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THE WHITE HOUSE
WASHINGTON

October 24, 89

Mr. James C. Neal
Dear Sir:

Another of the teachers - grown
from Phillips Exeter prepared the
attached for the President. I think
that it should bring back some
very pleasant memories.

I leave it in your hands.
Thanks.

A. Van B.



POPPY BUSH
"Watch out, Exeter, we're going to win!"

Poppy Bush On First Will Lead P.A. Attack

Moher, Junior, To Play Second;
Asbury, Shortstop, Leads In Hits

THE WHITE HOUSE

WASHINGTON

October 25, 1989

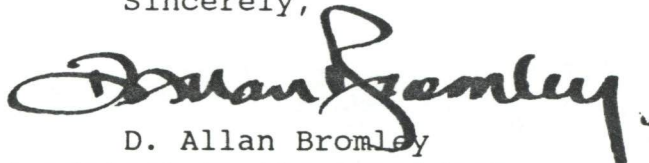
Dear Dr. Stafford:

I commend you and your business colleagues for forming the Science and Mathematics Booster Club in Boerne. It is only with the efforts of concerned citizens such as yourself, working with the local public schools, that we will be able to strengthen the mathematics and science education of our nation's youth.

Organizations similar to your club have found that the National Triangle Coalition offers an informative network. This coalition is operated from the headquarters of the National Science Teachers Association. If you wish further information, you may call (301) 220-0870.

With all best wishes,

Sincerely,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley". The signature is fluid and cursive, with a large, stylized initial "D".

D. Allan Bromley
Assistant to the President
for
Science and Technology

Dr. Frank Stafford
Science and Mathematics Booster Club
Post Office Box 1971
Boerne, Texas 78006

THE WHITE HOUSE
WASHINGTON

October 25, 1989

MEMORANDUM FOR JAMES W. CICCONI

FROM:

D. ALLAN BROMLEY

DOB

SUBJECT:

TEACHER AWARDS AND MEDALS OF SCIENCE AND
TECHNOLOGY

The enclosed memo to the President is not all that important but I thought he might like to know just how warmly his participation in these two recent affairs had been received.

I would ask you to transmit it as you think best.

Many thanks.

Enclosure

*P.S. Have just learned that we already have
copies of the President's remarks for distribution.
Thanks again.
DOB.*

THE WHITE HOUSE
WASHINGTON

October 25, 1989

MEMORANDUM FOR THE PRESIDENT

FROM:

D. ALLAN BROMLEY



SUBJECT:

THE SECONDARY SCHOOL TEACHER'S AWARDS

I wanted you to know that the 112 mathematics and science teachers have been ecstatic about their meeting with you and Mrs. Bush and the Vice President in the Rose Garden Tuesday morning. It was particularly gracious of Mrs. Bush to remain and shake the hand of each and every one present -- and very much appreciated.

The contrast with prior years has been noted repeatedly. Last year, for example, President Reagan chose to meet with the members of the Los Angeles Dodgers instead of the teachers. This group of teachers will spread the word about your very concrete interest in education and their work effectively and enthusiastically.

Many of them have asked if they might have copies of your remarks at the Rose Garden ceremony. They would, of course, appreciate receiving them from your office but if it would be more convenient, I shall be contacting each awardee soon in a follow-up letter and would be more than happy to forward a copy of your remarks, if you approve, with that letter.

I believe that we can consider that both the Medals of Science and Technology and the Excellence in Teaching Award activities to have been highly successful. Your generous participation was critical to that success and on behalf of all the awardees I want to thank you and Mrs. Bush for it.

THE WHITE HOUSE

WASHINGTON

DOMESTIC POLICY COUNCIL

Wednesday, December 20, 1989

3:00 P.M.

The Cabinet Room

AGENDA

1. President's International Environmental Initiative
2. Math/Science Education Plan



The Secretary of Energy
Washington, DC 20585

December 18, 1989

MEMORANDUM FOR: MEMBERS OF THE DOMESTIC POLICY COUNCIL

FROM: JAMES D. WATKINS
ADMIRAL, U.S. NAVY (RETIRED) *James D. Watkins*

SUBJECT: BRIEFING ON DEPARTMENT OF ENERGY INITIATIVE
IN MATHEMATICS AND SCIENCE EDUCATION

I appreciate the opportunity to brief the members of the Domestic Policy Council this Wednesday on an initiative in math and science education that our respective agencies can jointly undertake as one component of the President's comprehensive education reform program with the Nation's Governors.

Two weeks following the Charlottesville Education Summit, I co-chaired a Math/Science Education Action Conference in Berkeley with Nobel laureate Glenn T. Seaborg. One theme became dominant: for the Nation to compete in the technologies of the 21st century, we must bring the excitement of cutting-edge science into the classrooms of today's children, especially to young women and girls, minorities underrepresented in the sciences, and persons with disabilities; equip these children with the basic language of mathematics; and foster greater national scientific literacy for all Americans. There was universal consensus from business, academia and all levels of Government that without such an effort, the United States will have an inferior workforce compared to our economic competitors.

Two of the outcomes of that conference, consonant with both the goals proposed at Charlottesville and by the President's Office of National Service, will be the subject of my briefing to you on Wednesday. These proposals are:

1. To augment the current math and science teaching workforce by 10% by creating a highly qualified pool of adjunct teacher professionals drawn from the ranks of Federal and private sector scientific, engineering, and technical personnel, both active in their fields and retired;
2. To open the doors of Federal and private sector scientific and engineering facilities and field programs to our Nation's math and science teachers, so that each year at least 10% can participate in hands-on, state-of-the-art science and technology experiences that they can take back to their students and fellow teachers.

At our meeting on Wednesday, I will ask you to help design a Government and industry partnership program. To do so, each agency needs to conduct a technical assessment to determine the human and physical resources available to be utilized in this endeavor, so that together we may propose to the President a coordinated plan of action to be implemented by the summer of 1990. A similar assessment of private sector resources will also be necessary.

I look forward to our discussion and your comments.



Department of Energy
Washington, DC 20585

*Please see
page 4 for
mention of
Science Advisor*

MATH/SCIENCE EDUCATION ACTION CONFERENCE

**DRAFT
CHAIRMEN'S STATEMENT**

WORKING DRAFT

STATEMENT OF CONFERENCE CO-CHAIRMEN

PREAMBLE

The overarching goals motivating the following resolutions are:

- (1) To ensure that by the year 2007 the students who complete a K-12 education in the United States will be the best in the world in their knowledge of mathematics and science and that a significantly greater number of American students, particularly women, minorities, and disadvantaged, will complete this education.
- (2) To ensure that the Nation's math and science teaching professionals achieve their rightful place as full-share partners in the scientific community and to empower them to prepare this generation of children for lives of discovery in the 21st century.
- (3) To ensure that the Nation has an adequately-prepared, technologically-capable, diversified work force in the 21st century.
- (4) To ensure that the full and continued utilization of available resources from Federal, State, and local agencies, business and industry, community-based organizations, and other public and private agencies is brought to bear upon improving math and science education quality and increasing access.
- (5) To ensure that actions are taken to instill in youth and adults the excitement and promise in research, development and application of math, science and technology frontiers and that the mass media, communities, families, and public and private resources be mobilized to accomplish and sustain this purpose.

STATEMENT OF RESOLUTIONS

The Department of Energy will take the initiative to work with other Federal agencies, the White House, the Congress, the Governors, State legislators, State education departments, corporate leaders, national associations representing school boards, principals, teachers and administrators, universities, parents, and the public to promote the following actions by the start of the school year 1990-91:

- (1) Pursuant to the long-range objective of achieving a core of outstanding qualifications in the teaching of mathematics and science, provide high-quality math/science staff development training to 10% of the Nation's teachers, initially targeting teachers of the earliest grades. This program will be expanded in the ensuing years so that by the year 2000, enhancement programs have touched all K-12 teachers in the Nation and the ethic of continuous retraining is accepted.

(2) Increase the number of teachers entering the math and science teaching pipeline by developing ways to streamline credentialing and promote alternative certification programs for students in college and for individuals changing careers.

(3) Assist and supplement the current math/science teaching force by 10% by preparing a pool of qualified people drawn from laboratories, business, retired executives and professionals, and other individuals with unique educational and scientific expertise. This can be accomplished through expert volunteerism and with the cooperation of industry and universities.

(4) Utilize the Department of Energy's resources to create a national model for Federal agency and industrial partnerships to revitalize math/science education in targeted school districts. For school year 1990-91, selected urban and rural districts are targeted for a long-term, sustained commitment of service by DOE National Laboratories:

- o Through the Argonne National Laboratory and the Fermi National Accelerator Laboratory, DOE will work with the Chicago Public Schools and the Chicago business community to implement a national model of urban partnerships to improve math/science education and upgrade the skills of teachers in that district.

- o Through the Lawrence Berkeley Laboratory, the Lawrence Livermore National Laboratory, the Sandia National Laboratories and the Stanford Linear Accelerator Center, DOE will establish a similar program with the Oakland Public Schools in cooperation with the Lawrence Hall of Science.

- o Through the Pacific Northwest Laboratory, DOE will establish partnerships with the Seattle, Portland and Yakima Valley School Districts to target black, Hispanic and Native American students.

- o The Oak Ridge Associated Universities and the Oak Ridge National Laboratory will establish partnership programs with the Chattanooga and Roane County, Tennessee, school districts targeting urban minority and rural children.

- o The Los Alamos and Sandia National Laboratories will establish a middle school teacher enhancement program through which the region's student population, largely Hispanic and Native American, will be more effectively reached.

- o The Idaho National Engineering Laboratory will work with rural school districts in the Intermountain West, initially starting with Idaho school districts, to target rural students lacking access to adequate science lab facilities.

Building upon what is learned from the first year of implementation, DOE will add more partnership programs with urban and rural districts each year.

(5) Utilize the unique scientific opportunity presented by the development of the Superconducting Super Collider to make science education a fundamental part of the SSC mission, and, in partnership with the State of Texas and the private sector, put in place the most advanced education and communications technology to link teachers and students directly to science research.

(6) Endorse the goal of the President's Education Summit with the Governors to establish a national consensus on what students need to know and by what age they should know it and work with the Governors to develop and further this consensus in the areas of math and science, building on the recent work of the American Association for the Advancement of Science, the National Council of Teachers of Mathematics and the National Science Teachers Association.

(7) Assemble an inventory of successful math/science education partnership programs involving DOE National Laboratories and other partners and disseminate it to other Federal agencies, the White House, the Governors, State legislators, State education departments, corporate leaders, national associations representing school principals, teachers and administrators, and the public.

(8) Increase by X% the number of students taking chemistry, physics and advanced mathematics courses in our Nation's high schools.

(9) Work with the education community, the mass media, parents and the public to build the understanding that all children must and can learn math and science, and to increase the base of math, science and technology literacy in the Nation.

(10) Encourage out-of-classroom, hands-on science experiences with the goal of making them available every year to all children in the Nation's schools by the year 2000.

(11) Address the serious deterioration of facilities and equipment in our Nation's schools by reviewing the Federal laboratory inventory to identify resources that can be made available to schools and assisting in their placement.

(12) Work with the National Aeronautics and Space Administration, other Federal agencies, and scientific and education associations to provide science educators with access to an on-line computer data base with information on new and innovative math-based instructional materials and classroom experiments.

(13) Recognize that the ultimate solution to the human resource and science literacy needs of the Nation, and particularly women and minorities, is science education for everyone, every year, K-12, making science a part of the core curriculum in our schools.

(14) Set in place an effective assessment and monitoring process by which the programs initiated by these resolutions can be continually evaluated.

IMPLEMENTING STRUCTURES

(1) The Conference Co-Chairmen will support and assist the President's Science Advisor as he takes the following actions:

- o Convene and chair an interagency committee, under the Federal Coordinating Council on Science, Engineering and Technology (FCCSET), in coordination with ongoing Presidential Cabinet Council working group activities, to produce agreements among the Federal departments and agencies for major, national public and private math, science and technology education partnerships, building upon the DOE model and working with the Nation's Governors.

- o Direct this interagency committee to work with appropriate Federal agencies, including the Department of Education and the National Science Foundation, and the Governors, to refine and disseminate the national consensus on curriculum in the areas of math and science. Additionally this committee will work toward developing national standards for measuring the Nation's progress each year toward meeting these goals.

- o To the extent consensus can be developed, take these initiatives forward to the President and request an Executive Order directing all appropriate Federal resources carrying out research and development missions to include math/science education as a core part of their formal missions.

(2) DOE and the business community will establish a steering committee to marshal resources, monitor progress in implementing action projects, coordinate DOE and private sector efforts, and initiate expansion of successful projects to other Federal agencies. This committee will also:

- o Work with the Department of Education and the Governors, State boards of education, teacher associations, teacher training institutions and other appropriate bodies to develop ways to streamline credentialing to enable math/science experts to become teachers without delay.

- o As an adjunct to ongoing programs, expand summer employment opportunities for teachers in both Federal and private sector laboratories to make teachers full-share partners in the Nation's scientific community, to provide needed augmentation of their salaries and to upgrade their skills.

- o Develop a model teacher demonstration laboratory at each National Laboratory.

- o Establish local math/science community alliances (DOE facilities, other government facilities and industry) in 10% of the Nation's school districts over the next twelve months. These alliances will meet with local teachers, administrators, PTAs, churches, civic organizations, and the business community to identify local needs, set local goals, identify successful programs, and adapt these programs to local conditions.

- o Develop a minimum of ten pilot programs through National Laboratories and teams of teachers to deliver inter-generational math and science experiences to Head Start and other early childhood programs.

(3) The work of the President's Youth Entering Service to America is essential to attaining the goals of science and math literacy. The Science Advisor's interagency committee will work with the White House Office of National Service to develop a plan to increase the numbers of students participating in community service projects in science.

- o The Office of National Service will designate math/science education as a priority for community service. For example, mentoring of elementary and middle school students by college and high school students is a proven way to harness community service to improve math and science skills.

(4) The Secretary of Energy will serve as a member of the Education Commission of the States task force on improving science and mathematics education through State actions. This task force will link States to national and Federal resources, suggest strategies and policy options to States to restructure their education systems, and improve science and mathematics education.



Department of Energy

Washington, DC 20585

REPORT ON
DEPARTMENT OF ENERGY
SCIENCE AND ENGINEERING EDUCATION PROGRAMS

SUBMITTED BY

THE HONORABLE JAMES D. WATKINS
ADMIRAL, U.S. NAVY (RETIRED)
SECRETARY OF ENERGY

AT A HEARING ON

MATHEMATICS AND SCIENCE EDUCATION

BEFORE

THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

MAY 24, 1989

2318 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, D.C.

SUBMITTED TESTIMONY OF

THE HONORABLE JAMES D. WATKINS
ADMIRAL, U.S. NAVY (RETIRED)
SECRETARY OF ENERGY

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Mr. Chairman, and Members of the Committee, I am pleased to address the Committee on what I believe is one of the most serious problems facing the United States over the next ten years; namely, the declining quantity of young Americans, including minorities and women, interested in pursuing careers in science, mathematics and engineering, compounded by the often woefully inadequate preparation received by young students interested in such careers. Much of my career has been concerned with how we can best encourage and prepare our young people for careers in an increasingly complex and technologically driven global society. Given the important mission the Department of Energy carries in science and engineering education, one of my challenges as the Secretary will be to do what I can, both personally and through the Department, to improve science education in our nation.

History

DOE has had a long tradition of support for and involvement in science education, going back to the very earliest days of the Atomic Energy Commission (AEC). This tradition of support has not been fully recognized or appreciated, however, outside of the Department's own network of National Laboratories and university grantees. For example, AEC was one of the first Federal agencies to support graduate research fellowships in key scientific areas such as nuclear medicine, that have had enormous benefit to mankind, and in important engineering disciplines that have enabled America to remain at the cutting edge of technology worldwide. Many of today's scientific and technical leaders in the energy industry, the National Laboratories and the university community began their research careers with graduate student support from the AEC. Support was provided by the AEC for undergraduate student summer research and for related faculty research beginning in the late 1950's. Some precollege student and teacher science education programs were initiated in 1962 by AEC. This tradition of support for science education continues today at DOE.

The Department of Energy's Mission in Science and Engineering Education

The Department of Energy is uniquely positioned to provide major assistance to the national effort to strengthen science and engineering education. For example, several of our laboratories are "Centers for Excellence in Science Education," and it is our

plan to expand that program and include the site of the Superconducting Super Collider as one such center. Our efforts complement those of the National Science Foundation and the Department of Education, state and local governments and the education community by providing students and their teachers with "hands-on" research experiences in ongoing, cutting edge scientific and technical research. The Department is providing such assistance today, and we will do even more in the future.

Before I describe the Department's current programs in science education and our plans for the future, let me place this in the context of the Department's overall responsibilities and missions. Simply stated, the missions of the Department of Energy are to support fundamental scientific research on energy and matter, carry-out energy-related research and technology development in specific technical areas, conduct research and engineering development related to national security and ensure that all DOE programs are carried out with specific attention to environmental and public health concerns.

Budget Authority and Laboratory Resources

Collectively, DOE is a significant national resource in science, mathematics and engineering. Our FY 1990 budget request is for \$15 billion in budget authority, including \$6.2 billion in science, energy and defense-related R&D and an additional \$7.3 billion in engineering development work related to national defense production and support, environmental restoration and waste technology.

In order to carry out these missions, DOE is both a user and a patron of a large fraction of the nation's scientists and engineers. The Department manages a complex of over 50 contractor-operated research laboratories employing in excess of 135,000 people.

Within this complex, nine multiprogram National Laboratories and thirty specialized laboratories carry out much of the Department's fundamental scientific research and energy technology R&D and all of the Department's national defense-related R&D. These latter facilities account for slightly more than 40% of the Department's total field budget and employ over 60,000 people, more than half of whom are scientists, engineers and technicians. DOE, through its National Laboratory and university performer base, is responsible for research in almost every scientific and technical discipline.

Our ability to meet the many pressing challenges facing the Department today and in the future will ultimately depend on the scientific creativity and technical skills of our workforce. All science-based agencies and organizations, whether public or

private, must redouble their efforts to attract more young people into scientific and technical careers and to ensure that they receive the highest quality education and training possible. I now would like to describe in some detail DOE's current support for science education, addressing in turn the Committee's questions in the charge letter, and then discuss additional steps we plan to take in the future.

Historic Focus: Graduate and Postdoctoral Education

The historic focus of DOE support for science education has traditionally been at the graduate and postdoctoral levels. The principal means by which this is accomplished is through the support of university research by DOE which totals approximately \$400 million in FY 1989. This support also funds the participation of 3500-4000 graduate students. In recent years, expanded support has also been provided for precollege and undergraduate-level science education programs. For reference by the Committee, I am attaching a list of the current precollege and undergraduate science education programs supported by DOE, many of which will be discussed further in the following section. I am also attaching a schematic showing where our current programs are targeted on the education pipeline.

What underlies all of our science education efforts is the belief that it is essential to extend the classroom experience by exposing young students to real science as early as possible in their careers.

DOE support for science education includes both formally funded programs as well as a vast range of volunteer and informal assistance provided by many thousands of DOE-supported scientists and engineers to local schools and colleges. Science education is everybody's responsibility in the Department. I am directing both Department and contractor staff to redouble their efforts in supporting both formal and informal science education activities.

A central organizational focus for DOE's formal support of precollege and undergraduate science education programs is provided through the Office of Energy Research, specifically the University Research Support Program. In FY 1989 approximately \$12 million will be provided through this program for precollege and undergraduate science education.

An additional \$13 million is also provided by DOE for programs with Historically Black Colleges and Universities and other minority institutions, almost all of which is directed at the undergraduate level.

I. DEPARTMENT OF ENERGY PRECOLLEGE SCIENCE EDUCATION PROGRAMS

The strength of DOE's precollege science education programs lies with the scientists and engineers who work for DOE in universities and the National Laboratories. Exposing students and their teachers to "live science" in a research laboratory can ignite the interest and intellectual curiosity of the students and can vitalize and revitalize teachers and the members of the teaching profession. Even informal encounters with research scientists and engineers can be pivotal in stimulating young people to pursue careers in science and engineering. Therefore, the Department's current precollege science education programs focus on:

- > Encouraging more young people to enter into and stay in the science/engineering manpower pipeline; and
- > Strengthening the capabilities of precollege science teachers to motivate and excite young students about the opportunities and challenges of scientific and technical research.

The Department's precollege programs are:

PreFreshman Engineering Program (PREP). The PREP program provides support for summer enrichment institutes on engineering and related subjects for women and minority 7th to 10th grade students. These institutes are conducted on-campus and provide the participants with a number of pre-engineering enrichment experiences including laboratory work, field trips, career counselling and tutoring in mathematics. The overall purpose of PREP is to encourage the young participants to consider careers in engineering and related fields.

Over 2000 students participate in PREP projects located at campuses across the country. Statistics indicate that over the years 60% of the student participants have historically enrolled in college-level engineering or science programs. Some individual PREP projects have reported that over 80% of their participants have gone on to major in engineering or science in college. The project director of the PREP effort at Case Western Reserve University reports that 97% of the former PREP participants are now in college and 72% have enrolled in engineering.

One former PREP student's experiences are typical of what has happened to many of the participants in this program. Ms. Julia Mireles from San Antonio, Texas was a former participant in the PREP project at the University of Texas, San Antonio. She

has since completed a degree in chemical engineering from Texas A&M University and is now employed as a chemical engineer by the City of San Antonio. She credits her PREP experience with helping her realize that engineering was exciting and for her.

High School Student Research Apprenticeships. The Apprenticeship program is conducted at five DOE National Laboratories and is designed to motivate freshmen and sophomore high school students to pursue scientific or technical careers. The Apprenticeship program centers around laboratory research experiences along with counselling and tutoring. About 130 students (over 90% are women and minorities) are involved in this program each year at the participating laboratories.

International Science and Engineering Fair. Each year DOE, along with many other Federal agencies and private companies, participates in the annual International Science and Engineering Fair. This Fair involves over 2000 high school science students who have prepared exhibits on science-related research projects. DOE selects the top ten energy-related science exhibits and awards the winning students, along with their teachers, a week-long research and educational experience at a DOE National Laboratory. In 1989 the student winners will spend a week at the Idaho National Engineering Laboratory learning about the many exciting technical challenges we face in nuclear power technology.

DOE High School Science Student Honors Research Program. Beginning in 1985 DOE has provided opportunities to the nation's very best high school science students to participate in hands-on summer research at DOE laboratories. Students are selected for participation in this Honors Research program by the Governors of the respective states (including Puerto Rico, American Samoa and the District of Columbia). During the summer of 1989 there will be seven individual Honors Programs with 374 students participating.

Each of these programs concentrates on a different area of science as follows: synchrotron radiation research (Brookhaven); life sciences and genetics (Lawrence Berkeley); supercomputers and computational science (Lawrence Livermore); environmental research (Oak Ridge); materials sciences including superconductivity (Argonne); particle physics (Fermilab); and marine and semi-arid ecosystems (Pacific Northwest Laboratory). All of the former participants in the Honors Program have gone on to college. Over 75% are proposing to major in science or engineering with the remainder split among law, business and medicine. Many of the former Honors students return each summer to a DOE laboratory to continue their research experiences.

Alan Fry from Pocatello, Idaho was in the first class of DOE Honors students in 1985 at the Lawrence Livermore National

Laboratory. Alan is now majoring in physics at the University of Utah and has spent each subsequent summer at Livermore working in such areas as computational physics, designing X-ray spectrometers and participating in high energy physics research. Alan returns to Livermore once a month during the current academic year to work on an individual research project for his senior honors program at the University.

High School Science Teachers Research Associates Program. High school science and mathematics teachers are nominated by each State to participate in a special eight week summer research program at selected DOE National Laboratories. We expect 150 science teachers in this program this summer. Each teacher will serve as a participating member of a laboratory research team and will use this experience to develop supplemental materials and experiments for use in the classroom. Many of the teacher participants will also be awarded graduate-level credit by regional universities for participating in this program. The experiences of one high school science teacher illustrate the benefit and implications of this program.

Pat Ehrman, a biology teacher at Davis Senior High School in Yakima, Washington used his summer research assignment at the Pacific Northwest Laboratory to develop a unique junior-level course in microbiology. The students in this course conduct university-level research including gene splitting and identification. Pat will spend the coming summer at the Lawrence Berkeley Laboratory further refining this course for eventual dissemination to other high schools across the country. Pat was also a 1988 Presidential Award Winner from Washington for excellence in science teaching.

One of the underlying motivations in our support for the Teacher Research Associates Program is to help remind science teachers that they are full members of the broad scientific and technical community. Precollege science teachers tend to be isolated from new developments in their disciplines within a few years after they leave college. They have few opportunities for keeping current in their fields or for developing the kind of collegial relationships with research scientists that can help enhance the status of the science teaching profession. This program helps reinvigorate these front line warriors in science education.

We also view the program as providing a great return on investment. It is estimated that every teacher we train reaches at least 150 students during the following school year, and 150 additional students each subsequent school year. Through this "multiplier effect," the science and engineering information and expertise can be widely disseminated.

Middle School Nuclear Energy Curriculum. In response to numerous requests from middle school teachers for information on nuclear energy, the Department's Office of Nuclear Energy has developed a complete nuclear energy curriculum designed for use at the sixth through eighth grade levels. Titled "The Harnessed Atom," this curriculum consists of reading lessons for students, a teacher's guide and a filmstrip with audiotape. The curriculum covers the basic principles of nuclear fission and deals with some of the common misconceptions about nuclear power. The curriculum kit is currently being distributed to teachers around the country both directly and through the voluntary efforts of many utilities, industrial organizations and professional societies.

Museum of Science and Industry. The Department recognizes the importance of informal, out-of-school activities in science education, and to this end, we are currently involved with the renovation of a major science and energy exhibit at the world-renowned Museum of Science and Industry in Chicago. This facility hosts school children from Chicago area schools. The renovated exhibit will include a new presentation on solar photovoltaic technology, featuring a 1.5 kilowatt state-of-the-art solar cell array donated to the Museum by private industry. The overall exhibition will also include teaching materials and other resources designed specifically for use in inner-city schools.

Informal Precollege Science Education Programs. The programs I have just listed are national DOE initiatives funded through the University Research Support Program. In addition to these formal efforts, there is a range of informal, volunteer-based science education activities carried out at each DOE laboratory and research contractor.

A survey conducted last year for us by staff at Fermilab indicated that there were over 200 individual precollege efforts underway at 23 DOE facilities involving 13,000 teachers and over 130,000 students. These efforts included in-house tours, visits and demonstrations at the laboratories for elementary and secondary school students and teachers, direct classroom instruction and assistance at local schools, science fair sponsorship and judging, teacher workshops and institutes, research participation programs and a number of special events centering around the annual National Science and Technology Week celebration.

For example, the Lawrence Berkeley Laboratory hosted 500 San Francisco Bay Area science students and teachers in a program on Global Climate Change on April 25 of this year while DOE Headquarters brought in 300 local area teachers and students on April 26 for a half-day of discussions and presentations on DOE programs in superconductivity, the human genome and particle

physics. Four hundred students and their parents also participated in a program at the Fermi National Accelerator Laboratory led by local high school science students who performed a series of scientific demonstrations in a program titled "The Wonders of Magic and Science."

I also want to note how seriously we take the national "Adopted School" effort which is part of the President's Partnerships in Education Program. DOE laboratories and research contractors have formally adopted a number of local elementary and secondary schools over the last several years. For example, Oak Ridge National Laboratory has "adopted" the science departments at each of its local area high schools. Here at Headquarters, we have adopted Woodrow Wilson Senior High School in Washington, D.C.

These adopted school programs include such activities as DOE employees providing student tutoring and counseling, science fair judging, classroom lectures and assistance, summer research internships for teachers and students, support for extra-curricular science and math clubs, computer time and surplus equipment and materials loans.

I plan to significantly expand the Department's participation in the national adopt-a-school effort, including going beyond individual schools and working with entire school districts.

II. DOE UNDERGRADUATE SCIENCE EDUCATION PROGRAMS

The Department's support for undergraduate science education also is centered on providing students and faculty members with the opportunity to participate in "hands-on" research at DOE facilities. Undergraduate students are particularly important since experiences in participating in state-of-the-art scientific research directly influence their specific career choices in scientific and technical fields.

Specific programs in undergraduate science education are as follows:

Undergraduate Student Summer Research Participation Program.

Each summer approximately 1100 undergraduate science and engineering students are competitively selected to spend a summer conducting research at DOE laboratories and research facilities. About half of these participants are from small, predominantly undergraduate institutions. The students work as members of laboratory research teams, often in conjunction with university faculty members. Student research assignments are carefully

selected and monitored to ensure they are meaningful and at an appropriate professional level.

Evaluations of this program indicate that 90% of the participants go on to receive advanced degrees in science or engineering and that 65% of the participants indicate that their research participation experience greatly influenced their choice of career specialization.

These experiences can change lives as well as careers. Jeronimo Garay spent his days picking lettuce in the California Imperial Valley and his evenings in night school at a local community college. He was provided an opportunity to spend a summer at the Lawrence Berkeley Laboratory with a DOE research appointment from the Associated Western Universities. This experience led Jeronimo to apply to and be accepted by the University of California at Berkeley for full-time study in chemical engineering.

Science and Engineering Research Semester for Undergraduates.

The National Laboratories provide an ideal environment in which to place a science or engineering student attempting to determine a career path. Six of DOE's multipurpose laboratories (Argonne, Brookhaven, Lawrence Berkeley, Los Alamos, Oak Ridge, and Pacific Northwest) make their resources available to undergraduate juniors and seniors for use during the academic year.

The DOE Science and Engineering Research Semester program is a national competitive activity which provides semester-length research opportunities for junior and senior college students majoring in science, mathematics or engineering.

In FY 1989 over 300 students will participate in this program from universities and colleges across the country, many of which are small non-doctoral degree institutions. Each student participates in an on-going research program at the host laboratory and learns to use sophisticated, state-of-the-art scientific equipment.

An example of the kind of research in which the students participate is high-temperature superconductivity. The students work directly with chemists, solid state physicists, materials engineers, thin-film specialists, and x-ray crystallographers. These research teams are on the cutting edge of technology, and provide a stimulating and unmatched research experience for the students.

Undergraduate Student Research Projects. It is exciting to note how many young undergraduate science and engineering students are already capable of performing innovative research projects on their own, given the opportunity and the resources to do so.

One major example of this is the recent Methanol Marathon competition co-sponsored by the Department of Energy and the Society of Automotive Engineers. This project was established to foster the use of alternative fuels by supporting vehicle competitions among engineering students. Student teams were selected from fifteen engineering schools for the 1989 competition.

Each student group was given a new Chevrolet Corsica, donated by the General Motors Company, some elaborate computer hardware, and a methanol tolerant fuel tank. The students modified the Corsicas to optimize the use of methanol as an alternative fuel. All fifteen teams then competed in an 1100 mile road rally, with each team's entry rated on performance, fuel economy, acceleration, and rally times. The 1989 winning group was from the University of Tennessee.

Through this project, DOE stimulated 200 talented and eager engineering students and their university faculties to study the use of alternative fuels. Since each of the schools will retain their Corsica for future use and modification, we have also in a sense created fifteen new research facilities with the capability of future alternative fuel use study.

Faculty/Student Research Teams. DOE encourages faculty members, particularly at smaller institutions, to spend a summer or an academic year conducting research at a DOE facility along with one or more of their undergraduate students. There will be thirty faculty/student research teams at five different DOE laboratories this summer. These teams are important links between DOE laboratories and individual colleges. Faculty members tend to return each summer to the laboratory to continue their research bringing along a new group of students. Several campuses have made the faculty/student team program a major recruiting point with prospective students.

Used Energy-Related Scientific Equipment Program. Based on the legislation which established the Atomic Energy Commission, DOE has the authority to grant title to excess DOE-owned laboratory research equipment to universities, colleges and other non-profit institutions.

Over the years, this program has served as an important source of laboratory equipment for many smaller colleges and predominantly minority institutions. The equipment is awarded on a "first-come, first-served" basis. Information on available equipment is provided on a monthly basis in both a printed catalog and on a dial-up computer information system. The equipment can be used by the recipient institution for either research or instructional purposes with no prior or current DOE contracts or grants required.

There are times when a used research equipment grant can help refocus an institution's research and education programs. St. Cloud State University in Minnesota recently received title to an electron microprobe from the DOE Mound Laboratory. This microprobe is now used in a new minerals research program serving the entire upper Midwest.

Laboratory Outreach to Small Colleges and Universities. The DOE laboratories also provide a range of technical assistance and support to small regional colleges and universities. This can range from providing laboratory scientists as guest lecturers and adjunct faculty to advising on the set-up and maintenance of research equipment and instrumentation.

The Argonne National Laboratory has established a Regional Instrumentation Center where faculty and students from Midwest colleges can come to Argonne to use certain specialized instruments not normally found on many small campuses. This is in addition to the operation by Argonne and other DOE laboratories of major scientific user research facilities including synchrotron light sources, pulsed neutron facilities, electron microscopes, and environmental research parks, all of which are available for use by the scientific community.

III. MINORITY EDUCATION PROGRAMS

DOE Historically Black College and University Program. DOE is committed to strengthening the capabilities of the Historically Black Colleges and other minority institutions to participate in and contribute to the national research and education effort. DOE will provide approximately \$13 million in FY 1989 to Historically Black Colleges for research and related education projects. This includes support for programs at both two and four-year colleges.

For example, the DOE Office of Minority Economic Impact has established a nationwide program in energy related technologies at eight two-year colleges. These technologies include computer sciences, electronics, and robotics. Support is provided for student assistance in the form of scholarships and tuition costs. Special attention is paid to recruiting and retaining students.

The Department also places strong emphasis on developing close and formal relationships among minority colleges and DOE research laboratories. Currently, there are 15 formal cooperative agreements between DOE laboratories and minority colleges. These agreements encompass such cooperative efforts as faculty and student research internships at the laboratories, technical assistance from the laboratories in the establishment of research programs and facilities at the minority schools,

access to laboratory computers and specialized research equipment, collaborative research between laboratory and university researchers, and precollege minority student and teacher programs.

Examples of these formal relationships include:

DOE National Laboratory
Lawrence Berkeley

Lawrence Livermore

Oak Ridge

Pacific Northwest

Argonne

Minority College/University
Jackson State University
Turabo University (Puerto Rico)

Alabama A&M University

University of Puerto Rico

Southern University, Baton Rouge

Chicago State University

Also, the unique "Science and Alliance Program" involves three DOE laboratories and three minority institutions: Sandia, Los Alamos, and Oak Ridge National Laboratories, and New Mexico Highlands University, North Carolina A&T State University and Turabo University in Puerto Rico.

One of the unique features of the participation of the universities in Puerto Rico in this program is the support being provided by the Carnegie Corporation of New York for an extensive precollege science enrichment program involving over 300 junior and senior high school students each year. The students spend each Saturday at one of the universities participating in laboratory research, and each summer working on a research project. Over 95% of the graduates from this very special program have gone on to college, many on scholarships to mainland universities.

The joint program between the Pacific Northwest Laboratory and Southern University also has a precollege component. Financial and technical assistance is provided through the Laboratory to the University's Engineering Summer Institute and Retention Program. This effort is designed to introduce junior and senior minority high school students to careers in science and engineering and to provide engineering students with tutors once they enroll at the University.

Over time all of these formal relationships will greatly enhance the capabilities of these schools to participate in advanced scientific research and to better prepare their students for careers in science and engineering.

IV. DOE LABORATORIES AND SCIENCE EDUCATION

The DOE National Laboratories and research contractor labs form a national and regional network covering a spectrum of science education programs from elementary school to postdoctoral research, and are central to the Department's support for science education. Their range of activity includes outreach to early school years to stimulate and nurture interest in science, special programs at the upper precollege level to give students and their teachers a taste of "live science," and intensive research experiences for university students and faculty.

There are few places in this country that can equal the range of science education opportunities and resources available at a major DOE multiprogram National Laboratory -- "big science," disciplinary and multidisciplinary research, individual investigator and team research -- all coupled with world-class scientific facilities, equipment and technical support resources.

Even though thousands of scientists are currently involved in education-related activities, the potential of these laboratories to provide major assistance to precollege and university science education has only been partially realized, and these efforts will continue to be expanded as part of the Department's commitment to science education.

Several of our laboratories have been designated as "Centers for Excellence" in science education. As stated earlier, the Department is designing the site of the Superconducting Super Collider in Texas as a National Center of Excellence in Science, Engineering and Mathematics Education. The SSC will be a national symbol of pride and excellence in U.S. science and technology, and can also serve as a "real-time" window into science, engineering and math for school children and their teachers, as well as college faculty and their students.

We view the SSC as a learning laboratory throughout its planning, construction and operational stages. The SSC facility will host school tours, sponsor conferences and workshops for science teachers, conduct summer science camps for young students, serve as a "hands-on" research laboratory for undergraduate and graduate students in such disciplines as geology, mining and civil engineering, electronics and electrical engineering, environmental science and socioeconomic disciplines. We will also look at the feasibility of linking the SSC when it becomes operational to schools and colleges across the country through remote access telecommunications technology. We plan to do all of this in a working partnership with the State of Texas, the SSC operating contractor, and professional societies and associations of science teachers.

V. PROGRAM EVALUATION EFFORTS

All of the Department's science education programs discussed above has a built-in and long-term evaluation component. Students who participate in our Honors Research Program will be tracked for at least five years beyond their participation to see what impact this research experience has had on their academic and career choices. Teachers participating in our summer research program will be periodically surveyed to see how their teaching skills and scientific knowledge has been enhanced.

Each year we carry out a five-year retrospective assessment of one of our major undergraduate or faculty programs wherein we see what has happened to an entire cohort of participants in these programs--degrees obtained, research initiated, careers refocused or changed, publications and so forth. We are also working towards the establishment of a major and ongoing data base of all the participants in our various science education efforts. Our goal is to ensure that students who enter into the DOE network of programs even as early as the middle school years are periodically informed of other opportunities facing them with DOE as they move on up the education pipeline.

Based on these evaluation efforts we believe that several of our programs have been particularly successful including the summer undergraduate and faculty research participation programs and the High School Honors Research Program. Other efforts, including the teacher research participation program and the Science and Engineering Research Semester Program, have only recently been initiated, and it will be several years before we have data sufficient to measure success. The scientific literature tells us, and anecdotal evidence confirms, however, that direct involvement in advanced scientific and technical research is a major influence on career choices and research specialization.

VI. COORDINATION WITH OTHER FEDERAL AGENCIES

The Department of Energy and the National Science Foundation co-chair a formal precollege and undergraduate science education coordinating committee, co-managed by the NSF Assistant Director for Science and Engineering Education, Bassam Shakashiri, and Director of Field Operations Management in the DOE Office of Energy Research, Toni Grayson Joseph. NSF and DOE are collaborating on several precollege science education initiatives. NSF is currently reviewing a proposal from a consortium of six DOE laboratories for a research and instructional program for

intermediate school science teachers. This program would be a companion effort to DOE's support for high school science teacher research appointments. NSF has also provided support over the years to precollege teacher programs and instructional materials development efforts at such DOE laboratories as the Lawrence Livermore National Laboratory, Fermilab, the Oak Ridge Associated Universities, Los Alamos National Laboratory and the Brookhaven National Laboratory.

DOE has established a good working partnership with the Department of Education regarding the implementation of Title II of the Education for Economic Security Act, specifically the Mathematics and Science State Grants Program. DOE staff work closely with the State Science Supervisors in each State in their nomination and selection of high school science teachers and students for participation in our laboratory research programs. The teachers selected for the DOE programs may also seek support from their own state science education offices for follow-on activities including in-service training and dissemination of information and materials developed during their research assignment at the DOE laboratory.

Finally, the Department of Education recently provided \$322,000 in support of a unique materials sciences technology program created by the DOE Pacific Northwest Laboratory and the Richland Washington School District. These funds will be used to distribute the materials developed in this program to other secondary schools in the Pacific Northwest and to bring science teachers to the Laboratory for training their use.

In addition, there are ongoing periodic meetings at the staff-level among the various science agencies on science education support, so that each agency is aware of the successes of the others and also so that they can avoid any undesired duplication of effort.

VII. DISSEMINATION OF INFORMATION ON DOE SCIENCE EDUCATION PROGRAMS

Good staff contact exists among all the Federal science agencies for the exchange of information on science education programs including model efforts. Periodic meetings are held to update agency staff members on new or proposed science education activities. Even though DOE has been actively involved in science education programs, private industry and the education community at large are not fully aware of that involvement. This is something the Department intends to correct. The last comprehensive published description of the Department's university and science education programs was produced in 1986. A number of new initiatives have begun since then and we will

publish a new description of our programs by the end of this year.

We also plan to sponsor a workshop next year in conjunction with NSF to review different models of precollege teacher research participation programs. We expect a number of industrial and university groups to be represented at this meeting along with our own laboratories.

VIII. FUTURE EXPANSION AND DIRECTION OF DOE SCIENCE EDUCATION PROGRAMS

I am pleased with what the Department has accomplished in science education to date. I am convinced we can do far more. This is particularly true with respect to the earlier years of education before young students, especially women and minority students, decide to "drop out" of the science pipeline either consciously or unconsciously. We need to encourage young students to keep their career options open as long as possible and not foreclose on what can be exciting, challenging, and personally rewarding careers in science and technology.

Over the next year I plan to significantly expand the Department's involvement in science education including increasing the number of young students supported in our Prefreshman Engineering Program to 6000 students per year by 1991 and providing additional resources to our National Laboratories for local, regional and national programs at the precollege and university level.

The Department will also become deeply involved in the effort led by the National Academy of Sciences to revitalize precollege mathematics education. A new graduate research fellowship program will be initiated to especially encourage young women and minority students to pursue graduate research. Support will be provided in cooperation with other agencies and private foundations to encourage science and engineering students to become science teachers at the elementary or secondary school level. The Department's role in this effort would be to provide these new teachers with continuing opportunities to participate in ongoing research at one or more DOE laboratories.

Beyond these immediate efforts, I want to work closely with other Cabinet Officers, the President's Science Advisor, the Director of the National Science Foundation and the Administrator of NASA to develop a major national effort involving all of us focused on the middle school years. These are the most critical years for young students in developing career interests. I would also like to see all of us work together, along with our colleagues in the private sector, to see what can be done in

those major urban school districts that are so heavily populated with minority students. Each agency brings unique capabilities and resources to focus on the problems and needs in science education. Working together, perhaps under the leadership of a new interagency coordinating council on human resources, we can do far more for the nation than working separately.

IX. SCIENCE EDUCATION CONFERENCE

To this end, I am planning to co-host with Dr. Glenn Seaborg a conference this October 9th and 10th at the Lawrence Hall of Science in Berkeley that will involve the Federal science and education agencies and our private sector counterparts. This will not be a conference to simply review the reasons behind our current crisis in science education -- there have been over 300 studies concluded to date on this subject. Rather, this will be a conference to agree on a coordinated and clearly focused plan of action that can produce specific, measurable results over the next five years.

I will keep this Committee informed as plans for this conference progress, and will also relay to you the conference results.

Conclusion

Mr. Chairman, this concludes the submitted portion of my testimony. I thank you for your invitation to appear before this Committee and look forward to working closely with you on behalf of the Department of Energy in the months and years ahead to further the state of math, science, and engineering education in this country.

A P P E N D I X

Department of Energy

Current Precollege and University Science Education Programs

Participants

PRECOLLEGE

- HIGH SCHOOL SCIENCE STUDENT HONORS RESEARCH PROGRAM	374 High School Juniors and Seniors
- TEACHER RESEARCH ASSOCIATES (TRAC) PROGRAM	135-150 High School Teachers
- INTERNATIONAL SCIENCE AND ENGINEERING FAIR AWARDS	10 High School Students/10 Teachers
- PREFRESHMAN ENGINEERING PROGRAM (PREP)	2,000 7th - 10th Graders
	(underrepresented minorities and women)
- HIGH SCHOOL STUDENT RESEARCH APPRENTICESHIP PROGRAM	130 High School Freshmen and Sophomores
	(underrepresented minorities and women)

UNDERGRADUATE

- UNDERGRADUATE STUDENT SUMMER RESEARCH APPOINTMENTS	1,100 Undergraduates
- SCIENCE AND ENGINEERING RESEARCH SEMESTER	300 Juniors and Seniors
- FACULTY/STUDENT TEAMS	50 Undergraduates/Graduates

GRADUATE

- RESEARCH PARTICIPATION AND THESIS SUPPORT AT DOE LABS	250 Grad Students
- FACULTY/STUDENT TEAMS	50 Undergraduates/Graduates

FACULTY

- SUMMER AND SABBATICAL RESEARCH AT DOE LABS	300 Faculty
- FACULTY/STUDENT TEAMS	30 Faculty
- WORKSHOPS/INSTITUTES ON ENERGY-RELATED RESEARCH	500 Faculty

OFFICE OF ENERGY RESEARCH CURRENT SCIENCE EDUCATION PROGRAMS

LAB OUTREACH ACTIVITIES

INTERNATIONAL SCIENCE FAIR

FACULTY/STUDENT TEAMS

APPRENTICESHIPS

LAB COOP

LAB GRAD/THESIS

PREP

H.S.
HONORS

SERS

STUDENTS

K - 3	4 - 6	7	8	9	10	11	12	FR - SOPH	JR - SR	GRADUATE
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TEACHERS/FACULTY

TEACHER RESEARCH
ASSOCIATES

FACULTY/STUDENT TEAMS

FACULTY RESEARCH PARTICIPATION



Department of Energy

Washington, DC 20585

THE U. S. DEPARTMENT OF ENERGY HIGH SCHOOL SCIENCE STUDENT HONORS PROGRAM

Background

The United States Department of Energy (DOE) sponsors outstanding high school science students for all-expenses-paid research programs in fields of interest to the Department and the Nation. The two-week sessions are conducted at major DOE laboratories in various parts of the country. DOE is committed to strengthening science education for pre-university students as a way of ensuring an adequate future supply of well qualified scientists and engineers.

Current Programs

Summer programs are planned at six DOE laboratories. They are: Lawrence Livermore National Laboratory (located in Livermore, California with an emphasis on computational sciences using the CRAY II supercomputer); Lawrence Berkeley Laboratory (located in Berkeley, California with an emphasis on life sciences research); Fermi National Accelerator Laboratory (located in Batavia, Illinois with an emphasis on high energy particle physics research) Brookhaven National Laboratory (located in Upton, Long Island, New York with an emphasis on experimental work in physics, materials science and biology); Oak Ridge National Laboratory (located in Oak Ridge, Tennessee, with an emphasis on environmental research); and Argonne National Laboratory (located near Chicago, Illinois with an emphasis on material science, including superconductivity).

Student Selection and Eligibility

Students are selected for this program by State Governors, the Governor of Puerto Rico and the Mayor of the District of Columbia. Students must be U. S. citizens or permanent resident aliens, entering seniors or graduating seniors to be eligible. Demonstrated excellence in science and math is a prerequisite. Many former participants have been accepted to prestigious research universities such as MIT, Stanford, Cal Tech, Cornell, etc. Alternates will be asked to attend if the first choice is unable to participate. Foreign students from the United Kingdom, West Germany, Mexico, Italy, Japan, France and Canada are also invited to participate.

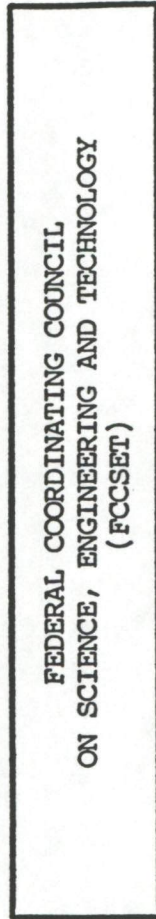
Cost

The Department of Energy pays for round-trip airfare between the student's home and the host laboratory, lodging, meals, recreational activities and special awards.



U.S. DEPARTMENT OF ENERGY

MATH/SCIENCE EDUCATION ACTION PLAN



MATH/SCIENCE EDUCATION ACTION CONFERENCE RECOMMENDATIONS FOR PRESIDENT'S SCIENCE ADVISOR

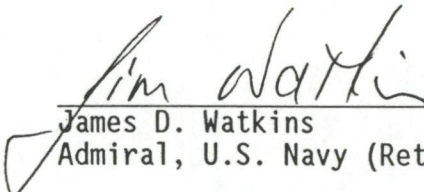
1. Convene an FCCSET council to build national public/private math, science and technology education partnerships.
2. Refine and disseminate national consensus on math/science curriculum, and increase efforts to develop national standards as measurements of progress.
3. Request Presidential Executive Order incorporating math/science education in all appropriate Federal R&D missions.



The Secretary of Energy
Washington, DC 20585

MATH/SCIENCE EDUCATION INITIATIVE
RECOMMENDED ACTIONS FOR DPC MEMBERS

1. Please comment on Chairmen's statement by January 6, 1990, and include suggested revisions or augmentations.
2. Please also provide a summary review of current educational programs and list those that could be broadened to include additional teachers beginning next summer.
3. Please conduct a technical assessment within your agency to determine the human and physical resources available to be utilized beginning in the summer of 1990 to bring science and math teachers into contact with cutting-edge science:
 - o Which facilities/field programs could incorporate (additional) teachers? (one day to eight weeks)
 - o Where are they located?
 - o How many teachers can each support?
 - o What area of math or science (e.g. space science, environment, geology, etc.)
 - o Could your agency professionals be used as expert teaching resources for demonstrations and lectures by regional schools? If so, in what specific subject areas?
4. To assist in the building of public-private sector partnerships, please identify businesses or industries that you believe would be likely partners in this effort.
5. In my capacity as interim coordinator of this initiative pending formalization of interagency coordinating responsibilities, please submit your responses to me by January 6, 1990.


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