Teacher Enhancement; Mt. Holyoke College Summer Mathematics Program; Lincoln University Aerospace and Engineering Recruitment Program; Florida A&M Engineering Concepts Institution; Xavier "Engineering Bridge"; El Ingeniero Mathematics and Science Education; Stevens Mathematics, Science and Computer Project; University of Cincinnati Summer Institute; Jackson State Science and Education; Mace Promotion and Awareness of Engineering; and North Carolina A&T Student Space Shuttle.
(Precollege — Formal and Informal — $1 million)

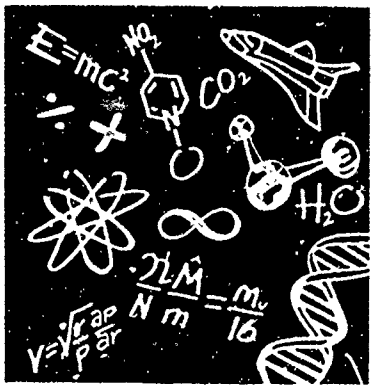
Challenger Center
By direction of Congress, NASA supports the Challenger Center for Space Science Education, a nonprofit organization working to develop curriculum materials for use in the classroom. The Center also conducts workshops and other programs that enhance teachers' knowledge and skill in teaching science, mathematics and technology. A national faculty of more than 100 highly skilled teachers run these programs. The Challenger Center plans to expand its outreach substantially to reach more of the educational community in the near future.
(Precollege — Informal — $1 million)

FOR FURTHER INFORMATION, PLEASE CONTACT:

Dr. Robert W. Brown
Director
Educational Affairs Division
Office of External Relations
NASA Headquarters
400 Maryland Avenue SW
Washington, D.C. 20546

"Education presents an enormous challenge to the Nation. Clearly all who have a stake in it—government, educators and academic administrators, parents, industry, and the science and engineering community—must work together if the President's goal of U.S. superiority in science and mathematics is to be met. Providing leadership to foster these efforts is integral to NSF's mission."

Fred Bernthal
Acting Director
National Science Foundation



THE AGENCY IN BRIEF

The National Science Foundation is an independent Federal agency, established in 1950, to promote and advance scientific progress in the United States. The Foundation has a legislative mandate to initiate and support basic science and engineering research with the dual objective of strengthening research potential and education programs at all levels. Policy-making authority within the agency is vested in the National Science Board, which is composed of scientists, educators, and public affairs experts who collectively represent the views of science and engineering leaders in all areas of the Nation. Its 25 members, which include the NSF Director, are appointed by the President, with the consent of Congress.

While the Foundation itself does not conduct research, over one-half of its professional staff are scientists and engineers—40% on temporary assignment as visiting scholars. These individuals help oversee the disbursement of over 90% of the Foundation's budget, which supports activities in

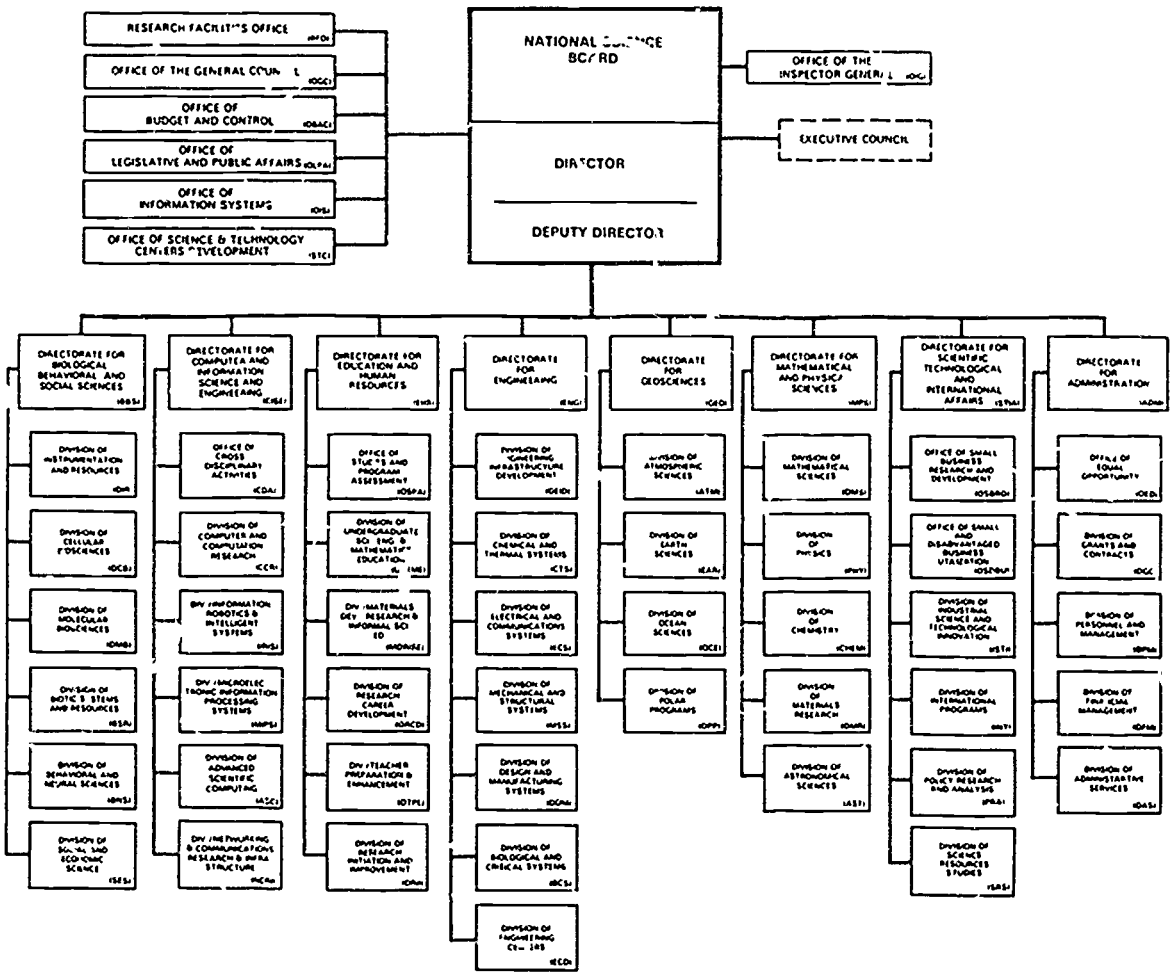
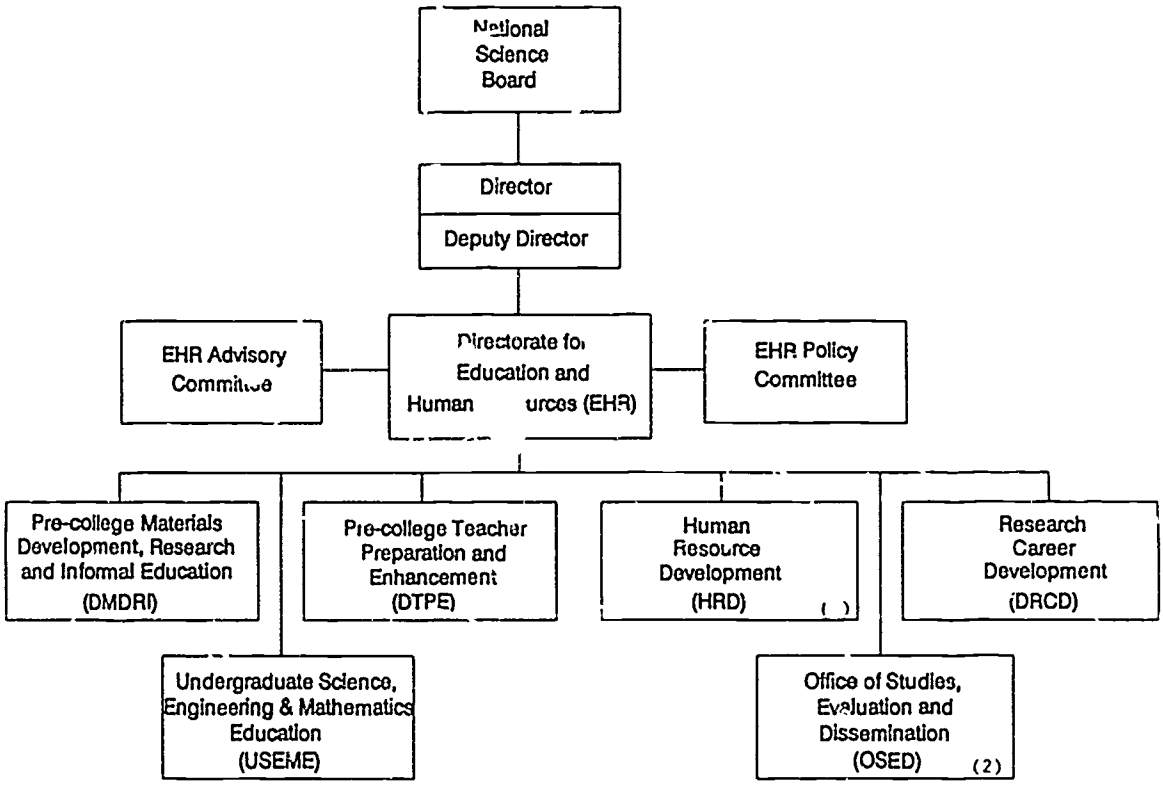


Table of Organization - National Science Foundation

HIGHLIGHT NSF will increasingly stress development of leader teachers who can leverage change by training colleagues and by bringing their expertise to education research projects.



National Science Foundation - Dictorate for Education and Human Resources

seven directorates (Biological, Behavioral and Social Sciences; Computer and Information Science and Engineering; Education and Human Resources; Engineering; Geosciences; Mathematical and Physical Sciences; and Scientific, Technological, and International Affairs). [For further information on NSF program activities see National Science Foundation, *Guide to Programs: Fiscal Year 1991*, Washington, D.C., 1990. NSF does not support clinical research, including research on the etiology diagnosis, or treatment of physical or mental disease, abnormality, or malfunction in human being.] Advisory committees and review panels further link NSF with all segments of the science and engineering research, policy, and education community.

NSF IN THE FEDERAL EHR PROGRAM PLAN

In FY 1992, the President is requesting $2.7 billion for NSF with nearly $456 million targeted on education and human resources activities as defined in the FCCSET CEHR process. The Foundation's varied and comprehensive portfolio of programs bridge all educational levels. Fifty-five percent of the NSF education budget supports precollege programs, undergraduate and graduate programs constitute 29% and 16%, respectively (Chart 1).

HIGHLIGHT Middle and secondary school projects will complete the development of integrated precollege mathematics materials designed to meet national curriculum standards.

Comprising nearly one-quarter of the total Federal education effort, NSF ranks second only to the Department of Health and Human Services (DHHS) in its total education request (Chart 2). At the precollege level, NSF accounts for 38% of total Federal funding. Its precollege programs—in both the formal and informal arena—lead other agencies in the support of curriculum development and organization reform; its teacher preparation and enhancement programs are second only to those of the Department of Education. At the undergraduate level, NSF accounts for nearly 28% of total Federal support. Here, its programs are concentrated in formal (in-the-classroom) activities and dominate the support of faculty enhancement, curriculum development, and organizational reform programs. The Foundation ranks third, behind DHHS and the Department of Defense in support of graduate programs, representing 9% of the Federal total. The agency's graduate efforts are focused primarily on predoctoral programs.

Between FY 1991-92, the NSF FCCSET education and human resources budget is anticipated to increase by $84.4 million or 22.7% (Table 1). Precollege programs make up nearly one-half of the increase; undergraduate programs over one-third. At both the precollege and undergraduate levels, comprehensive organizational and operational reform and curriculum programs are receiving strong emphasis. The Foundation's efforts in these areas are described below.

Research grants, though lacking an explicit education objective, contribute to the education mission of an agency by providing both research experiences and financial support to science and engineering graduate students. In addition to the efforts described above, in FY 1992, it is estimated that NSF research awards to colleges and universities will provide approximately $205 million in support of 17,000 graduate students.

NSF EDUCATION MISSION

The National Science Foundation Act of 1950 (42 U.S.C. Sec. 1862, as amended) authorizes and directs NSF to initiate and support education programs in virtually all fields of science and engineering, at all education levels. Under this mandate, NSF views its permanent role as one that utilizes its unique background and capability to provide vigorous leadership and strong sup-

Chart 1
NSF Education Budget FY 1992

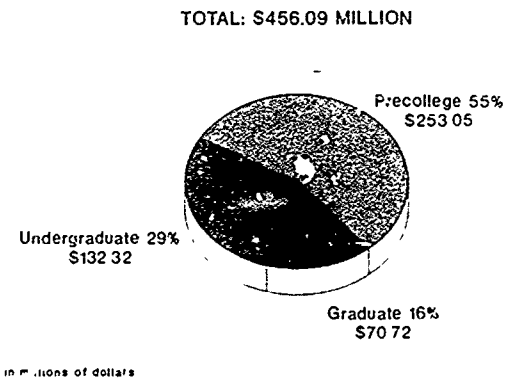
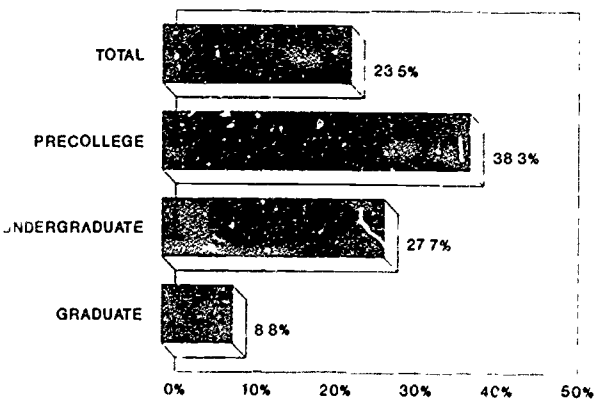


Chart 2
NSF Share of Federal Plan by Educational Level



HIGHLIGHT Enhanced student assessment strategies will align methods and instruments with the knowledge requirements of new curriculum and allow tracking of student achievement over time.

port for science, mathematics, and engineering education and human resources development activities. Its programs serve at once the needs of the Nation and the individual. [A number of NSF human resource activities were excluded from this exercise since they are targeted on initiating or advancing the research careers of scientists and engineers who have already left the education system. These programs generally aid young investigators, as well as investigators from underrepresented groups, e.g., women and minorities.]

Underlying the Foundation's broad, comprehensive array of programs is the belief that education is a continuum, all links of which—from preschool to graduate school—must be strong. Its programs also recognize that the Nation's needs are served by ensuring not only sufficient numbers of well-educated individuals to meet the technical needs of the U.S. workforce, but also scientifically literate citizens who can keep pace with the technological challenges of the 21st century. Specifically, the education goals of NSF are to stimulate and provide direction for nationwide efforts that will:

- strengthen and accelerate the transmission, adaptation, and utilization of knowledge from science, engineering, and mathematical disciplines;
- attract talented youth to careers in those fields and prepare them for sustained creative endeavor; and
- provide students of every age, whether or not scientifically inclined, such background in the disciplines as will sustain their understanding and use of science and mathematics.

Table 1
NSF Education Budget : FY 1991-92

Education Level	FY 1992 (in millions)	FY 1991-92 Change (Percent)
Total	$456.1	22.7%
Precollege *	$253.1	19.0%
Teachers	$ 97.3	3.8%
Curriculum	$ 72.8	21.0%
Org. Reform	$ 47.6	48.5%
Student Incentives	$ 11.0	22.2%
Eval./Assessment	$ 11.0	22.2%
Undergraduate *	$132.3	31.1%
Faculty	$ 27.6	29.3%
Curriculum	$ 63.7	19.2%
Org. Reform	$ 15.0	203.0%
Student Incentives	$ 24.8	24.9%
Graduate *	$ 70.7	21.8%
Fellowships	$ 61.4	21.9%
Traineeships	$ 8.4	11.9%

* Includes "other" programs

Each year, the Foundation submits an updated five-year strategic plan for science and engineering education to the Congress. Since 1987, that plan has followed a composite strategy for education programming that simultaneously addresses short-term objectives and long-term goals. Short-term objectives refer to **incremental improvements** in the educational system that benefit students currently in the pipeline (e.g., enhancements in course material, provision of inservice teacher training, cost-sharing of instructional instrumentation); long-term goals refer to **fundamental changes** that promise to alter the basic delivery of education for both current and future

HIGHLIGHT Faculty enhancement activities will promote regional coalitions of 2-year and 4-year institutions to invigorate 2-year faculty and ease student transfer from 2-year to upper division institutions.

students (e.g., adoption of advanced technologies; research in teaching and learning processes, reform of preservice teacher education; and systemic changes in education-related policies and programs).

The Foundation is committed to assisting the President and the Nation's Governors in achieving the ambitious education goals adopted in February 1990. If, however, competency of U.S. students and international leadership in science and mathematics are to become reality by the end of the century, a number of long-delayed problems in the educational system must be redressed. To that end, NSF will identify strategic areas of the system that will benefit from experimentation, facilitate change, and assist in the implementation of programs. The agency's strategy calls for a controlled flexibility that permits changes in emphasis to meet emerging needs; for continuous investment and commitment to successful and developing programs, and for the stimulation and coordination of resources from other sectors to improve the quality and effectiveness of education nationwide.

STRUCTURE OF EDUCATION PROGRAMS WITHIN NSF

The Directorate for Education and Human Resources (EHR) is the primary focus for education programs within the National Science Foundation and is funded by Congress through separate appropriation. All NSF research-related directorates, however, actively participate in education activities as they relate to the specific needs of their disciplines. Education activities of these directorates are funded under the agency's research accounts and are coordinated through the EHR Directorate.

The EHR Directorate, which constitutes the majority of the NSF education budget, is comprised of six organizational units having the following responsibilities:

- **Division of Teacher Preparation and Enhancement** improves the teaching and learning of science and mathematics in elementary, middle, and high schools: facilitates partnerships between the public and private sectors; catalyzes statewide systemic reform; and manages the Presidential Awards Program for Excellence in Elementary and Secondary Science and Mathematics Teaching.

- **Division of Materials Development, Research, and Informal Science** expands understanding of effective teaching and learning in science and mathematics; stimulates development and use of exemplary, state-of-the-art model curricula and materials; encourages informal learning in out-of-school settings; analyzes the potential for and explores uses of advanced technologies; and stimulates the development of contemporary assessment strategies and instruments for performance in precollege science and mathematics education.

- **Division of Undergraduate Science, Engineering, and Mathematics Education** supports course and curriculum development, faculty enhancement, and instrumentation and laboratory improvement programs; and encourages involvement of academic scientists, institutions. States, the private sector, and other Federal agencies in undergraduate education.

- **Division of Research Career Development** promotes career development of young scientists and engineers in order to assure a

HIGHLIGHT In January 1993, NSF will release the first in a series of Congressionally mandated reports that will track progress toward achieving education goals for kindergarten through undergraduate education.

steady flow of talented science and engineering students (secondary level through postdoctoral training) through the education and research training systems of the Nation. Students from all sectors and regions are represented in the programs of this division.

- **Division of Human Resource Development** (formerly the Division of Research Initiation and Improvement) fosters comprehensive approaches for addressing the development of scientific and engineering talent, especially of underrepresented groups and faculty in predominantly undergraduate institutions.

- **Office of Studies, Evaluation, and Dissemination** (formerly the Office of Studies and Program Assessment) provides data collection, analysis, program evaluation, program dissemination and policy support for the EHR-related activities of the Foundation.

The Foundation's education activities are coordinated and receive guidance from a number of sources. The Assistant Director (AD) for EHR receives policy and programmatic advice from the NSF Director, the National Science Board, and an external Advisory Committee for Education and Human Resources composed of experts from various sectors of the science and engineering education community.

Since education activities are conducted throughout the Foundation, their coordination and interface with the EHR Directorate is effected through the EHR Policy Committee. Chaired by AD/EHR, this Committee is composed of Assistant Directors from all NSF research directorates. Below the Directorate level, overall guidance on the design and effectiveness of programs is elicited from divisional advisory committees, when appropriate. Moreover, every three years, each major NSF program undergoes a technical and administrative management review by a Committee of Visitors—a panel of experts appointed by the relevant AD.

AGENCY PRIORITIES

In order to achieve its wide-reaching education goals, NSF focuses on critical points along the education pipeline. The agency continues to place major emphasis on precollege science and mathematics, with the objectives of attracting and sustaining the interest of students in these fields, as well as improving the quality of their instruction. Virtually all precollege program efforts are complementary and synergistic. NSF is actively involved in the support of national reform efforts in science and mathematics curricula that emphasize comprehensive, integrated approaches to teaching throughout elementary, middle and high school years. Critical to the long-term effectiveness of these programs is the development of instructional materials, identification of factors that affect success in teaching and learning; forward-looking advanced educational technologies, enhanced teacher skills, and student assessment techniques.

At the undergraduate level, NSF is expanding newly established approaches to calculus and engineering curricula to all fields of science, with strong emphasis on neglected introductory-level courses and increased involvement of faculty members. Simultaneous with the expansion of curriculum efforts, improvements in instrumentation and laboratory equipment will be supported to enhance the quality of laboratory instruction through development of experiments and courses using contemporary equipment and techniques.

HIGHLIGHT Large-scale programs—Statewide Systematic Initiative (SSI) and Alliances for Minority Participation (AMP)—will increasingly link NSF with the entire science and engineering community to catalyze comprehensive change in the delivery of education.

At the University of Illinois students explore ways of learning calculus through interactive computer software. Computers individualize instruction by allowing students to master material at their own speed. Undergraduate curriculum projects at NSF integrate changes in course content and teaching methods with innovative applications of new technologies.

Recognizing that no one player can effectively address the educational challenges ahead, NSF has designed programs to enlist active involvement and collaboration of the education community. This class of programs is designed to generate fundamental, permanent changes in the education system; to challenge the community to devise innovative approaches to achieving such changes; and to leverage limited Federal resources. Two such complementary programs, Career Access Opportunities for Women, Minorities, and the Disabled in Science and Engineering (ACCESS) and Alliances for Minority Participation (AMP) (focused on precollege and undergraduate education levels, respectively) support development of regional alliances of K-12 school districts, higher education institutions, and local industries to increase representation of minorities among science and engineering degree recipients. A third program, Statewide Systemic Initiative (SSI), seeks collaboration of State executive, legislative, education, business and public leadership for making comprehensive changes in State education systems to support reform in the delivery of precollege education.

The magnitude of the education problem, as well as the developing maturity of NSF programs, make increased program evaluation and dissemination activities critical. Large-scale programs such as ACCESS, AMP, and SSI will have built-in evaluation components to ensure accountability and continued support of only the most successful approaches. Increased dissemination of model projects across all NSF programs will further ensure maximum benefit to Federal resources and accelerate the pace at which the Nation's education goals can be attained.

INTERAGENCY COOPERATION

NSF regularly interacts with other agencies in support of education activities that are of mutual interest. Such collaborations take the form of co-funding projects that (1) duplicate or tax the resources of any one agency (i.e., major curriculum reform activities with Department of Education (ED) or support for the Chicago Academy for Mathematics and Science Teachers with the Department of Energy and other Federal agencies); (2) capitalize on the relative strength of various agencies (i.e., support for teachers and faculty to gain research experiences at mission agency laboratories); or (3) encourage the effective use of Federal resources in support of a common goal (i.e., use of ED Eisenhower Funds in support of the NSF Statewide Systemic Initiative Program).

HIGHLIGHT Through NSFNET, NSF will electronically link education practitioners and researchers throughout the United States to ensure dialogue and dissemination of successful projects.

NEW INITIATIVES

Precollege

The **Statewide Systemic Initiatives Program** is designed to catalyze comprehensive, coordinated changes in State education systems for improving science, engineering, mathematics and technology education (precollege and undergraduate). With collaboration of executive, legislative, education, business and public leaders, these highly competitive projects seek to foster adoption of more effective curricula; better instructional materials; new educational technologies; appropriate assessment procedures; new methods and standards for the preparation and continued development of teachers; and methods to increase student achievement and citizen understanding in science-related issues. Awards of three-year duration will be made, with an average annual grant size of $1.7 million. First awards will be made in 1991; at full implementation, it is anticipated that 25 to 30 projects will be funded. The Department of Education has agreed to use Eisenhower Act science and mathematics funds in support of this program.
(Precollege, Comprehensive—$31 million)

Undergraduate

The **Alliances for Minority Participation (AMP) Program** is designed to yield fundamental changes to remedy the underrepresentation of minorities in science and engineering. Focused at the undergraduate level, AMP promotes the creation of regionally-based alliances of K-12 school districts, two-year and four-year colleges, universities, local business and industries. The program encourages innovative strategies (1) to enhance the quality of science and engineering instruction; (2) to promote the attraction and retention of minority students to science and engineering undergraduate majors; and (3) to assist ultimately in achieving a steady production of minority science and engineering baccalaureate and graduate-degree recipients at several-fold the current low rate. In addition, projects must facilitate minority participation in at least one critical transition point along the science and engineering education pipeline, i.e., high school-to-college, two-year to four-year college; undergraduate-to-graduate study, and graduate study-to-faculty careers. Annual awards of up to $1 million will be given over a five-year period. Each project will require a one-to-one leverage of NSF funds.
(Undergraduate, Comprehensive—$10 million)

ONGOING PROGRAMS

Precollege Programs

The **Teacher Enhancement Program** supports model projects that provide inservice professional development experiences (e.g., courses, research participation, structured leaves-of-absence) to improve the subject knowledge and classroom practices of science and mathematics teachers. Projects may support individuals or collaborative efforts with school districts, community colleges, universities, and other organizations to identify potential regional and national leaders who not only train colleagues, but also participate in research in teaching and learning and curriculum development activities. In FY 1992, the program will reach 20,000 teachers. Through interaction with colleagues, a total impact of 200,000 teachers is anticipated.
(Precollege, Teacher Enhancement—$83 million)

HIGHLIGHT In FY 1992, the Young Scholars Program will encourage 7,000 talented students in grades 7-12 to continue study in the sciences and mathematics. A new initiative will ease the high school-to college transition.

The **Teacher Preparation Program** supports model projects in the preservice education of future science and mathematics teachers, as well as their educators. These projects address inadequacies in the content and pedagogical techniques offered in existing teacher education programs. The program supports development and use of new courses and instructional materials, and emphasizes laboratory-based introductory science courses, integrated science-education courses, and methods courses for teaching at elementary and secondary school levels. In FY 1992, the program will reach 1,200 teachers.
(Precollege, Teacher Preparation—$14 million)

The **Instructional Materials Development Program** supports development of materials that both promote the science and mathematics literacy of students at all grade levels and build a sound background for disciplinary learning in both high school and college. The varied projects range from those dealing with a few modules at a single grade level to those that prepare model curricula covering as many as six school years. Many of the curriculum projects are linked to elementary and secondary teacher preparation and enhancement, as well as to increased use of educational technologies and curricula dissemination projects. Products of this program affect over 16,000 school districts.
(Precollege, Curriclum—$41 million)

The **Informal Science Education Program** utilizes a broad range of media (e.g., broadcasing, museums, science clubs and other community-centered activities) to assure a balanced and rich environment that encourages informal learning. All aspects of this program are designed to stimulate and maintain self-confident interest in science, mathematics and technology. New program areas target urban children and sponsor activities in youth-serving organizations. The total informal education program, especially educational television programs, reaches about 3 million children.
(Precollege, Curriculum—$25 million)

A family at the Boston Children's Museum discovers the physical principles of thin films that underlie the unique character of such diverse phenomenon as soap bubbles, biological membranes, and thin-film optical communications. NSF-sponsored museum programs contribute to an understanding of science and technology; supplement traditional school programs; and support valuable patterns of museum cooperation.

The **Applications of Advanced Technologies Program** supports research, development and demonstrations of state-of-the-art computer and telecommunications technologies in education. The program seeks to lay the research and conceptual foundation for technologies that will be available in five to ten years. An FY 1992 initiative, Curriculum and Technology Implementation will speed transfer of new theories and concepts from scientists to educators and the education research commu-

nity; provide curriculum developers and teachers the tools for applying new materials; and speed dissemination of materials to schools. **(Precollege, Curriculum—$8 million)**

The **Research in Teaching and Learning Program** supports expansion of basic knowledge about the processes of teaching and learning science, mathematics and technology, and about the factors that affect success in these fields. A significant dissemination focus is included. A new initiative focuses on promoting more effective, informed teaching practices and curriculum reform through involvement of classroom teachers in the research process. **(Precollege/Undergraduate, Curriculum—$8 million)**

Studies, Evaluation and Dissemination Program has responsibility for (1) data collection and analysis of data on science and engineering education issues and the conduct of education policy studies, analyses, and development; (2) implementation of evaluation projects to determine the effectiveness and value of NSF programs; and (3) dissemination of state-of-the art analyses and materials tailored to meet the specific needs of various segments of the education community. Projects will provide useful information to non-NSF programs implemented in schools, colleges, universities and government at all levels. Collaborative projects will be undertaken with other NSF units and with other Federal or State agencies, private foundations, and higher education institutions, as appropriate. **(Evaluation and Assessment—$11 million)**

The **Career Access Opportunities in Science and Technology for Women, Minorities and the Disabled (ACCESS) Program** combines two approaches for increasing the representation of women, minorities and the disabled in science and technology. Comprehensive Centers are systemic projects in regions of high minority population. The Centers require partnerships among school systems, higher education institutions, State and local governments, professional organizations, community groups and industry; one-to-one leveraging of NSF funds; and bridging across education levels. Full centers are given five-year funding commitments of up to $1 million per year; a limited number of smaller, prototype centers are also funded. The complementary Model Projects support innovative and experimental instructional and outreach activities with high potential for dissemination and extended impact. Projects addressing issues related to underrepresentation are encouraged. **(Precollege/Undergraduate, Comprehensive—$15 million)**

Edward James Olmos portrays Jaime Escalante, and unconventional high school teacher with a radical approach to combating student apathy, in the motion picture "Stand and Deliver." An NSF grant helped to bring this real-life incident to motion pictures.

The **Science and Mathematics Education Networks Program** supports collaborations among groups (local, regional, State and national) to share information, resources and talent in service of a general or specific eductional objectives—often, the improvement of some aspect of the delivery of an education service. Networking projects improve the dissemination of exemplary models, instructional materials, assessment information and research findings—especially the output of successful projects supported by the Foundation.
(Precollege, Comprehensive—$4 million)

The **Private Sector Partnerships Program** is intended to promote commitment and use of the intellectual capital of business and industry to address the needs of K-12 education in partnership with large urban schools, school districts and regional consortia. Projects will increasingly emphasize active involvement of scientists and engineers from business and industry **(Precollege, Comprehensive—$3 million)**

The **Young Scholars Program** provides support for talented secondary school students (especially from underrepresented groups) to stimulate their interest in mathematics, science and engineering and to help them maintain options to pursue related careers. Most projects are carried out at universities and colleges; in some cases, NSF-funded Science and Technology Centers, Engineering Research Centers, and Astronomical Observatories serve as research training sites. In FY 1992, the program is expected to reach 7,000 students.
(Precollege, Student Support/Incentives—$11 million)

The **Presidential Awards for Excellence in Science and Mathematics Teaching Program** demonstrates the importance of good teaching through the recognition and reward of exemplary science and mathematics teachers at the elementary, middle and high school levels. Awards are made in each State and U.S. territory. Each awardee is provided modest resources and becomes part of a national network of excellent teachers.
(Precollege, Other, Recognition—$4 million)

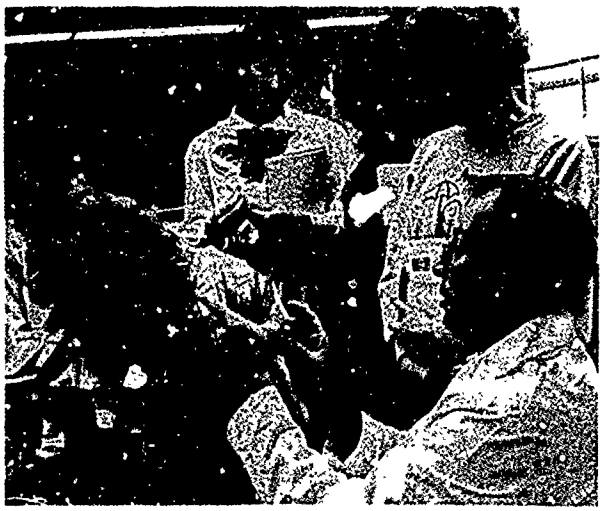
Undergraduate Programs

The **Faculty Enhancement Program** seeks to improve the disciplinary capabilities and teaching skills of faculty members who are primarily involved in undergraduate teaching. Grants are made to conduct regional or national seminars, short courses, workshops or similar activities for groups of faculty members. Of particular concern are growing areas of the curriculum, such as technology. As such, the program complements Laboratory Instrumentation efforts, especially at two-year institutions. A key component of the program is the development of partnerships between two-year colleges and at least one four-year college or university in a region.
(Undergraduate, Faculty Enhancement—$6 million)

The **Research in Undergraduate Institutions Program** is designed to enhance the scientific and technical training of students in undergraduate institutions. The program supports high-quality research by faculty with active involvement of undergraduate students; strengthens the research environment in academic departments that are oriented primarily toward undergraduate instruction;

and promotes integration of research and education at predominantly undergraduate institutions. Grants provide support for both research and instrumentation in non-doctorate granting departments.
(Undergraduate, Faculty Enhancement—$19 million)

The **Instrumentation and Laboratory Improvement (ILI) Program** seeks to improve the quality of undergraduate laboratory instruction for both majors and non-majors. Supported projects (1) enhance the quality of laboratory work through development of experiments and courses that use modern instrumentation and advanced technologies, and (2) design and test new approaches that are cost effective, powerfully stimulative of learning, and reflect actual science and engineering practice. The projects serve as models for laboratories in various single



Northeast Missouri State University strengthened its biology curriculum and laboratory facilities with support from the NSF Instructional Laboratory Improvement Program. Above, students join their professor in exploring techniques to determine the chemical composition of fungi which play a critical role in the decomposition of organic matter and its subsequent recycling.

disciplines and inter-disciplinary areas; dissemination of products through manuals, software, journal articles and presentations is encouraged. A new program component includes comprehensive projects undertaken by groups of institutions to revise entire laboratory sequences. The program is highly leveraged.
(Undergraduate, Curriculum—$23 million)

The **Curriculum/Materials Development Program** focuses on the critically important and neglected introductory-level courses in science, engineering and mathematics to make them more attractive and effective for potential majors, technical non-majors, non-science majors (literacy), and especially future K-12 teachers. The **Calculus** component fosters improvement in the quality of calculus instruction on a national scale through development of teaching strategies; problem solving activities; utilization of computer systems; application of calculus to other fields of science; and research in teaching and learning. **Engineering Education Coalitions** support coalitions of U.S. institutions to develop major new curricular structures and delivery systems in engineering education. Special emphasis is placed on women, minorities and the disabled. More broadly based **Engineering, Mathematics, and Sciences** projects support focused and comprehensive efforts to improve curricula, course material, teaching methods and teaching technologies. In all components, incentives are provided to involve faculty in curriculum reform. This program is highly leveraged. **(Undergraduate, Curriculum—$39 million)**

The **Research Experience for Undergraduates Program** provides opportunities to undergraduate students to participate in active,mean-

ingful science, mathematics and engineering research experiences. Two categories of awards are supported: Supplemental Grants to ongoing NSF research grants for small numbers of undergraduates and Site Grants, made on the basis of independent proposals (single or multidisciplinary) to initiate and conduct specially designed undergraduate research projects. The program goal is to support 4,000 students annually. **(Undergraduate, Student Support—$20 million)**

The **Research Careers for Minority Scholars Program** is designed to increase the number and quality of minority students pursuing science and engineering careers, particularly at the Ph.D. level. Grants awarded to colleges and universities are intended to stimulate departmental and institutional approaches for enhancing the academic environment for talented minority undergraduate and graduate students. The highly-leveraged program is modeled after the successful Department of Health and Human Services Minority Access to Research Careers (MARC) Program. Grants cover direct student participant costs, stipends, tuition, laboratory fees, conference travel and student research participation costs. **(Undergraduate, Student Support/Faculty Enhancement—$7 million)**

Graduate Programs

The **Graduate Fellowships and Minority Graduate Fellowship Programs** provide students an opportunity to work toward masters and doctoral degrees in the fields of mathematics, physics, biology, engineering, social science and the history and philosophy of science. Awards are also made toward a research- based Ph.D. in science education.

Fellowships are awarded for three years and are to be used over a maximum five-year period. In FY 1990, a new Women in Engineering component (of 80 awards) was added to address a serious deficiency in female participation in this field. The program is at a steady-state level of nearly 1,100 awards. **(Graduate, Predoctoral Fellowships—$50 million)**

The **Biological, Behavioral, and Social Sciences (BBS) Postdoctorate Program** supports postdoctoral research fellowships to individuals wishing to pursue innovative and creative research in selected biological and behavior science fields. An initiative across all NSF supported biological and behavioral science fields has been developed to prepare exceptionally trained minority scientists to assume positions of scientific leadership in academia. **(Graduate, Postdoctoral Fellowships — $4 million)**

NATIONAL SCIENCE FOUNDATION
1800 'G' STREET, N.W.,
WASHINGTON, D.C. 20550

PROGRAM CONTACTS DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES:

Division of Teacher Preparation and Enhancement
Dr. Charles Puglia
(202) 357-7073
- Teacher Preparation Program
- Teacher Enhancement Program
- Science and Mathematics Education Networks Program
- Presidential Awards for Excellence

in Science and Mathematics Teaching Program
— Statewide Systemic Initiatives

Division of Materials Development, Research, and Informal Science Education
Dr. Joan Leitzel
(202) 357-7452
— Instructional Materials Development Program
— Research in Teaching and Learning Program
— Informal Science Education Program
— Applications of Advanced Technologies Program

Division of Undergraduate Science, Engineering, and Mathematics Education
Dr. Robert Watson
(202) 357-9644
— Instrumentation and Laboratory Improvement (ILI) Program
— Faculty Enhancement Program
— Curriculum and Materials Development Program
— Research Experiences for Undergraduates

Division of Research Career Development
Dr. Terence Porter
(202) 357-7536
— Young Scholars Program
— Graduate Fellowships
— Graduate Traineeships

Division of Human Resource Development
Dr. Joseph Danek
(202) 357-7552
— Career Access Opportunities in Science and Technology for Women, Minorities, and the Disabled (ACCESS) Program
— Alliances for Minority Participation Program
— Research Careers for Minority Scholars Program
— Research in Undergraduate Institutions Program

Office of Studies, Evaluation, and Dissemination
Dr. Kenneth Travers
(202) 357-7425

DIRECTORATE FOR BIOLOGICAL, BEHAVIORAL, AND SOCIAL SCIENCES (BBS):

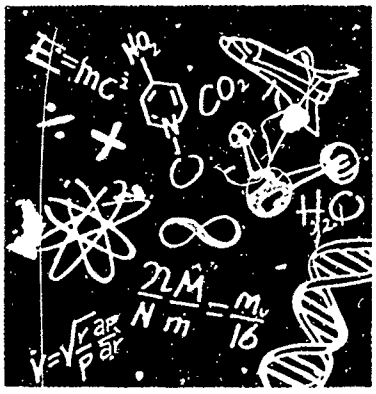
Office of the Assistant Director
(202) 357-9854
— BBS Postdoctorate Program

DIRECTORATE FOR ENGINEERING:

Division of Engineering Infrastructure Development
Dr. Wilbur Meier
(202) 357-9631
— Engineering Coalitions Program

"We hear a lot these days about literacy, but we should recognize that it is a moving target. Cultural literacy without a significant and growing component of scientific and technological literacy is, for our era, as unimaginable as our civilization is without its scientific and technological aspirations and underpinnings."

Robert McC. Adams
Secretary of the Smithsonian



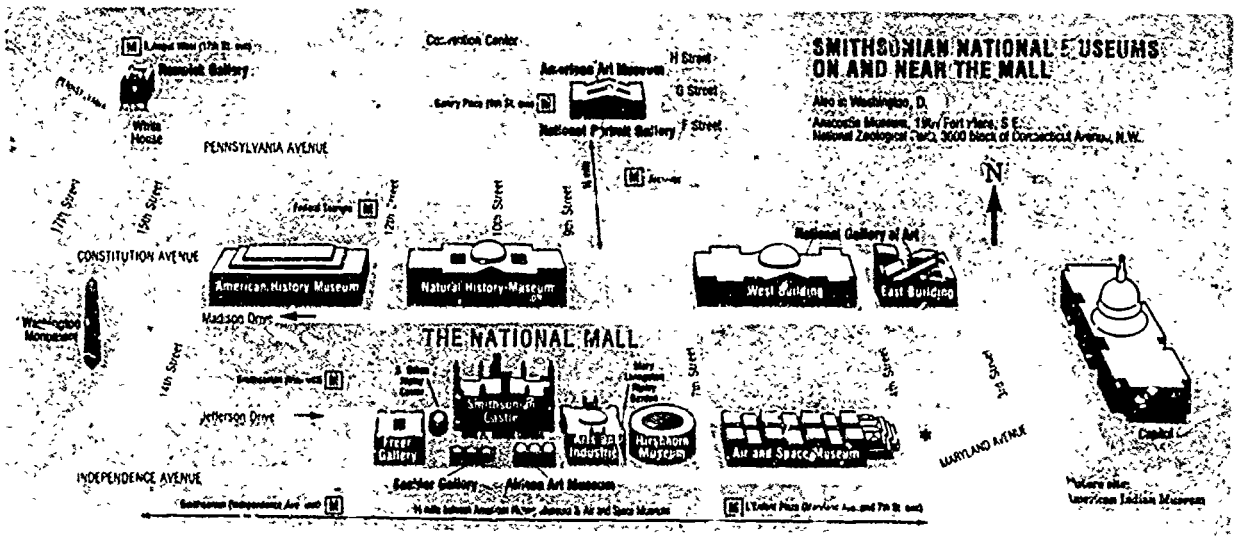
INTRODUCTION

As part of its mandate "to increase and diffuse knowledge," the Smithsonian Institution considers science education to be one of its most important missions. Best known for its 13 museums and the National Zoo, the Smithsonian also functions as one of the country's premier research facilities. To the task of educating its vast public, the Institution, then, brings its own practical work in science.

The Smithsonian Institution was founded in 1846. It is a trust instrumentality of the Federal Government, established, as mentioned, "for the increase and diffusion of knowledge." While it receives support for its operation from the Federal Government, it has no government or regulatory functions and serves, in effect, as an independent agency.

This chapter summarizes primarily the Institution's Federally-funded science education programs, using the Smithsonian's administrative divisions to structure the materials.

In addition to the Federally-funded programs described in the following pages, the Institution also has many activities in science education that are funded privately. For example, at least one-third of the articles and essays appearing in Smithsonian Magazine (circulation 2.3 million) deal with science and technology, and a second magazine, Air and Space (circulation 316,000) devotes each issue to science and technology matters. In addition, SITES, the Smithsonian Institution Traveling Exhibition Service, circulates science exhibitions on a range of topics to museums across the country, and many of these shows, such as an interactive exhibit "Volcanoes" (developed jointly with the National Museum of



Approximate Walking Times Between Smithsonian Museums On and Near the Mall

10 minutes	Smithsonian Castle to National Gallery of Art (West Building)
8 minutes	National Gallery of Art (Constitution Ave.) to Natural History Museum
5 minutes	Natural History Museum (Constitution Ave.) to American History Museum (Constitution Ave.)
6 minutes	American History Museum (Mall) to Smithsonian Castle
1 minute	Sackler Gallery to African Art Museum
4 minutes	Natural History Museum (Mall) to Smithsonian Castle
2 minutes	African Art Museum to Arts and Industries Building
3 minutes	Arts and Industries Building to Hirshhorn Museum and Sculpture Garden
5 minutes	Hirshhorn Museum and Sculpture Garden to Air and Space Museum
17 minutes	Air and Space Museum to American History Museum
13 minutes	Natural History Museum to American Art Museum/National Portrait Gallery

Also note on the Mall map, the Metrorail station(s) [M] convenient to the museum(s) you wish to visit.

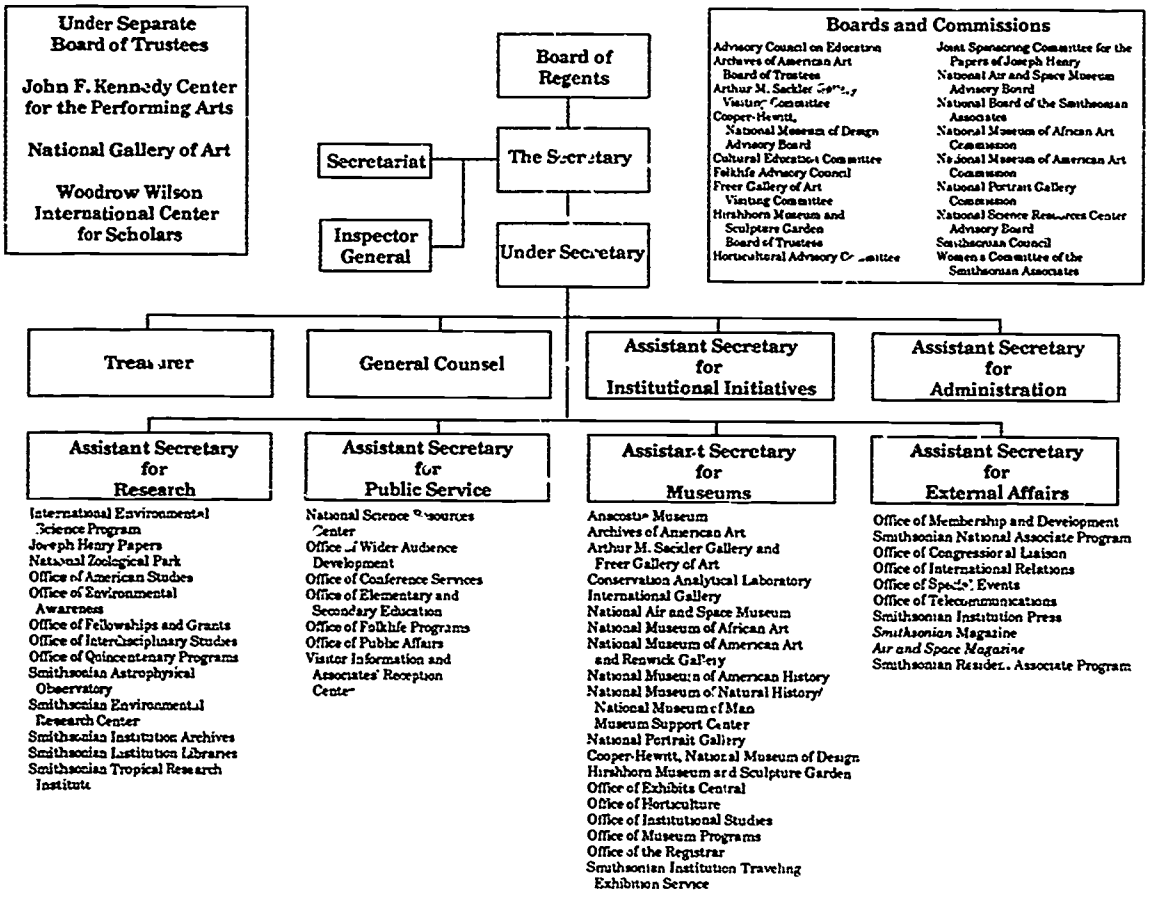


Table of Organization - Smithsonian Institution

Natural History) are accompanied by packets of materials for schools. The National Museum of American History, for its part, has privately-supported exhibitions with major education components on the history of science and technology. One example is "Science in American Life," scheduled to open in 1993. This show will help demystify science not only for museum visitors but for teachers and students across the country, through an extensive outreach program that will include demonstration kits, printed materials, teacher workshops, and satellite networking. Further, a range of programs, sponsored by the Smithsonian's National and Resident Associates programs, are designed to increase science literacy among Smithsonian members and the general public.

HISTORY

In recent years, the Institution has begun to focus increasing effort on assisting school systems in addressing the national crisis in science and math education. Three areas receiving particular attention both in the museums and in other Smithsonian bureaus have been professional edu-

cation for teachers; curriculum materials for schools; and programs to effect attitudinal changes about science.

Smithsonian Institution Science Education Programs

National Science Resources Center (NSRC) (Education Base Budget: $260,000)

The National Science Resources Center is a joint undertaking of the Smithsonian Institution and the National Academy of Sciences to improve the quality of science and mathematics teaching in the Nation's schools. NSRC identifies, develops and disseminates science and mathematics teaching materials that are imaginative, classroom tested, and scientifically up-to-date. The Center also organizes leadership development institutes for science teachers and other school system personnel. These institutes encourage the sharing of resources and help build a talent pool to staff local program improvement efforts. NSRC programs stress the involvement and collaboration of teachers and scientists and place special emphasis on increasing the numbers of under-represented minorities and women engaged in the study of science.

To increase the scientific and technological literacy of young children, NSRC has undertaken several projects to improve the teaching of science in the Nation's elementary schools. School systems and other organizations that are initiating these projects use NSRC's elementary science resource collection and computer information data base, which include bibliographic information and brief annotations about the materials in the resource collection. NSRC's *Science for Children: Resources for Teachers*, developed from the data base, includes information about the materials in the elementary science resource collection and a directory of science museums and other organizations that provide hands-on science kits and assistance to elementary school teachers.

D.C. Public Schools sixth graders Eric Brevard, Patrick Stefas, and Renee Strong work as a team to conduct and experiment from the Experimenting with Plants science education unit of the Science and Technology for Children (STC) project. STC, the elementary science curriculum project of the National Science Resources Center, is developing for nationwide distribution a set of 24 modular units that emphasize student investigation in age-appropriate topics in the life, physical, and earth sciences and technology.

"Science and Technology for Children" (STC) is a four-year NSRC elementary science curriculum project that is developing curriculum units for grades 1-6 in the areas of physical science, life science, earth science and technology. STC units are simple, inexpensive materials designed to teach science and link science to the broader elementary school curriculum of mathematics, reading, writing, art and social studies. Teachers across the country field-test the STC units to refine and validate them.

NSRC is developing a network of teachers, scientists, science educators and school administrators who are working to improve the teaching of elementary school science. NSRC also sponsors leadership development institutes to prepare selected teachers, science supervisors, school system administrators and scientists to organize hands-on elementary science programs in their school districts. These institutes help school systems design effective in-service education programs, establish science materials support systems, and develop the community support needed to reform their science programs.

In FY 1992, the NSRC plans to expand its Clearinghouse for Science Teaching Resources Program to include resources for middle schools as well as elementary schools. This expansion will enable the Clearinghouse to provide teachers and science educators across the country with up-to-date information about high quality resources for teaching elementary and middle school science.

The expanded Clearinghouse will include a resource collection, housed in NSRC's facilities in the Arts and Industries Building, and a computer information data base. The Clearinghouse will disseminate information to teachers and science educators through published resource guides and a computer telecommunications network.

Office of Elementary and Secondary Education (Education Base Budget: $399,000)

The Office of Elementary and Secondary Education (OESE) serves as the focal point for formulating pan-Institutional policies and goals for education. In addition, the office develops and disseminates programming that applies resources from across the Institution to the needs of elementary and secondary schools both locally and nationally. Publications, professional training for teachers, and internships for students are among the programs offered in a range of disciplinary areas, including the natural and the physical sciences.

For example, Art to Zoo, a quarterly journal for teachers, reaches approximately 90,000 educators (and more than 2 million students) in more than 20,000 schools. Encouraging experiential, hands-on learning, recent issues have explored such topics as "insect adaptations" and "how mirrors reflect." Also for educators across the country, OESE's Regional Workshop Program, now in its eighth year, works with local communities to serve as a catalyst for strengthening relations between museums and schools. Dozens of zoos, nature centers and science museums have taken part in this program over the years.

The national summer high school internship program—conducted by the Smithsonian's Office of Elementary and Secondary Education—enables students to learn about academic disciplines by working in them. Approximately 15 positions each summer are in the sciences. Here intern Sarbori Bhattacharya examines an artifact from the Division of Medical Sciences, National Museum of Natural History.

Internships for high school students are another staple of OESE programming. Each summer 40 students from across the country participate in this competitive five-week program. The students are placed in Smithsonian curatorial divisions and other offices to work on research projects in their fields of interest. Approximately half of these placements are in the sciences. In addition, during the summer of 1990, OESE piloted an eight-week internship program designed to meet the specific academic and economic needs of District of Columbia Public School students.

For D.C. area teachers, the office offers professional training through seminars, workshops, and a diverse menu of accredited summer courses. In addition, the OESE recently inaugurated a program with the Foxfire Foundation and two D.C. public elementary schools in which the schools, Foxfire and OESE are collaborating to develop ways that resources from across the Institution can be used to improve the quality of education in the arts, the humanities and the sciences.

Smithsonian Astrophysical Observatory (SAO) (Education Base Budget: $69,000)

The Smithsonian Astrophysical Observatory (SAO) conducts research in astronomy and astrophysics to increase knowledge and understanding of the universe, its origin and its contents, and to communicate this information through publications, teaching and public presentations. SAO research has a major impact in the worldwide scientific community and has helped the United States maintain world leadership in astrophysical research. SAO coordinates its varied scientific program with the Harvard College Observatory, and together the two observatories form the Center for Astrophysics in Cambridge, Massachusetts. In addition, SAO operates the Oak Ridge Observatory in Massachusetts and the Fred Lawrence Whipple Observatory in Arizona.

Perhaps because of its close association with a major university, SAO has always had a deep commitment to education. Even before national concerns about the lack of "science literacy" among young Americans were widespread, SAO began developing a program to use examples based on astronomy to improve the teaching of science and mathematics at the high school level. These materials emphasize low-cost student activities based on "high-tech" demonstrations and devices, such as a hand-held spectrograph, that allow students to understand the physics of light.

SAO now plans to develop similar classroom materials for use at lower grade levels and to train elementary and junior high teachers in their use. Video presentations will be vital components of this training program, particularly in assisting graduates of SAO workshops to organize instruction sessions for other teachers in their home regions.

Smithsonian Tropical Research Institute (STRI) (Education Base Budget: $100,000)

The Smithsonian Tropical Research Institute (STRI) is the Nation's premier center for basic research on the ecology, behavior and evolution of tropical organisms. Headquartered in Panama, STRI staff conduct scientific investigations throughout the New and Old World tropics. The terms of the Panama Canal Treaties of 1977 designate STRI as the custodian of the Barro Colorado Nature Monument, a 12,000-acre tropical nature preserve located in the Panama Canal.

in the insect Zoo (National Museum of Natural History), visitors learn first-hand about arthropods – in this case by examining a large millipede.

The preserve consists of Barro Colorado Island and five adjacent mainland peninsulas. Other STRI facilities include a cloud forest station, a research vessel, marine laboratories on the Atlantic and Pacific oceans, a research library, and a modern laboratory and conference center and administrative headquarters in Panama City.

One of STRI's major efforts centers on the development of young scientists. In 1990, approximately 62 students from 12 nations participated in academic programs at STRI. With the opening of the new Earl S. Tupper Research and Conference Center in late 1989, the staff also prepared a bilingual photographic exhibit entitled "Parting the Green Curtain," which highlights the history of tropical biology. This exhibit will tour Latin American science museums and university centers as part of STRI's effort to focus public attention on issues important to biology, conservation, and global change.

Smithsonian Environmental Research Center (SERC)

The Smithsonian Environmental Research Center (SERC), occupying 2,600 acres of the Rhode River tidal river system in Edgewater, Maryland, per-forms basic scientific research on coastal land/water systems. SERC is part of a network of United States and international sites, conducting ecological research relevant to their geographic regions. SERC provides a broad range of educational activities, including teacher-led field trips, self-guided nature trails and guided tours. Groups of students and the general public observe firsthand a variety of natural habitats. A work/learn intern program enat. stu- dents from all over the world to work with scientists and educational staff, both in the field and in the laboratory. Predoctoral, post-doctoral and sabbatical programs for professionals enable visitors to carry out collaborative or independent research. SERC disseminates the results of its research through scientific journals, national and international meetings and seminars, the training of scientists, and public education activities.

National Zoological Park (NZP)
(Education Base Budget: $560,000)

Since 1889, the primary mission of the National Zoological Park (NZP) has been "the advancement of science and the instruction and recreation of the people." The Zoo's living collection, open to the public, occupies 163 acres at Rock Creek Park in Washington, D.C. The Zoo also maintains the Conservation and Research Center, a major conservation, animal breeding and research facility on 3,150 acres in Front Royal, Virginia. Through programs in education, research, conservation and animal health, NZP serves the public and specialized audiences and

promotes understanding of animal adaptations and evolution and the interaction of wildlife with the environment. Because of world environmental crises and the need to keep people informed, the National Zoo endeavors to represent the whole of life on earth, both plant and animal. To this end the Zoo is transforming the animals-only zoological park into a biological park. This holistic approach will combine living exhibits of plants and animals with museum-type exhibits of skeletons and fossils. The BioPark will educate visitors and will stimulate a concern for the future of life in all its forms.

As the Zoo begins its second hundred years, it continues to inform and educate the large and diverse audience it serves through a wide range of creative programs, exhibits and materials. At the precollege level, the Zoo's education department offers guided programs and tours, self-guiding materials, outreach kits, films and learning lab sessions. Curriculum units for high school students are also available. Teacher workshops introduce school programs.

National Museum of Natural History/ Museum of Man (NMNH/MOM) (Education Base Budget: $654,000)

The National Museum of Natural History/Museum of Man (NMNH/MOM) houses the world's largest and most valuable assemblage of natural history specimens and human artifacts. It is the largest research organization in the Smithsonian complex. The Museum acquires, preserves, cares for and studies these collections, and makes them accessible to others. (Last year's attendance was 6.2 million visitors.) The Museum's scholars conduct research on living and fossil animals and plants, rocks, minerals and meteorites. These studies help us understand the evolutionary relationships of animals and plants living today and in earlier periods and shed light on the great physical changes that take place on this planet through time. Studies of human biology and culture enrich our knowledge of human cultural and biological adaption and the history and diversity of human evolution from the early stages to the present. Through its many exhibits, educational programs, and scholarly and popular publications, NMNH/MOM disseminates knowledge about the natural and cultural diversity of the world. Through outreach programs, the Museum is deeply involved in science education. Relying heavily on nearly 300 volunteer docents, the Museum's Office of Education develops programs and instructional materials for schools, Museum visitors and the general public. Among the special activities in 1990 was a forum on "Shaping a New Environmental Agenda," cosponsored by the Museum to mark the 20th anniversary of Earth Day. Distinguished speakers included Paul Ehrlich of Stanford University, John Holdren of the Resources Institute, and Thomas Lovejoy of the Smithsonian. Another special activity was the Natural Science Institute for Teachers of Minority Students, organized by the Museum and funded by the D.C. School System. Running for three weeks in July 1990, this science program for teachers of grades 4-12 featured activities aimed at learning how to "read" natural history objects.

National Air and Space Museum (NASM) (Education Base Budget: $511,000)

The National Air and Space Museum (NASM) is an international repository for artifacts and documentation related to the development of aviation, space flight and space science. Through its exhibitions, research, collections management and education programs, the Museum serves a

wide public and scholarly community interested in the history and technological achievements of aviation and space flight. (Last year's attendance was 8.2 million visitors.) In addition to its Mall location, NASM maintains a facility for the preservation, restoration and exhibition of artifacts at the Paul E. Garber Preservation, Restoration, and Storage Facility in Suitland, Maryland. NASM plans to build an extension facility at Dulles International Airport for storage and exhibition of its largest aircraft and spacecraft. Through on-site science demonstrations and development of curriculum materials in coordination with the D.C school system, the Museum is expanding its educational role to reach a broader audience with relevant, scientifically based information.

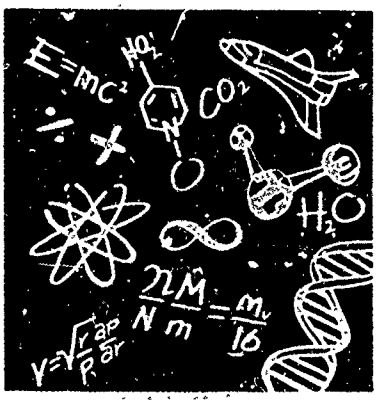
The Museum is currently performing a daily science demonstration in the "Looking at Earth" gallery. Expanding this popular and successful program to include additional demonstrations in various galleries around the Museum several times each day will dramatically increase the opportunity for visitors to participate in the program. In addition to other educational outreach programs, the Museum is proposing a Teacher-in-Residence program in coordination with the D.C. school system. By working with the local educational systems to develop curriculum materials and programs for teachers and students, the Museum will build stronger relationships with the community and encourage an early interest in science. Each year a different D.C. teacher will work in residence at the Museum to develop specific grade-related materials for hands-on use in the classroom and in conjunction with planned future visits to the Museum.

It is vital that the United States improve the scientific literacy of its citizenry. The Museum can assist by increasing the number of visitors participating in science demonstrations and developing curriculum materials relevant to the educational needs of the local community.

SMITHSONIAN INSTITUTION
Ann I. Bay
Director, Elementary and Secondary Education
The Smithsonian Institution
Arts & Industry Building, Room 1163
Washington, D.C. 20560

"The United States technical proficiency is one of our most precious national assets. Our Nation must maintain leadership in science and technology to maintain a competitive edge over other advanced industrial nations. By recognizing promising young scientists and mathematicians, the Goldwater Foundation have and will continue to provide a beneficial impact in retaining our leadership in these critical fields."

Howard W. Cannon
Chairman of the Board



The Barry Goldwater Scholarship and Excellence in Education Foundation was established as an independent agency within the Executive Branch by Public Law 99-661 on November 14, 1986. The Foundation was authorized by the United States Congress to honor Senator Barry M. Goldwater who served his country for 56 years as a soldier and statesman, including 30 years in the United States Senate.

The enabling legislation established an endowed recognition program in Senator Goldwater's name to foster and encourage excellence in science and mathematics. The Foundation is authorized to award undergraduate scholarships to eligible students for study in the fields of mathematics and the natural sciences as preparation for careers in these disciplines. The legislation, aimed at alleviating a critical current and future shortage of scientists and mathematicians in the United States, also authorized a future graduate fellowship program which the Trustees have not, as yet, decided to initiate.

The Foundation is supported by the Barry Goldwater Scholarship and Excellence in Education fund which has been established in the Treasury of the United States. Funding for awards and administrative expenses derives from interest on the trust fund, originally appropriated at $40 million and currently valued in excess of $50 million invested in U.S. Government securities. Investments are limited to Treasury bills, bonds and notes and portfolio purchases are made upon recommendation from investment consultants serving the Foundation on a pro bono basis.

The Foundation is subject to the supervision and direction of a Board of Trustees composed of 13 members as follows: (1) two members from the Senate appointed by the majority and minority leaders, (2) two members of the House of Representatives appointed by the majority and minority leaders, (3) eight members appointed by the President with the advice and consent of the Senate, and (4) the Secretary of Education or his designee.

The Foundation's first Trustees, nominated by President Reagan and confirmed by the Senate during 1987 and 1988 are:

Honorable Howard W. Cannon
Honorable Dean Burch
Honorable Barry Goldwater, Jr.
Mr. Sam E. Keith
Dr. Hans Mark
Mr. Thomas Pownall
Lt. Gen. William Quinn, USA (Ret.)
Honorable R. James Woolsey
Honorable Lauro Cavazos - Ex Officio

Appointed by the Majority and Minority Leaders of the House and Senate are:

Honorable John McCain
Honorable David O'B Martin
Honorable G.V. Sonny Montgomery
Honorable Sam Nunn

Currently, several vacancies in the Board of Trustees are awaiting appointment and/or confirmation.

The Foundation officially began operations on September 25, 1988 and the following officers were elected by the Board of Trustees:

Chairman - Honorable Howard W. Cannon
Vice Chairman - Honorable Dean Burch
Executive Secretary - Mr. Gerald J. Smith
General Counsel - Mr. Jeffrey H. Smith, Esq. - (Pro Bono)

GOLDWATER SCHOLARSHIP PROGRAM

The Foundation awards undergraduate scholarships on the basis of merit to college sophomores who have outstanding potential and intend to pursue careers in mathematics and the natural sciences.

To be considered, a student must be nominated by his or her college or university using the official nomination materials provided to each institution.

Each scholarship will cover eligible expenses for tuition, fees, books, room and board up to a maximum of $7,000 annually. Scholarship recipients are eligible for two years of support for a total of $14,000.

In awarding scholarships, the Foundation Board of Trustees considers the nominee's field of study, career objectives and the extent to which that individual has the commitment and potential to make a significant contribution to his or her field.

The Foundation, now in its third year of operation, has so far awarded a total of 255 scholarships worth more than $3 million.

These scholarships were chosen from a field of more than 1900 mathematics and science students nominated by the faculties of over 700 colleges and universities nationwide.

All have very impressive academic qualifications in a wide variety of scientific and mathematical disciplines and have indicated a high degree of motivation toward pursuing careers in those fields. Forty-two percent of those selected were female and 58% were male students. Approximately 65% are science majors, 20% are mathematics majors and 15% are double majors in math and science.

Many of the first graduates have received graduate study fellowships and one Goldwater Scholar has been selected as a Rhodes Scholar.

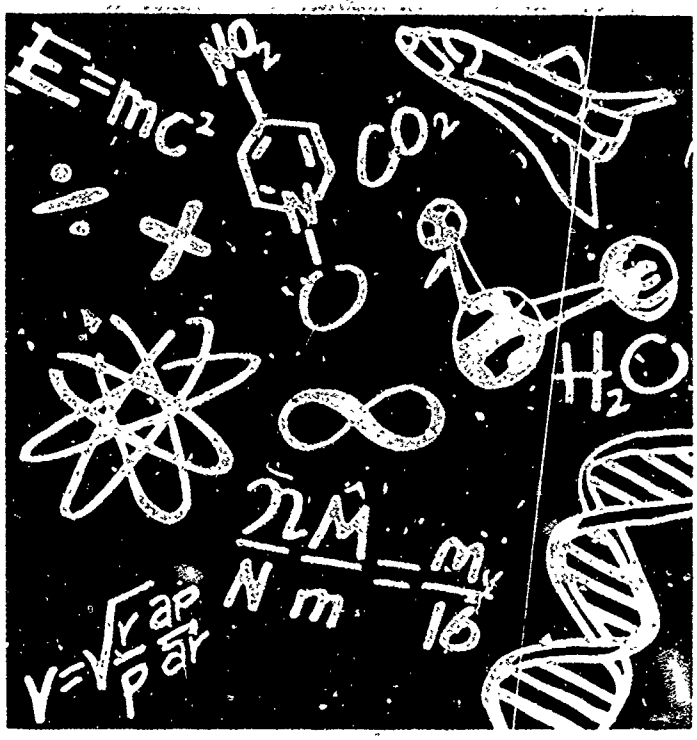
The Goldwater Trustees have decided to significantly expand the scholarship program beginning with the 1991/92 academic year to award up to 250 scholarships annually. More than 1300 colleges and universities nationwide have indicated a desire to participate in the 1991/92 program.

CONTACT

For further information, please contact:

Mr. Gerald J. Smith
Executive Secretary
Barry M. Goldwater Foundation
499 South Capitol Street, S.W.
Suite 405
Washington, D.C. 20003-4013
(202) 755-2312

BY THE YEAR 2000



APPENDIX

FY 1992

FY 1992 Matrix
FY 1991 Matrix
FY 1990 Matrix
FY 1990-1992 Comparison

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRAND TOTAL	1940.79	456.09	329.90	74.43	415.85	7.60	67.15	41.71	513.09	13.37	21.60
PRECOLLEGE: FORMAL & INFORMAL	660.62	253.05	313.80	21.65	4.97	0.55	14.10	21.96	21.77	8.07	0.70
Program Evaluation/Assessment	11.90	11.00	0.00	0.20	0.00	0.00	0.00	0.00	0.70	0.00	0.00
PRECOLLEGE: FORMAL TOTAL	528.79	199.37	313.80	0.00	0.002	0.27	0.99	1.75	10.80	1.61	0.20
Teacher Preparation/Enhancement	337.26	97.30	239.00	0.00	0.002	0.00	0.50	0.46	0.00	0.00	0.00
Curriculum Development, Total	86.22	48.00	34.80	0.00	0.00	0.06	0.00	0.72	1.05	1.59	0.00
Curriculum/Materials	74.39	41.25	30.70	---	---	---	---	0.72	1.05	0.67	---
Educational Technologies	7.67	6.75	---	---	---	---	---	--	---	0.92	---
Dissemination/Tech. Assistance	4.16	---	4.10	---	---	0.06	---	---	---	---	---
Comprehensive (Org. Reform)	45.84	44.92	0.00	0.00	0.00	0.00	0.22	0.50	0.00	0.00	0.20
Student Incentives	10.25	0.00	0.00	0.00	0.00	0.21	0.27	0.00	9.75	0.02	0.00
Direct Student Support	10.01	---	---	---	---	0.21	0.05	---	9.75	---	---
Bridging Programs	0.24	---	---	---	---	---	0.22	---	---	0.02	---
Other	49.23	9.15	40.00	0.00	0.00	---	0.00	0.08	0.00	0.00	0.00
PRECOLLEGE: INFORMAL TOTAL	119.92	42.68	0.00	21.45	4.97	0.28	13.11	20.21	10.26	6.46	0.50
Teacher Preparation/Enhancement	21.27	0.00	0.00	6.20	0.63	0.25	5.07	1.60	5.15	2.37	0.00
Curriculum Development, Total	39.15	25.75	0.00	1.70	0.00	0.03	5.60	2.88	2.77	0.42	0.00
Curriculum/Materials	36.22	25.00	---	1.70	---	---	4.31	2.83	2.20	0.18	---
Educational Technologies	1.33	0.75	---	---	---	0.02	0.50	0.05	---	0.01	---
Dissemination/Tech. Assistance	1.60	---	--	---	---	0.01	0.79	---	0.57	0.23	---
Comprehensive (Org. Reform)	11.73	2.63	0.00	6.40	0.00	0.00	0.06	0.00	0.60	2.04	0.00
Student Incentives	37.50	11.00	0.00	5.75	4.34	0.00	0.28	14.32	1.12	0.19	0.50
Direct Student Support	31.88	11.00	---	5.25	---	---	0.28	14.28	0.92	0.15	---
Bridging Programs	5.62	---	---	0.50	4.34	---	---	0.04	0.20	0.04	0.50
Other	10.27	3.30	0.00	1.40	0.00	0.00	2.10	1.41	0.62	1.44	0.00

* Includes Category I Programs only.

NOTE: Numbers may not sum to totals due to rounding

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: FORMAL & INFORMAL....	477.38	132.32	16.10	30.18	176.08	1.90	25.03	8.83	70.14	4.30	12.50
Program Evaluation/Assessment....	0.14	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.04	0.00	0.00
UNDERGRADUATE: FORMAL TOTAL.....	348.64	131.33	16.10	0.00	107.30	1.90	8.85	[illegible]	66.68	0.39	12.50
TWO-YEAR: FORMAL TOTAL.....	14.26	6.38	0.00	0.00	0.00	0.09	0.50	0.10	7.19	0.00	0.00
Faculty Preparation/Enhancement.	2.79	2.25	0.00	0.00	0.00	0.00	0.50	0.02	0.02	0.00	0.00
Curriculum Development, Total...	2.55	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials.....	0.25	0.25	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	2.30	2.30	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).. ..	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Student Incentives.....	6.72	0.00	0.00	0.00	0.00	0.09	0.00	0.08	6.55	0.00	0.00
Direct Student Support.....	6.72	---	---	---	---	0.09	---	0.08	6.55	---	---
Bridging Programs.....	0.00	---	---	---	---	---	---	---	---	---	---
Other.....	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00
FOUR-YEAR: FORMAL TOTAL.....	334.39	124.95	16.10	0.00	107.30	1.81	8.35	3.49	59.50	0.39	12.50
Faculty Preparation/Enhancement.	25.46	25.30	0.00	0.00	0.00	0.00	0.00	0.06	---	0.10	0.00
Curriculum Development, Total...	69.78	61.11	6.10	0.00	0.00	0.20	1.66	0.50	0.16	0.05	0.00
Curriculum/Materials.....	47.02	38.37	6.10	---	---	0.20	1.66	0.50	0.14	0.05	---
Laboratory Equipment.....	22.76	22.74	---	---	---	[illegible]	---	---	0.02	---	---
Comprehensive (Org. Reform).....	39.19	12.38	0.00	0.00	6.80	0.00	1.68	0.53	5.30	0.00	12.50
Student Incentives.....	197.15	24.81	10.00	0.00	100.50	1.61	4.85	1.39	53.75	0.24	0.00
Direct Student Support.....	197.15	24.81	10.00	---	100.50	1.61	4.85	1.39	53.75	0.24	---
Bridging Programs.....	0.00	---	---	---	---	---	---	---	---	---	---
Other.....	2.81	1.35	0.00	0.00	0.00	0.00	0.16	1.01	0.29	0.00	0.00

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: INFORMAL TOTAL.....	128.61	0.99	0.00	30.08	68.78	0.00	16.18	5.24	3.43	3.91	0.00
TWO-YEAR: INFORMAL TOTAL.....	2.12	0.40	0.00	1.13	0.00	0.00	0.48	0.00	0.11	0.00	0.00
Faculty Preparation/Enhancement.	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	---	0.00	---
Curriculum Development, Total...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials.....	0.00	---	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	0.00	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Student Incentives.....	1.72	0.00	0.00	1.13	0.00	0.00	0.48		0.11	0.00	0.00
Direct Student Support.....	1.72	---	---	1.13	---	---	0.48	---	0.11	---	---
Bridging Programs.....	0.00	---	---	---	---	---	---	---	---	---	---
Other.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FOUR-YEAR: INFORMAL TOTAL.....	126.49	0.59	0.00	28.95	68.78	0.00	15.70	5.24	3.32	3.91	0.00
Faculty Preparation/Enhancement.	14.11	0.00	0.00	2.40	---	0.00	9.15	1.76	0.00	0.80	--
Curriculum Development, Total...	51.22	0.00	0.00	11.50	38.90	0.00	0.15	0.62	0.00	0.05	0.00
Curriculum/Materials.....	51.22	---	---	11.50	38.90	--	0.15	0.62	---	0.05	---
Laboratory Equipment.....	0.00	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	6.48	0.59	0.00	3.85	0.00	0.00	0.00	0.00	1.04	1.00	0.60
Student Incentives.	24.68	0.00	0.00	11.20	0.00	0.00	6.40	2.83	2.19	2.06	0.00
Direct Student Support.....	24.63	---	---	11.20	---	--	6.40	2.81	2.16	2.06	---
Bridging Programs.....	0.05	---	---	---	---	---	---	0.02	0.03	---	---
Other.....	30.01	0.00	0.00	0.00	29.88	0.00	0.00	0.04	0.09	0.00	0.00

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRADUATE	802.79	70.72	0.00	22.60	234.80	5.15	28.02	10.92	421.18	1.00	8.40
Program Evaluation/Assessment	0.15	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Predoctoral Fellowships	100.53	51.52	0.00	10.04	16.70	0.85	13.80	0.03	6.79	0.80	0.00
Predoctoral Traineeships	153.85	4.40	0.00	0.00	3.90	0.00	4.70	10.41	126.44	0.00	4.00
Postdoctoral Fellowships	100.08	9.85	0.00	10.05	10.50	3.35	9.10	0.48	52.15	0.20	4.40
Postdoctoral Traineeships	157.57	4.00	0.00	0.00	0.00	0.00	0.00	0.00	153.57	0.00	0.00
Other	290.60	0.95	0.00	2.41	203.70	0.95	0.42	0.00	82.17	0.00	0.00

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRAND TOTAL	100.0%	23.5%	17.0%	3.8%	21.4%	0.4%	3.5%	2.1%	26.4%	0.7%	1.1%
PRECOLLEGE: FORMAL & INFORMAL	100.0%	38.3%	47.5%	3.3%	0.9%	0.1%	2.1%	3.3%	3.3%	1.2%	0.1%
Program Evaluation/Assessment	100.0%	92.4%	---	1.7%	---	---	---	0.0%	5.9%	---	---
PRECOLLEGE: FORMAL TOTAL	100.0%	37.7%	59.3%	---	---	0.1%	0.2%	0.3%	2.0%	0.3%	0.0%
Teacher Preparation/Enhancement	100.0%	28.8%	70.9%	---	---	---	0.1%	0.1%	---	---	---
Curriculum Development, Total	100.0%	55.7%	40.4%	---	---	0.1%	---	0.8%	1.2%	1.8%	---
Curriculum/Materials	100.0%	55.5%	41.3%	---	---	---	---	1.0%		0.9%	---
Educational Technologies	100.0%	88.0%	--	---	---	---	---	---		12.0%	---
Dissemination/Tech. Assistance	100.0%	---	98.6%	---	---	1.4%	---	---	---	---	---
Comprehensive (Org. Reform)	100.0%	98.0%	---	---	---	---	0.5%	1.1%	---	---	0.4%
Student Incentives	100.0%	---	---	---	---	2.0%	2.6%	---	95.1%	0.2%	---
Direct Student Support	100.0%	---	---	---	---	2.1%	0.5%	---	97.4%	---	---
Bridging Programs	100.0%	---	---	---	---	---	91.7%	---	---	8.3%	---
Other	100.0%	13.6%	81.3%	---	---	---	---	0.2%	---	---	---
PRECOLLEGE: INFORMAL TOTAL	100.0%	35.6%	---	17.9%	4.1%	0.2%	10.9%	16.9%	8.6%	5.4%	0.4%
Teacher Preparation/Enhancement	100.0%	---	---	29.1%	3.0%	1.2%	23.8%	7.5%	24.2%	11.1%	---
Curriculum Development, Total	100.0%	65.8%	---	4.3%	0.0%	0.1%	14.3%	7.4%	7.1%	1.1%	---
Curriculum/Materials	100.0%	69.0%	---	4.7%	0.0%	---	11.9%	7.8%	6.1%	0.5%	---
Educational Technologies	100.0%	56.4%	---	---	---	1.5%	37.6%	3.8%	---	0.8%	---
Dissemination/Tech. Assistance	100.0%	---	---	---	---	0.6%	49.4%	---	35.6%	14.4%	---
Comprehensive (Org. Reform)	100.0%	22.4%	---	54.6%	---	---	0.5%	---	5.1%	17.4%	---
Student Incentives	100.0%	29.3%	---	15.3%	11.6%	---	0.7%	38.2%	3.0%	0.5%	1.3%
Direct Student Support	100.0%	34.5%	---	16.5%	---	---	0.9%	44.8%	2.9%	0.5%	---
Bridging Programs	100.0%	---	---	8.9%	77.2%	---	---	0.7%	3.6%	0.7%	8.9%
Other	100.0%	32.1%	---	13.6%	---	---	20.4%	13.7%	6.0%	14.0%	---

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: FORMAL & INFORMAL....	100.0%	27.7%	3.4%	6.3%	36.9%	0.4%	5.2%	1.8%	19.7%	0.9%	2.6%
Program Evaluation/Assessment....	100.0%	---	---	74.1%	---	---	---	0.0%	25.9%	---	---
UNDERGRADUATE: FORMAL TOTAL.....	100.0%	37.7%	4.6%	---	30.8%	0.5%	2.5%	1.0%	19.1%	0.1%	3.6%
TWO-YEAR: FORMAL TOTAL.....	100.0%	44.7%	---	---	---	0.6%	3.5%	0.7%	50.4%	---	---
Faculty Preparation/Enhancement.	100.0%	80.6%	---	---	---	---	17.9%	0.7%	0.7%	---	---
Curriculum Development, Total...	100.0%	100.0%	---	---	---	---	---	---	---	---	---
Curriculum/Materials.....	100.0%	100.0%	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	100.0%	100.0%	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	100.0%	100.0%	---	---	---	---	---	---	---	---	---
Student Incentives.....	100.0%	---	---	---	---	1.3%	---	1.2%	97.5%	---	---
Direct Student Support.....	100.0%	---	---	---	---	1.3%	---	1.2%	97.5%	---	---
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	100.0%	---	---	---	---	---	---	---	100.0%	---	---
FOUR-YEAR: FORMAL TOTAL.....	100.0%	37.4%	4.8%	---	32.1%	0.5%	2.5%	1.0%	17.8%	0.1%	3.7%
Faculty Preparation/Enhancement.	100.0%	99.4%	---	---	---	---	---	0.2%	---	0.4%	---
Curriculum Development, Total...	100.0%	87.6%	9.7%	---	---	0.3%	2.4%	0.7%	0.2%	0.1%	0.0%
Curriculum/Materials.....	100.0%	81.6%	13.0%	---	---	0.4%	3.5%	1.1%	0.3%	0.1%	0.0%
Laboratory Equipment.....	100.0%	99.9%	---	---	---	---	---	---	0.1%	---	---
Comprehensive (Org. Reform).....	100.0%	31.6%	---	---	17.4%	---	4.3%	1.4%	13.5%	---	31.9%
Student Incentives.....	100.0%	12.6%	5.1%	---	51.0%	0.8%	2.5%	0.7%	27.3%	0.1%	0.0%
Direct Student Support.....	100.0%	12.6%	5.1%	---	51.0%	0.8%	2.5%	0.7%	27.3%	0.1%	0.0%
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	100.0%	48.0%	---	---	---	---	5.7%	35.9%	10.3%	---	0.0%

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: INFORMAL TOTAL.....	100.0%	0.8%	---	23.4%	53.5%	---	12.6%	4.1%	2.7%	3.0%	---
TWO-YEAR: INFORMAL TOTAL.....	100.0%	18.9%	---	53.3%	---	---	22.6%	---	5.2%	---	---
Faculty Preparation/Enhancement.	---	---	---	---	---	---	---	---	---	---	---
Curriculum Development, Total...	---	---	---	---	---	---	---	---	---	---	---
Curriculum/Materials.....	---	---	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	100.0%	100.0%	---	---	---	---	---	---	---	---	---
Student Incentives.....	100.0%	---	---	65.7%	---	---	27.9%	---	6.4%	---	---
Direct Student Support.....	100.0%	---	---	65.7%	---	---	27.9%	---	6.4%	---	---
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	---	---	---	---	---	---	---	---	---	---	---
FOUR-YEAR: INFORMAL TOTAL.....	100.0%	0.5%	---	22.9%	54.4%	---	12.4%	4.1%	2.6%	3.1%	---
Faculty Preparation/Enhancement.	100.0%	---	--	17.0%	---	---	64.8%	12.5%	---	5.7%	---
Curriculum Development, Total...	100.0%	---	---	22.5%	75.9%	---	0.3%	1.2%	---	0.1%	---
Curriculum/Materials.....	100.0%	---	---	22.5%	75.9%	---	0.3%	1.2%	---	0.1%	---
Laboratory Equipment.....	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	100.0%	9.1%	---	59.4%	---	---	---	---	16.0%	15.4%	---
Student Incentives.....	100.0%	---	---	45.4%	---	---	25.9%	11.5%	8.9%	8.3%	---
Direct Student Support.....	100.0%	---	---	45.5%	---	---	26.0%	11.4%	8.8%	8.4%	---
Bridging Programs.....	100.0%	---	---	---	---	---	---	40.0%	60.0%	---	---
Other.....	100.0%	---	---	---	99.6%	---	---	0.1%	0.3%	---	---

Table 1. FCCSET Committee on Education and Human Resources
FY 1992 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 92 BUDGET REQUEST	AGENC									
		NSF	ED	OOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRADUATE	100.0%	8.8%	---	2.8%	29.2%	0.6%	3.5%	1.4%	52.5%	0.1%	1.0%
Program Evaluation/Assessment....	---	---	---	---	---	---	---	---	---	---	---
Predoctoral Fellowships.....	100.0%	51.2%	---	10.0%	16.6%	0.8%	13.7%	0.0%	6.8%	0.8%	---
Predoctoral Traineeships.....	100.0%	2.9%	---	6.5%	2.5%	---	3.1%	6.8%	82.2%	---	2.6%
Postdoctoral Fellowships.....	100.0%	9.8%	---	10.0%	10.5%	3.3%	9.1%	0.5%	52.1%	0.2%	4.4%
Postdoctoral Traineeships.....	100.0%	2.5%	---	---	---	---	---	---	97.5%	---	---
Other.....	100.0%	0.3%	---	0.8%	70.1%	0.3%	0.1%	---	28.3%	---	---

Table 2. FCCSET Committee on Education and Human Resources
FY 1991 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 91 PLAN	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRAND TOTAL	1715.70	371.66	235.00	64.14	416.04	7.26	68.15	40.58	486.33	6.59	19.95
PRECOLLEGE: FORMAL & INFORMAL	514.65	212.65	228.10	20.82	5.17	0.55	13.32	20.65	10.65	1.54	1.20
Program Evaluation/Assessment	9.49	9.00	---	0.08	---	---	---	0.01	0.40	---	---
PRECOLLEGE: FORMAL TOTAL	405.63	164.37	228.10	0.00	0.002	0.31	1.38	0.88	9.19	0.70	0.70
Teacher Preparation/Enhancement	296.56	93.70	202.00	---	0.002	---	0.49	0.37	---	---	---
Curriculum Development, Total	63.25	35.35	26.10	0.00	0.00	0.10	0.40	0.13	0.00	0.67	0.50
Curriculum/Materials	53.90	29.50	22.70	---	---	---	0.40	0.13	---	0.67	0.50
Educational Technologies	5.85	5.85	---	---	---	---	---	---	---	---	---
Dissemination/Tech. Assistance	3.50	---	3.40	---	---	0.10	---	---	---	---	---
Comprehensive (Org. Reform)	29.84	29.42	0.00	0.00	---	---	0.22	---	---	---	0.20
Student Incentives	9.69	0.00	0.00	0.00	0.00	0.21	0.27	0.00	9.19	0.02	0.00
Direct Student Support	9.45	---	---	---	---	0.21	0.05	---	9.19	---	---
Bridging Programs	0.24	---	---	---	---	---	0.22	---	---	0.02	---
Other	6.28	5.90	---	0.00	---	---	---	0.38	---	---	---
PRECOLLEGE: INFORMAL TOTAL	99.53	39.28	0.00	20.74	5.17	0.24	11.94	19.76	1.06	0.84	0.50
Teacher Preparation/Enhancement	15.46	---	---	7.86	0.63	0.20	5.05	1.59	0.12	0.01	---
Curriculum Development, Total	34.95	25.65	0.00	1.65	0.20	0.04	4.55	2.57	0.00	0.29	0.00
Curriculum/Materials	32.30	25.00	---	1.65	0.20	---	2.75	2.52	---	0.18	---
Educational Technologies	0.80	0.65	---	---	---	0.02	0.07	0.05	---	0.01	---
Dissemination/Tech. Assistance	1.85	---	---	---	---	0.02	1.73	---	---	0.10	---
Comprehensive (Org. Reform)	9.67	2.63	0.00	6.95	---	---	0.05	---	---	0.04	---
Student Incentives	32.49	9.00	0.00	3.08	4.34	0.00	0.26	14.20	0.92	0.19	0.50
Direct Student Support	27.18	9.00	---	2.88	---	---	0.26	14.16	0.73	0.15	---
Bridging Programs	5.31	---	---	0.20	4.34	---	---	0.04	0.19	0.04	50
Other	6.96	2.00	---	1.20	---	---	2.03	1.40	0.02	0.31	---

* Includes Category I Programs only

NOTE: Numbers may not sum to totals due to rounding.

Table 2. FCCSET Committee on Education and Human Resources
FY 1991 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 91 PLAN	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: FORMAL & INFORMAL....	416.90	100.96	6.90	20.53	176.08	1.92	25.53	8.42	61.26	4.45	10.85
Program Evaluation/Assessment....	0.13	---	---	0.08	---	---	---	0.03	0.04	---	---
UNDERGRADUATE: FORMAL TOTAL.....	294.92	99.97	6.90	0.00	107.30	1.92	6.67	2.98	57.94	0.39	10.85
TWO-YEAR: FORMAL TOTAL.....	12.57	5.58	0.00	0.00	0.00	0.08	0.00	0.10	6.81	0.00	0.00
Faculty Preparation/Enhancement.	1.54	1.50		---	---	---	---	0.02	0.02	---	---
Curriculum Development, Total...	2.50	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials.....	0.20	0.20	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	2.30	2.30	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	1.58	1.58	0.00	---	---	---	---	---	---	---	---
Student Incentives.....	6.37	0.00	0.00	0.00	0.00	0.08	0.00	0.08	6.21	0.00	0.00
Direct Student Support.....	6.37	---	---	---	---	0.08	---	0.08	6.21	---	---
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	0.58	---	---	---	---	---	---	---	0.58	---	---
FOUR-YEAR: FORMAL TOTAL.....	282.35	94.39	6.90	0.00	107.30	1.84	6.67	2.88	51.13	0.39	10.85
Faculty Preparation/Enhancement.	20.01	19.85	---	---	---	---	---	0.06	---	0.10	---
Curriculum Development, Total...	59.61	50.95	5.90	0.00	0.00	0.25	1.60	0.11	0.15	0.05	0.60
Curriculum/Materials.....	34.85	26.21	5.90	---	---	0.25	1.60	0.11	0.13	0.05	0.60
Laboratory Equipment.....	24.76	24.74	---	---	---	---	---	---	0.02	---	---
Comprehensive (Org. Reform).....	25.29	2.38	---	---	6.80	---	1.62	0.74	4.00	---	9.75
Student Incentives.....	175.24	19.86	1.00	0.00	100.50	1.59	3.29	1.30	46.96	0.24	0.50
Direct Student Support.....	175.24	19.86	1.00	---	100.50	1.59	3.29	1.30	46.96	0.24	0.50
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	2.21	1.35	---	---	---	---	0.16	0.67	0.03	---	---

Table 2. FCCSET Committee on Education and Human Resources
FY 1991 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 91 PLAN	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
UNDERGRADUATE: INFORMAL TOTAL.....	121.85	0.99	0.00	20.45	68.78	0.00	[illegible].86	5.43	3.28	4.06	0.00
TWO-YEAR: INFORMAL TOTAL.....	2.29	0.40	0.00	0.93	0.00	0.00	0.86	0.00	0.10	0.00	0.00
Faculty Preparation/Enhancement.	0.40	---	---	---	---	---	0.40	---	---	---	---
Curriculum Development, Total...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials.....	---	---	---	---	---	---	---	---	---	---	---
Laboratory Equipment.....	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	0.40	0.40	0.00	---	---	---	---	---	---	---	---
Student Incentives.....	1.49	0.00	0.00	0.93	0.00	0.00	0.46	0.00	0.10	0.00	0.00
Direct Student Support.....	1.49	---	---	0.93	---	---	0.46	---	0.10	---	---
Bridging Programs.....	---	---	---	---	---	---	---	---	---	---	---
Other.....	0.00	---	0.00	---	---	---	0.00	---	---	---	---
FOUR-YEAR: INFORMAL TOTAL.....	119.56	0.59	0.00	19.52	68.78	0.00	18.00	5.43	3.18	4.06	0.00
Faculty Preparation/Enhancement.	12.53	---	---	1.40	---	---	8.35	1.83	---	0.95	---
Curriculum Development, Total...	46.34	0.00	0.00	3.20	38.90	0.00	3.45	0.74	0.00	0.05	0.00
Curriculum/Materials.....	46.34	---	---	3.20	38.90	---	3.45	0.74	---	0.05	---
Laboratory Equipment.....	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform).....	10.19	0.59	0.00	7.60	---	---	---	---	1.00	1.00	0.00
Student Incentives.....	20.50	0.00	0.00	7.32	0.00	0.00	6.20	2.82	2.10	2.06	0.00
Direct Student Support.....	20.45	---	---	7.32	---	---	6.20	2.80	2.07	2.06	---
Bridging Programs.....	0.05	---	---	---	---	---	---	0.02	0.03	---	---
Other.....	30.00	---	---	---	29.88	---	---	0.04	0.08	---	0.00

Table 2. FCCSET Committee on Education and Human Resources
FY 1991 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 91 PLAN	AGENCY									
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRADUATE	784.15	58.05	0.00	22.79	234.79	4.79	29.30	11.51	414.42	0.60	7.90
Program Evaluation/Assessment	0.13	---	---	0.08	---	---	---	---	0.05	---	---
Predoctoral Fellowships	85.34	40.40	---	7.78	16.68	[illegible].85	12.40	1.39	5.44	0.40	---
Predoctoral Traineeships	144.06	2.00	---	2.00	3.91	---	4.10	9.64	118.91	---	3.50
Postdoctoral Fellowships	100.02	8.05	---	7.79	10.50	3.02	12.40	0.48	53.18	0.20	4.40
Postdoctoral Traineeships	161.67	4.70	---	---	---	---	---	---	156.97	---	---
Other	292.93	2.90	---	5.14	203.70	0.92	0.40	---	79.87	---	---

Table 3. FCCSET Committee on Education and Human Resources
FY 1990 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 90 PLAN	AGENCY										
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA	DOL
GRAND TOTAL	1463.08	277.78	162.90	42.04	416.04	7.31	50.91	27.14	435.42	26.93	19.60	0.00
PRECOLLEGE, FORMAL AND INFORMAL	343.66	147.94	157.50	7.12	5.17	0.64	6.99	11.26	5.18	1.16	0.70	0.00
Program Evaluation/Assessment	4.66	4.37	---	0.05	---	---	---	0.01	0.23	---	---	---
PRECOLLEGE: FORMAL TOTAL	277.25	113.56	157.50	0.00	0.00	0.45	1.15	0.46	3.41	0.52	0.20	0.00
Teacher Preparation/Enhancement..	189.86	62.10	126.80	---	0.00	0.15	0.49	0.27	---	0.05	---	---
Curriculum Development	41.64	26.87	13.70	0.00	0.00	0.09	0.18	0.11	0.50	0.19	0.00	0.00
Curriculum/Materials	35.86	21.20	13.70	---	---	0.01	0.18	0.11	0.50	0.16	---	---
Educational Technologies.....	5.67	5.67	---	---	---	---	---	---	---	---	---	---
Dissemination/Tech. Assistance.	0.11	---	---	---	---	0.08	---	---	---	0.03	---	---
Comprehensive (Org. Reform)	32.98	18.51	14.00	---	---	---	0.22	---	---	0.05	0.20	---
Student Incentives	6.91	0.30	3.00	0.00	0.00	0.21	0.27	0.00	2.91	0.22	0.00	0.00
Direct Student Support.....	6.67	0.30	3.00	---	---	0.21	0.05	---	2.91	0.20	---	---
Bridging Programs	0.24	---	---	---	---	---	0.22	---	---	0.02	---	---
Other	5.86	5.78	---	---	---	---	---	0.08	---	---	---	---
PRECOLLEGE: INFORMAL TOTAL	61.74	30.01	0.00	7.07	5.17	0.19	5.84	10.79	1.53	0.64	0.50	0.00
Teacher Preparation/Enhancement..	7.30	---	---	3.20	0.63	0.15	2.12	1.08	0.12	---	---	---
Curriculum Development	21.98	16.33	0.00	1.10	0.20	0.04	2.73	1.40	0.00	0.18	0.00	0.00
Curriculum/Materials	20.31	15.70	---	1.10	0.20	---	1.87	1.39	---	0.05	---	---
Educational Technologies.....	0.73	0.63	---	---	---	0.02	0.07	0.01	---	0.00	---	---
Dissemination/Tech. Assistance.	0.94	---	---	---	---	0.02	0.79	---	---	0.13	---	---
Comprehensive (Org. Reform)	5.91	4.76	---	1.10	---	---	0.05	---	---	---	---	---
Student Incentives	16.34	7.00	0.00	1.47	4.34	0.00	0.24	1.18	1.39	0.22	0.50	0.00
Direct Student Support.....	11.24	7.00	---	1.47	---	---	0.24	1.15	1.20	0.18	---	---
Bridging Programs	5.10	---	---	---	4.34	---	---	0.03	0.19	0.04	0.50	---
Other	10.21	1.92	---	0.20	---	---	0.70	7.13	0.02	0.24	---	---

* Includes Category 1 programs only.

NOTE: Numbers may not sum to totals due to rounding.

Table 3. FCCSET Committee on Education and Human Resources
FY 1990 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 90 PLAN	AGENCY										
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA	DOL
UNDERGRADUATE, TOTAL	383.95	82.97	5.40	18.00	176.08	2.07	19.89	14.32	48.89	5.23	11.10	0.00
Program Evaluation/Assessment	0.56	0.50	---	0.05	---	---	---	0.01	---	---	---	---
UNDERGRADUATE: FORMAL TOTAL	269.79	81.07	5.40	0.00	107.30	2.07	5.47	11.30	45.59	0.49	11.10	0.00
2-YEAR: FORMAL	5.94	4.18	0.00	0.00	0.00	0.08	0.00	0.10	1.43	0.15	0.00	0.00
Faculty Preparation/Enhancement	1.35	1.31	---	---	---	---	---	0.02	0.02	---	---	---
Curriculum Development	1.68	1.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials	0.10	0.10	---	---	---	---	---	---	---	---	---	--
Laboratory Equipment	1.58	1.58	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform)	1.19	1.19	---	---	---	---	---	---	---	---	---	---
Student Incentives	1.18	0.00	0.00	0.00	0.00	0.08	0.00	0.08	0.87	0.15	0.00	0.00
Direct Student Support	1.18	---	---	---	---	0.08	---	0.08	0.87	0.15	---	---
Bridging Programs	0.00	---	---	---	---	---	---	---	---	---	---	---
Other	0.54	---	---	---	---	---	---	---	0.54	---	---	---
4-YEAR: FORMAL	263.86	76.89	5.40	0.00	107.30	1.99	5.47	11.20	44.17	0.34	11.10	0.00
Faculty Preparation/Enhancement	18.24	17.99	---	---	---	---	---	0.06	0.04	0.15	---	---
Curriculum Development	44.81	36.92	5.40	0.00	0.00	0.41	1.50	0.56	0.01	0.00	0.00	0.00
Curriculum/Materials	24.10	16.23	5.40	---	---	0.41	1.50	0.56	---	---	---	---
Laboratory Equipment	20.71	20.70	---	---	---	---	---	---	0.01	---	---	--
Comprehensive (Org. Reform)	21.94	1.79	---	---	6.80	---	1.62	0.63	---	---	11.10	---
Student Incentives	169.21	17.63	0.00	0.00	100.50	[illegible]	1.79	3.45	44.09	0.17	0.00	0.00
Direct Student Support	169.21	17.63	---	---	100.50	1.58	1.79	3.45	44.09	0.17	---	---
Bridging Programs	0.00	---	---	---	---	---	---	--	---	---	---	---
Other	9.67	2.56	---	---	---	---	0.56	6.50	0.03	0.02	---	---

Table 3. FCCSET Committee on Education and Human Resources
FY 1990 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 90 PLAN	AGENCY										
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA	DOL
UNDERGRADUATE: INFORMAL TOTAL	113.62	1.40	0.00	17.95	68.78	0.00	14.43	3.02	3.30	4.74	0.00	0.00
2-YEAR: INFORMAL TOTAL	1.43	0.30	0.00	0.60	0.00	0.00	0.43	0.00	0.10	0.00	0.00	0.00
Faculty Preparation/Enhancement..	0.00	---	---	---	---	---	---	---	---	---	---	---
Curriculum Development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curriculum/Materials	0.00	---	---	---	---	---	---	---	---	---	---	---
Laboratory Equipment	0.00	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform)	0.30	0.30	---	---	---	---	---	---	---	---	---	---
Student Incentives	1.13	0.00	0.00	0.60	0.00	0.00	0.43	0.00	0.10	0.00	0.00	0.00
Direct Student Support	0.93	---	---	0.40	---	---	0.43	---	0.10	---	---	---
Bridging Programs	0.20	---	---	0.20	---	---	---	---	---	---	---	---
Other	0.00	---	---	---	---	---	---	---	---	---	---	---
4-YEAR: INFORMAL TOTAL	112.19	1.10	0.00	17.35	68.78	0.00	14.00	3.02	3.20	4.74	0.00	0.00
Faculty Preparation/Enhancement..	8.88	0.00	---	1.38	---	---	6.00	0.40	---	1.10	---	---
Curriculum Development	45.02	0.15	0.00	3.20	38.90	0.00	2.30	0.37	0.00	0.10	0.00	0.00
Curriculum/Materials	45.02	0.15	---	3.20	38.90	---	2.30	0.37	---	0.10	---	---
Laboratory Equipment	---	---	---	---	---	---	---	---	---	---	---	---
Comprehensive (Org. Reform)	8.85	0.45	---	5.40	---	---	---	---	1.00	2.00	---	---
Student Incentives	19.41	0.50	0.00	7.37	0.00	0.00	5.70	2.19	2.11	1.54	0.00	0.00
Direct Student Support	19.32	0.50	---	7.37	---	---	5.70	2.17	2.04	1.54	---	---
Bridging Programs	0.09	0.00	---	---	---	---	---	0.02	0.07	---	---	---
Other	30.02	---	---	---	29.88	---	---	0.06	0.08	---	---	---

Table 3. FCCSET Committee on Education and Human Resources
FY 1990 Budget Matrix
(Dollars in Millions)

EDUCATION LEVEL/ MAJOR PROGRAM AREAS	FY 90 PLAN	AGENCY										
		NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA	DOL
GRADUATE	738.46	46.87	0.00	16.92	234.79	4.60	24.03	1.56	381.35	20.54	7.80	0.00
Program Evaluation/Assessment....	0.0	---	---	0.05	---	---	---	---	0.05	---	---	---
Predoctoral Fellowships.....	79.59	30.66	---	6.90	16.68	0.85	9.56	0.03	4.24	10.67	---	---
Predoctoral Traineeships.....	120.96	2.00	---	---	3.91	---	2.10	1.01	109.02	0.12	2.80	---
Postdoctoral Fellowships.....	106.09	8.90	---	5.80	10.50	2.85	12.00	0.52	51.32	9.20	5.00	---
Postdoctoral Traineeships.....	148.80	4.00	---	---	---	---	---	---	144.80	---	---	---
Other	282.93	1.31	---	4.17	203.70	0.90	0.37	---	71.93	0.55	---	---

Table 4. FCCSET Committee on Education and Human Resources
FY 1990-1992 Budget Comparison
(Dollars in Millions)

Education Level/ Major Program Areas	FY 1990	FY 1991	FY 1992 Request	Percent Increase for FY 90-92	Percent Increase for FY 91-92
Grand Total	**$1466.09**	**$1715.70**	**$1940.79**	**32.4%**	**13.1%**
Precollege	**343.65**	**514.60**	**660.62**	**92.2%**	**28.4%**
Teacher Preparation/ Enhancement	197.16	312.02	358.53	81.8%	14.9%
Curriculum Development*	68.28	107.69	137.27	101%	27.5%
Comprehensive Programs Organization Reform	38.89	39.51	57.57	48.0%	45.7%
Student Incentives and Opportunities	23.25	42.18	47.75	105%	13.2%
Other	16.07	13.24	59.50	273%	349.4%
Undergraduate	**383.97**	**416.90**	**477.38**	**24.3%**	**14.5%**
Faculty Preparation/ Enhancement	28.47	34.48	42.36	48.8%	22.9%
Curriculum Development*	92.07	103.58	123.69	34.3%	13.9%
Comprehensive Programs Organization Reform	32.28	37.46	47.65	47.6%	27.2%
Student Incentives and Opportunities	190.93	203.60	230.27	20.6%	13.1%
Other	40.23	32.79	33.44	-16.9%	2.0%
Graduate	**738.46**	**784.15**	**802.79**	**8.7%**	**2.4%**
Predoctoral Fellowhips	79.59	85.34	100.53	26.3%	17.8%
Predoctoral Traineeships	120.96	144.06	153.85	27.2%	6.8%
Postdoctoral Fellowships	106.09	100.02	100.03	-5.6%	0.1%
Postdoctoral Traineeships	148.80	161.67	157.57	5.9%	-2.5%
Other*	283.03	293.06	290.75	2.7%	-0.8%

* includes program assessment and evaluation

dollars in millions

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

For Immediate Release February 5, 1991

For more information contact:

Peggy Dufour, Department of Energy -- (202) 586-7970
Sarah Keegan, Office of Science and Technology Policy -- (202) 395-6142

PRESIDENT'S BUDGET REQUESTS UNPRECEDENTED $1.9 BILLION FOR SCIENCE AND MATHEMATICS EDUCATION

The President's budget for Fiscal Year 1992 includes $1.94 billion for mathematics, science, and engineering education at the precollege through post-doctoral levels. This is an increase of $225 million or 13 percent over FY 1991.

Precollege mathematics and science education received the largest portion of this new proposed funding, with an additional $146 million requested, an increase of 28 percent to $660 million.

Undergraduate education received the second largest increase, $60 million or 14 percent, raising it to $477 million. An additional $19 million, 2 percent, is being requested for graduate education, which is the largest educational component at $803 million.

D. Allan Bromley, Assistant to the President for Science and Technology, stated that "This increase reflects the President's strong commitment to both educational and scientific excellence in America. This is a subject that he wants to keep at the very top of the national agenda."

The $1.94 billion request was detailed in a report prepared by the Committee on Education and Human Resources (CEHR), chaired by James D. Watkins, Secretary of Energy, under the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). The report, entitled "By the Year 2000: First in the World," released today, contains the first coordinated interagency budget in science and mathematics education ever produced by the Federal government.

-MORE-

"By the Year 2000," which is the product of seven months of deliberations by the 16-agency Committee on Education and Human Resources, includes detailed budget crosscuts going back to FY 1990. It also contains program descriptions from all participating agencies or institutions and information on whom to contact, so that the public can more easily participate in the programs presented. A summary of the FY 1992 budget proposal is attached.

Citing the National Education Goals developed by the President and the Governors, Watkins stated, "The President is sending a clear message that education is a top priority in this Administration, even in difficult budget times. Our nation's children are our future, and this budget puts resources where they can do the most to reach the Goals -- in precollege education, with greatest emphasis on our teachers."

Highlights of the report include:

o The level of Federal effort in science and mathematics education was far greater than previously recorded, and no mechanism has previously existed for extensive interagency planning, funding, coordination, or evaluation.

o The FCCSET established strategic objectives and priorities for the Federal effort in reaching the National Education Goals, with precollege teachers the number one priority.

o There was already significant precollege program growth in several agencies following the Education Summit, through Secretary- or Administrator-directed agency reallocations. Between FY 1990, the baseline year, and the FY 1992 request, precollege science and mathematics education has grown by 98 percent.

o Virtually every Federal agency relies on scientists, mathematicians, engineers, and technicians to carry out its mission. Many of these men and women could work in an expanded educational capacity with our nation's schools.

o The Federal government owns a vast complex of scientific facilities that could be more widely used to train teachers and students in cutting-edge science at relatively low cost.

o By coordinating its efforts, the Federal government can make most efficient use of resources, more rapidly disseminate effective programs, and link its work to the important reforms underway in the States and the private sector.

The Committee on Education and Human Resources has already begun the process of further evaluating the hundreds of programs represented in the report, an effort expected to continue through 1991.

-MORE-

The Vice-Chairmen of the Committee on Education and Human Resources are Ted Sanders of the Department of Education and Luther Williams of the Nati l Science Foundation.

Copies of the report may be obtained from Peggy Dufour, Committee on Education and Human Resources, Department of Energy, 1000 Independence Ave., S.W., Washington, D.C. 20585, phone (202) 586-7970.

-END-

FCCSET Committee on Education and Human Resources
The President's FY 1992 Budget Request for Mathematics and Science Education

MAJOR CATEGORIES	Total Request	NSF	ED	DOE	DOD	DOC	NASA	DOI	HHS	EPA	USDA
GRAND TOTAL	1940.79	456.09	329.90	74.43	415.85	7.60	67.15	41.71	513.09	13.37	21.60
Precollege Total	660.62	253.05	313.80	21.65	4.97	0.55	14.10	21.96	21.77	8.07	0.70
Teacher Preparation/Enhancement	358.53	97.30	239.00	6.20	0.63	0.25	5.57	2.06	5.15	2.37	0.00
Curriculum Development*	137.27	84.75	34.80	1.90	0.00	0.09	5.60	3.60	4.52	2.01	0.00
Comprehensive/Organizational Reform	57.57	47.55	0.00	6.40	0.00	0.00	0.28	0.50	0.60	2.04	0.20
Student Incentives	47.75	11.00	0.00	5.75	4.34	0.21	0.55	14.32	10.87	0.21	0.50
Other	59.50	12.45	40.00	1.40	0.00	0.00	2.10	1.49	0.62	1.44	0.00
Undergraduate Total	477.38	132.32	16.10	30.18	176.08	1.90	25.03	8.84	70.14	4.30	12.50
Faculty Preparation/Enhancement	42.36	27.55	0.00	2.40	0.00	0.00	9.65	1.84	0.02	0.90	0.00
Curriculum Development*	123.66	63.66	6.10	11.60	38.90	0.20	1.81	1.12	0.19	0.10	0.00
Comprehensive	47.65	14.95	0.00	3.85	6.80	0.00	1.68	0.53	6.34	1.00	12.50
Student Incentives	230.27	24.81	10.00	12.33	100.50	1.70	11.73	4.30	62.59	2.30	0.00
Other	33.44	1.35	0.00	0.00	29.88	0.00	0.16	1.05	1.00	0.00	0.00
Graduate Total	802.79	70.72	0.00	22.60	234.80	5.15	28.02	10.92	421.17	1.00	8.40
Predoctoral Fellowships	100.53	51.52	0.00	10.04	16.70	0.85	13.80	0.03	6.79	0.80	0.00
Predoctoral Traineeships	153.85	4.40	0.00	0.00	3.90	0.00	4.70	10.41	126.44	0.00	4.00
Postdoctoral Fellowships	100.08	9.85	0.00	10.05	10.50	3.35	9.10	0.48	52.15	0.20	4.40
Postdoctoral Traineeships	157.57	4.00	0.00	0.00	0.00	0.00	0.00	0.00	153.57	0.00	0.00
Other*	290.75	0.95	0.00	2.51	203.70	0.95	0.42	0.00	82.22	0.00	0.00

* includes program assessment and evaluation

dollars in millions

Education Level/ Major Program Areas	FY 1990	FY 1991	FY 1992 Request	Percent Increase for FY 90-92	Percent Increase for FY 91-92
Grand Total	$1466.09	$1715.70	$1940.79	32.4%	13.1%
Precollege	343.65	514.60	660.62	92.2%	28.4%
Teacher Preparation/ Enhancement	197.16	312.02	358.53	81.8%	14.9%
Curriculum Development*	68.26	107.69	137.27	101%	27.5%
Comprehensive Programs Organization Reform	38.89	39.51	57.57	48.0%	45.7%
Student Incentives and Opportunities	23.25	42.18	47.75	105%	13.2%
Other	16.07	13.24	59.50	273%	349.4%
Undergraduate	383.97	416.90	477.38	24.3%	14.5%
Faculty Preparation/ Enhancement	28.47	34.48	42.36	48.8%	22.9%
Curriculum Development*	92.07	108.58	123.69	34.3%	13.9%
Comprehensive Programs Organization Reform	32.28	37.46	47.65	47.6%	27.2%
Student Incentives and Opportunities	190.93	203.60	230.27	20.6%	13.1%
Other	40.23	32.79	33.44	-16.9%	2.0%
Graduate	738.46	784.15	802.79	8.7%	2.4%
Predoctoral Fellowhips	79.59	85.34	100.53	26.3%	17.8%
Predoctoral Traineeships	120.96	144.06	153.85	27.2%	6.8%
Postdoctoral Fellowships	106.09	100.02	100.08	-5.6%	0.1%
Postdoctoral Traineeships	148.80	161.67	157.57	5.9%	2.5%
Other*	283.03	293.06	290.75	2.7%	-0.8%

* includes program assessment and evaluation

dollars in millions