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ABSTRACT

The hearing reported in this document focused on H.R. 4726, a bill concerned with improving the facilities and instructional equipment available at science-technology centers, two-year colleges, and other non-profit institutions engaged in informal and formal education in science and technology. Witnesses from three agencies (National Aeronautics and Space Administration, National Science Foundation, and Department of Energy) charged with implementing and administering the bill described how the new program relates to their agencies' current educational activities and provided an assessment of the likelihood of the bill achieving its objectives. (PR)

H.R. 4726—THE OPPORTUNITIES IN SCIENCE & TECHNOLOGY ACT OF 1992

HEARING

BEFORE THE

SUBCOMMITTEE ON SCIENCE

OF THE

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

ONE HUNDRED SECOND CONGRESS

SECOND SESSION

JUNE 23, 1992

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*Ranking Republican Member.

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WITNESSES

H.R. 4726—THE OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992

TUESDAY, JUNE 23, 1992

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
SUBCOMMITTEE ON SCIENCE,
Washington, D.C.

The subcommittee met, pursuant to call, at 10:05 a.m., in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr. [acting chairman of the subcommittee] presiding.

Mr. BROWN OF CALIFORNIA (presiding). The subcommittee will come to order.

This morning the Science Subcommittee will obtain testimony on H.R. 4726, the Opportunities in Science and Technology Act of 1992. This bill addresses the important subject of improving public understanding of science and technology as well as the problem of attracting greater student interest in careers in science and engineering.

As the United States enters the twenty-first century, we will need to work hard to ensure that we have a citizenry knowledgeable in science and technology. H.R. 4726 focuses on some of the key resources available to address that task—our Nation's junior and community colleges and science and technology centers.

These institutions, located in communities all across America, too often lack the means to keep their educational activities up to date, especially with the rapid advances occurring in science and technology. Moreover, in many cases they are victims of their own success in teaching the public: their facilities have become overcrowded and outdated related to the growth in public interest and participation.

I believe that it is an appropriate role for the Federal Government to assist these national assets in meeting the challenge of fostering increased knowledge and understanding of science and technology. I also believe that an effective means of providing this assistance is to make it the result of a coordinated national effort that involves the agencies most directly involved in the sponsoring of civilian science and technology—namely, the National Aeronautics and Space Administration, the National Science Foundation, and the Department of Energy.

This bill makes such coordination a keystone. In addition, it makes assistance the result of a nationwide competitive merit review rather than through earmarking, however well intention, of

specific projects that have never been assessed on their merits relative to other possible projects.

I look forward to the testimony of our Federal and public witnesses this morning and welcome you all to these proceedings.

I might say also that this is a very modest start on something that is far more important than the amount of authorization contained in the bill. On the other hand, I think it merely gives impetus to something that is already going on in most of the agencies which are involved here, and I want to commend them all for the efforts that they have made in trying to stimulate the improvement of science and technology education through these institutions and others.

We constantly confront the problem of how to address more effectively goals that we know are important to the country. We rarely succeed in doing as much as we would like and hope we don't do any harm in what we are trying to do.

May I ask if there is a statement on the Republican side?

Mr. FAWELL. I have no statement, Mr. Chairman.

Mr. BROWN OF CALIFORNIA. Do you have a statement?

We never want to miss a good statement.

I think your mike isn't on.

Mr. GILCHREST. One of the young people in charge of the microphones didn't get a good science education. He was asleep during his electronics class, I think, maybe.

Mr. Chairman, I think this is an excellent subject that you have brought before us this morning, and I want to commend and congratulate you on this type of hearing.

For someone who has been a schoolteacher and has children at home, there is some way that you can infuse curiosity in children. It doesn't have to be drowned when they get to school. When little kids first learn to walk, they are a hundred times more curious than a newborn kitten, and if we can somehow hold on and make that curiosity flower and grow in the classroom, the sky is the limit.

Mr. BROWN OF CALIFORNIA. Thank you very much.

Now let me recognize the ranking member of the subcommittee, Mr. Packard.

Mr. PACKARD. Thank you very much, Mr. Chairman.

I apologize for being a few moments late. I annually bring a group of students back from each of my high schools, and I have 40 students here, and we had a full program this morning, that I needed to make some introductions and then excuse myself, but I appreciate the chance to be here.

Mr. Chairman, I want to commend you for your efforts on H.R. 4726, the goals of which are to enhance this Nation's scientific literacy and to interest today's youth in pursuing the fields of science, math, and engineering.

I think all of us can agree on the merits that are proposed in the bill. There are many, however, with some disagreement, perhaps on this side of the aisle, as to how we can best accomplish the goals of the bill, and we will receive testimony today from three Federal agencies that will be responsible for administering the program. I will be interested in hearing about the ongoing programs of each of

these agencies as they promote the growth of science and technology.

The second panel of witnesses will be able to give us a first-hand account of what is needed at both the community colleges and the science and technology centers. And I want to particularly welcome one of my dear friends from my district who is the president of the American Association of Community and Junior Colleges, and he is also the dean of the community college that resides in my district, Palomar College, Dr. Boggs, and I want to particularly welcome him here.

My thanks again to you, Mr. Chairman, for calling this hearing. I anticipate that it will be a very important and very good hearing and will provide us valuable information and perspective on the bill, H.R. 4726.

I look forward to all of the witnesses, want to welcome them here, and appreciate their involvement and input into this very important subject.

Thank you very much, Mr. Chairman.

Mr. BROWN OF CALIFORNIA. Thank you, Mr. Packard.

Let me first explain this morning that the chairman of the subcommittee, Mr. Boucher, is temporarily detained at a markup in another committee. Because of his great expertise and energy, he serves on more committees than he should. And he sometimes gets conflicts which will delay him, but he should be here shortly.

Mr. Thornton, who in a previous life was also chairman of this subcommittee, is going to temporarily take over for me in a few minutes, and I will recognize him for any opening statement he has at this point.

Mr. THORNTON. Mr. Chairman, I don't really have an opening statement, except to congratulate you for bringing this legislation to our subcommittee's attention and to once again refer to the pleasure that I personally have in having a dear friend on the opening panel of witnesses, Dr. Luther Williams, who I tried to recruit to Arkansas State University as dean of the College of Arts and Sciences and then, while president of the University of Arkansas System, tried to recruit Dr. Williams to be the chancellor of our Pine Bluff campus, unsuccessfully in both instances, to my great regret. And so I had to come back to Washington in order to get in a position of working with Dr. Williams. I am delighted that he is here today as well as Dr. Brown and Mr. Stephens and look forward to their testimony.

Mr. BROWN OF CALIFORNIA. Thank you very much, Mr. Thornton.

[The prepared statements of Messrs. Boucher and Costello follow:]

STATEMENT BY THE
HONORABLE RICK BOUCHER, (D-VA), CHAIRMAN
SUBCOMMITTEE ON SCIENCE
ON THE
OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992
(H.R. 4726)

June 23, 1992

This morning the Science Subcommittee will consider the Opportunities in Science and Technology Act of 1992, H.R. 4726. The bill was introduced by the Chairman of the full Committee, Rep. George Brown. It is focused on improving the facilities and instructional equipment available at science-technology centers, two-year colleges and other non-profit institutions engaged in informal and formal education in science and technology.

In April of this year, the Subcommittee convened a hearing on the problem of attracting a greater proportion of U.S. students to graduate study in science, math and engineering. The main point made by witnesses at that hearing was the need to improve the precollege and undergraduate education of students in science and math in order to increase their level of interest in these

subjects and to better prepare them for subsequent, more intensive studies at the college level.

Reversing the downward trends in student interest and performance in science and math is important not only to ensure a future supply of scientists and engineers. As technology becomes more pervasive in society, the number of jobs requiring technical knowledge and skills will also increase. Moreover, scientific and technical literacy will become necessary for all citizens to make informed judgements about public policy issues.

Both science-technology centers and two-year colleges contribute to overcoming the problem of low student interest in science and in helping to prepare future scientists and engineers. Science-technology centers, which may include museums, planetariums and zoos, offer interactive exhibits and demonstrations designed to increase public understanding of science and technology and to illustrate the interactions of science

and technology with society.

Two-year colleges enroll a large percentage of all undergraduates in the nation's institutions of higher education, including a larger proportion than other institutions of minority groups which are underrepresented in science and engineering. The quality of science instruction in these institutions is important since it influences students' career choices and may be the only exposure to science that most students receive in their college studies.

The goal of H.R. 4726 is to strengthen the capabilities of science-technology centers and two-year colleges to foster knowledge of science and technology by providing support for facilities and equipment. The federal witnesses represent the three agencies charged in the bill, jointly, to implement and administer the facilities and equipment program. We have asked these witnesses to review how the new program relates to their agencies'

current educational activities. The public witnesses have been asked to comment on the contribution the bill would make to the effectiveness of the programs at their institutions. And finally, all witnesses have also been asked for an assessment of the likelihood of the bill achieving its objectives and for recommendations for improvements to the legislation.

We welcome our witnesses today and look forward to your testimony on this important subject.

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STATEMENT OF U.S. REPRESENTATIVE JERRY F. COSTELLO (D-IL)

SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON SCIENCE

"OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992,

H.R. 4726"

JUNE 22, 1992

MR. CHAIRMAN, THANK YOU FOR CALLING THIS HEARING TO EXAMINE H.R. 4726, THE OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992. I AM PLEASED TO BE HERE AS WE DISCUSS CHAIRMAN BROWN'S BILL. I WOULD LIKE TO TAKE THIS OPPORTUNITY TO WELCOME OUR PANEL OF EXPERT WITNESSES. I AM LOOKING FORWARD TO HEARING FROM DOE, NSF, AND NASA. I AM ALSO LOOKING FORWARD TO THE TESTIMONY THAT WILL BE PROVIDED BY REPRESENTATIVES FROM THE EDUCATIONAL COMMUNITY.

IT IS MY UNDERSTANDING THAT THIS BILL IS FOCUSED ON IMPROVING THE FACILITIES AND INSTRUCTIONAL EQUIPMENT AT SCIENCE-TECHNOLOGY CENTERS, TWO-YEAR COLLEGES AND OTHER NON-PROFIT INSTITUTIONS PARTICIPATING IN INFORMAL AND FORMAL EDUCATION IN SCIENCE AND TECHNOLOGY. AS WE HAVE DISCUSSED AT PRIOR HEARINGS, THERE HAS BEEN A DOWNWARD TREND IN INTEREST OF U.S. STUDENTS PURSUING CAREERS IN SCIENCE AND ENGINEERING. THERE HAS ALSO BEEN A DECLINE IN THE CHOICE OF SCIENCE AND ENGINEERING MAJORS BY U.S. COLLEGE STUDENTS.

IN MY OWN DISTRICT IN SOUTHWESTERN ILLINOIS, TWO-YEAR COLLEGES

ARE NOTICING THIS STEADY DECLINE AND FACE DIFFICULTIES IN PROVIDING ADEQUATE OPPORTUNITIES IN THE AREA OF SCIENCE AND TECHNOLOGY TO LIMITED NUMBERS OF STUDENTS. I AM INTERESTED IN HEARING TO WHAT DEGREE THE WITNESSES BELIEVE THE BILL WILL CONTRIBUTE TO THE EFFORTS OF INSTITUTIONS ENGAGED IN IMPROVING SCIENCE LITERACY AND INCREASING STUDENT INTEREST IN SCIENCE AND TECHNOLOGY.

AGAIN, MR. CHAIRMAN, THANK YOU FOR CALLING THIS HEARING AND FOR YOUR CONTINUED LEADERSHIP OF THIS SUBCOMMITTEE.

Mr. BROWN OF CALIFORNIA. Let us begin with Dr. Brown, the deputy associate administrator for the Office of Human Resources and Education of NASA.

We will have your testimony and then Mr. Williams' and Mr. Stephens'—in that order—and then, when you have completed your statements, we will interrogate you as a panel at that time.

Mr. Brown.

STATEMENTS OF ROBERT W. BROWN, DEPUTY ASSOCIATE ADMINISTRATOR, OFFICE OF HUMAN RESOURCES AND EDUCATION, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.; LUTHER S. WILLIAMS, ASSISTANT DIRECTOR FOR EDUCATION AND HUMAN RESOURCES, NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C.; AND RICHARD E. STEPHENS, ASSOCIATE DIRECTOR, OFFICE OF ENERGY RESEARCH, DEPARTMENT OF ENERGY, WASHINGTON, D.C.

Dr. BROWN. Mr. Chairman, thank you for the opportunity to testify on H.R. 4726, the Opportunities in Science and Technology Act of 1992.

The general goal of the proposed legislation—that of enhanced scientific and technological literacy for students and adults as we move towards the twenty-first century—is entirely consistent with the goals of the National Aeronautics and Space Administration. If the United States is to remain at the forefront of space science and aerospace research and technology, we must help students, teachers, and the general public to develop the knowledge and skills that they will need in this highly complex environment in which we work now and in the future. The next generation, from our perspective, of science research and technology can only be as good as the next generation of scientists, engineers, technicians, and, yes, an informed public.

I am also pleased to be here today with my colleague, Dr. Williams, and Dr. Stephens. Each of us is on the Committee on Education and Human Resources of the Federal Coordinating Council on Science, Engineering, and Technology. This 16-member committee, as I'm sure you know, is now in its third year, and it has been an excellent resource for our agencies to coordinate our activities.

I would like to briefly describe how NASA, through our NASA visitor centers and our educational outreach to science museums and community colleges and others, is already supporting the goals of H.R. 4726. Although our aerospace education program in NASA does not involve grants for upgrading facilities and equipment, per se, we do provide other kinds of support for both informal and formal education to promote science and technology literacy.

First, our visitor centers. The activities of our visitor centers—and we have nine of those in each one of our NASA locations around the country—represent an example of our informal science and technology education outreach. They offer the general public a unique opportunity to see the past, the present, and the future of aeronautics and space research first hand.

For example, out at Goddard, nearby in Greenbelt, Maryland, in its visitor center, we have models of research and communications satellites. We have a display where a visitor can actually retrieve a

satellite in space or a person can experience the sensation of how a spacecraft is controlled by steering a gyro-chair.

At our Spaceport U.S.A. in Florida, the Kennedy Space Center, we feature an art gallery displaying over 250 renderings of paintings and sculpture by artists commissioned by the NASA Art Program.

Last year at our Langley Research Center, we moved the visitor center to the new Virginia Air and Space Center there, combined it, provided some financial support, and transferred a number of our activities there. There is room for classrooms, conferences, and it also has a teacher resource room that was commissioned by NASA.

As a final example of our visitor centers, the Ames Research Center in Moffett Field, California, is housed in a former hyper-velocity flight facility. Among its extraordinary displays is an unmanned HiMat test craft, one of the most maneuverable flight vehicles ever built.

Let me say a word now about our outreach to science museums. We have a very active program of assistance to science museums and related facilities such as planetariums and other civic organizations, large and small. We loan hardware and equipment to these science museums, many of whom are members of the Association of Science and Technology Centers—ASTC. In fact, several of our NASA field centers became members of ASTC to facilitate their interaction with this national and important international organization.

A few examples: The Kansas Cosmosphere and Space Center in Hutchinson, Kansas, which has perhaps the largest collection of spacesuits in the country. Many of the exhibits are on permanent loan from the Kennedy Space Center.

The Chicago Museum of Science and Industry. There we have NASA displays of the Apollo 13 command module, a lunar lander, space suits, a moon rock, and numerous other science and other aeronautical artifacts.

The Challenger Center for Space Science Education has received assistance from NASA in developing their very innovative Learning Science Center.

One site, the Howard B. Owens Center, in Greenbelt, Maryland—every fifth-grade student in the Prince Georges County system there has an opportunity to participate in a simulated crew mission. Last year, Mr. Chairman, you might recall I had the pleasure of accompanying you and Congressman Cramer out to that center.

Then at the Davis Planetarium in Jackson, Mississippi, our aerospace education specialist from NASA assisted the planetarium there in developing, in my judgment, one of the most innovative student space station projects that we have seen. Approximately 30 sixth- and seventh-grade students are selected each summer to participate in an intensive 14-week seminar involving science and mathematics, and it culminates in a simulated space station mission. During the mission, a crew of eight students and their teachers stay for three days in a simulated space station made from an old oil tanker. While there for the three days, they eat, sleep, exercise, conduct various experiments. And then the remaining students form a rotating ground crew upstairs in the planetarium and

manage the mission control simulation. It is a very innovative project.

Finally, as an example of our science outreach, we have developed special exhibits to illustrate the interaction between science and technology in society. One exhibit called "Discovering Space for America's Economic Growth" spent two years touring museums around the country.

I might just say in a quantitative term I spoke first about our visitor centers. We handle about four and a half million people each year in the NASA visitor centers. If you look at our traveling exhibits to various facilities around the country, those numbers are considerably larger.

Turning finally now to our outreach to community colleges, we are expanding our involvement with the community colleges, recognizing that these institutions are very important links to the science and engineering work force. I understand that about 25 percent of the approximately five million students in these community colleges around the country are enrolled in mathematics and statistics courses, for example. Also, over two-thirds of the blacks, Hispanics, and Native Americans who are involved in higher education are also enrolled in these institutions, and from our perspective any effort to increase and enhance the science and engineering pipeline will have to include the important community colleges in that process.

As an example of our involvement with community centers, down at Langley Research Center in Virginia, they have developed a 10-year program with community colleges designed to generate technicians for the aerospace industry at Langley. At our Johnson Space Center in Houston, we are working there with three of the nine local community colleges to establish a two-year degree program in aerospace technology.

Then at the Kennedy Space Center, that has been working with Brevard Community College for many years, we have worked out an arrangement where the majority of the technician contractors who work at the NASA facility there have been trained by Brevard Community College. In addition, many of the civil servants at the Kennedy Space Center participate in the college programs ranging in specialties from shuttle tile technology to quality control.

Finally, as an example of our outreach to community colleges, our relatively new National Space Grant College and Fellowship Program is helping to expand our partnership with community colleges beyond the immediate facility of our NASA field centers. For example, such efforts are under way with the Nevada Space Grant Consortia and the Colorado Space Grant Consortia.

And we provide other kinds of support, coming to a conclusion, Mr. Chairman. We have an extensive network of teacher resource centers, and we also have NASA Select, which is our internal televised service that reaches schools and organizations around the country. A number of our teacher resource centers are located in museums such as the Kansas Cosmosphere, the Chicago Museum of Science and Industry, and the National Air and Space Museum right here in Washington. Our NASA Select televised system reaches many aspects of the community, and each day has a three-hour segment devoted to education.

So in conclusion, Mr. Chairman, while we applaud the intent of H.R. 4726, many of its objectives are already being achieved under existing programs and authorities. NASA itself does not need new legislation or new legislative authority and already has the funds to carry out many of the bill's activities. Therefore, H.R. 4726, in our estimation, should not be reported out by the subcommittee.

In these times of shrinking budgets, NASA and other agencies must carefully economize to ensure that they can conduct their missions and not extend themselves beyond the ability to produce successful results. In addition, a joint program like this would not yield appreciably greater results than existing efforts, at least not enough to satisfy another level of administration.

Again, I applaud the committee's concern for the state of our education institutions and pledge our continued efforts to further these objectives within the means provided us.

Mr. Chairman, I would be glad to answer any questions that you may have or other members of the committee.

[The prepared statement of Dr. Brown follows:]

Hold for Release Until
Presented by Witness

June 23, 1992

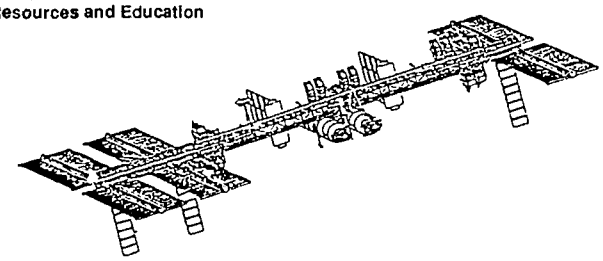
Subcommittee on Science

Committee on Science, Space and Technology

U.S. House of Representatives

Statement by:

Dr. Robert W. Brown
Deputy Associate Administrator
for Human Resources and Education



102nd Congress

Statement of
Dr. Robert W. Brown
Deputy Associate Administrator
Office of Human Resources and Education
National Aeronautics and Space Administration

before the
Subcommittee on Science
Committee on Science, Space and Technology
United States House of Representatives

June 23, 1992

Mr. Chairman, thank you for the opportunity to testify today on H.R. 4726, the Opportunities in Science and Technology Act of 1992. The general thrust of the proposed legislation, that of enhanced scientific and technical literacy for students and adults as we move toward the 21st century, is entirely consistent with NASA's goals. If the United States is to remain at the forefront of space science and aerospace research and technology, we must help students, teachers, and the general public to develop the knowledge and skills they will need in the highly complex and technical workplace of the future. The next generation of science, research, and technology can only be as good as the next generation of scientists, engineers, technicians, teachers, and an informed public.

I am also pleased to be here today with our interagency colleagues, Dr. Luther Williams from the National Science Foundation and Mr. Richard Stephens from the U.S. Department of Energy. Each of our agencies is represented on the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering, and Technology. This committee of 16 Federal agencies, now in its second year, is evolving into an excellent resource to help coordinate Federal science, mathematics, and technology education programs.

I would like to briefly describe how NASA, through our educational outreach to science museums and community colleges, is already supporting the general goals of H.R. 4726. Although our aerospace education program mission does not involve grants for upgrading facilities and equipment, we do provide other kinds of support for both formal and informal education to promote science and technology literacy.

We support programs that promote scientific literacy through informal education activities. The NASA Visitor Centers, located at all NASA Field Centers, offer the public a unique chance to see the past, present, and future of U.S. aerospace research first hand, by visiting the institutions around the country where the work is actually conducted. The spectacles of the Space Age come alive for the visitor who touches real vehicles used in space flight or inspects a moon rock billions of years old. NASA Visitor Centers have on display hundreds of artifacts, scale models, and pieces of actual flight equipment, from spacesuits and astronaut food to the gigantic launch towers from which rockets and Space Shuttles have blasted off into orbit.

As examples: The Goddard Visitor Center features models of rockets and spacecraft, an eight-screen theater for viewing scenes of Earth and neighboring planets and stars, as well as displays where a visitor can retrieve a satellite "in space" or experience the sensation of how spacecraft are controlled by steering a gyro chair. Model rocket launches are held on the first and third Sunday of every month.

Spaceport USA at the Kennedy Space Center features a NASA Art Gallery displaying more than 250 paintings and sculptures created by artists commissioned by the NASA Art Program. At the

Exploration Station, one of Kennedy's most popular features, students participate in hands-on aerospace experiments and demonstrations.

When Langley Research Center had to move its Visitor Center off-site, it joined with the Virginia Air and Space Center in a special partnership. In return for Langley's contribution to the operating budget for the Virginia Air and Space Center, the Center will continue Langley's aerospace education and outreach programs. The building houses classrooms and conference areas, and teachers will be able to take advantage of a Teacher Resource Center replete with computer software, audiovisual materials, and publications.

The Ames Research Center's visitor center is housed in a former hypervelocity flight facility. This unique facility is open to the public and showcases the unmanned HiMat test craft, the most maneuverable flight vehicle ever built, along with a model of the Space Station and a U-2 spy plane. These and other exhibits are designed to show the range of NASA and Ames research to teachers, students, and the general public.

We also offer exhibits for loan to schools, museums, civic groups, and other organizations. Many of the members of the Association of Science and Technology Centers (ASTC) enjoy long-term loans of NASA hardware and exhibits. In fact, many of the NASA Field Centers are members of ASTC to facilitate their interaction with ASTC's approximately 300 members worldwide.

For example, the Kansas Cosmosphere and Space Center in Hutchinson, Kansas, boasts the largest collection of spacesuits in the country. Many of its exhibits are on permanent loan from the NASA Kennedy Space Center. The U.S. Space and Rocket Center in Huntsville, Alabama, has a wide variety of NASA hardware on display, including the 363-foot, three-stage Saturn V rocket which took a total of 27 astronauts to the Moon. At the Chicago Museum of Science and Industry, displays include the Apollo 13 command module, a lunar lander, spacesuits, a Moon rock, and numerous other space artifacts.

Smaller, less-well-known science and technology centers also take advantage of the natural draw space exhibits have for the general public. The William Weinman Mineral Museum, in Cartersville, Georgia, has borrowed items from the NASA Langley Research Center, including a 1/3 Viking Lander Model and an exhibit entitled "Exploring the Planets."

At the Davis Planetarium in Jackson, Mississippi, NASA aerospace education specialists have helped develop one of the most innovative student space station projects in the country. In this program designed to improve student competence in science and mathematics, 31 competitively selected sixth and seventh graders participate in an intensive 14-day workshop that culminates in a simulated space flight mission. During the mission, a crew of eight students and their teacher stay in the space station for four days, where they eat, sleep, exercise, and conduct science experiments. With the space station located immediately outside of the Davis Planetarium, the remaining 23 students form a rotating ground crew of technical personnel situated in a Mission Control Simulator on the upstairs floor of the Planetarium.

NASA has also developed special exhibits to illustrate the interactions of science and technology with society. One such exhibit, "Discovering Space For America's Economic Growth," spent two years on tour in smaller museums across the United States—from the Schenectady Museum and Planetarium in Schenectady, New York to the Bradbury Science Museum in Los Alamos, New Mexico. Exhibits like this help the public understand the extent to which science and technology impact our everyday lives.

The Challenger Center for Space Science Education, an ASTC member, is making a measurable impact on the quality of science, mathematics, and technology education offered to students. NASA scientists, engineers, and education specialists helped Challenger Center to develop the

innovative and highly-effective aerospace education curriculum modules utilized in their Learning Centers located across the United States and Canada. To date, more than 150,000 students have gone through a Challenger Center simulation, and each one walks away from it with experience in teamwork, cooperation, and success in a highly technical scientific undertaking. At one site, the Howard B. Owens Science Center in Greenbelt, Maryland, every fifth-grade student in Prince George's County (Maryland) experiences a simulated space mission.

To facilitate the Agency's impact on the national education system, NASA is developing a presence in every state. This national network is the mechanism through which we reach out to the entire education community, including teachers, students, parents, and all lifelong learners.

In the mid-1980's, NASA began the Teacher Resource Center Network, which provides dissemination points for the distribution of NASA information and education materials such a videotapes, slides, software, posters, and teacher's guides. There are 10 Teacher Resource Centers located at the NASA Field Centers. In addition, more than 25 Regional Teacher Resource Centers are housed in universities, community colleges, museums, and science and technology centers across the country. These institutions include the Mississippi Delta Community College in Moorehead, Mississippi, Bossier Parish Community College in Bossier City, Louisiana, the Kansas Cosmosphere, the Chicago Museum of Science and Industry, and the National Air and Space Museum. The NASA Teacher Resource Center Network serves over 90,000 teachers annually.

NASA Select, the Agency's internal communication service, is another valuable teaching resource. It offers informational and educational programs as well as real-time mission coverage, accessible in both the classroom and the home via satellite dishes and cable television systems. Three one-hour segments are reserved each day exclusively for sixty-minute classroom-suitable programs. All programs may be taped. Aimed at inspiring students to achieve in math and science, these programs range from live interactive shows, to "Launch Box," a series produced by the Nickelodeon cable network and NASA. We are working closely with the cable industry to make NASA Select available to schools nationwide.

We recognize that community colleges are an important link in the science and engineering workforce pipeline. There are nearly 1,400 two-year colleges in the United States with a total enrollment of nearly 5 million students, 25% of whom are enrolled in mathematics or statistics courses. Collectively, two-year colleges enroll nearly 40% of all undergraduate mathematics course enrollments. Over two-thirds of Black, Hispanic, and Native American students in higher education are enrolled in community colleges. Clearly, any effort to strengthen the science and engineering education pipeline and recruitment of more underrepresented minority students must be carried out in a manner that includes two-year colleges as full partners.

NASA's community college initiatives benefit all participants. Students receive an excellent, practical education including experience on state-of-the-art equipment. These programs, in turn, provide us with a pool of well-trained personnel, resulting in significant cost-savings in training time for new personnel. In addition, the educational institutions are able to offer their students an education which will truly prepare them as the workforce of the next century. In particular, many of these programs are aimed at training the next generation of aerospace technicians.

As examples: At the NASA Langley Research Center in Hampton, Virginia, a three-phase, 10-year program has been developed to generate the technicians that will be needed by the aerospace industry generally, and Langley Research Center specifically. The first phase of the program is a 5-year pilot containing several projects designed to identify, involve and mentor middle and high school students toward technician training. The second phase of the program will develop, pilot, assess and implement a regional associate degree program. The third phase will seek to export the prototype throughout the United States.

At the NASA Johnson Space Center in Houston, Texas, three of the nine local community colleges are establishing a 2-year degree in aerospace technology in anticipation of future workforce needs. The curriculum is currently under development using a committee of local representatives from industry, NASA, and academia.

The community college initiative at NASA's Goddard Space Flight Center in Greenbelt, Maryland has two thrusts: 1) to provide advanced technician training by Maryland's community colleges to technicians already employed at the Center, and, 2) to increase the technician pipeline. Current major players in the beginning stages of this initiative are the Goddard Contractor Working Group and the State Board of Community Colleges. As the initial step in this process, the State Board has been asked to survey its colleges to determine current offerings as well as possible future innovations.

The NASA Stennis Space Center in Mississippi and its contractors have teamed with Pearl River Community College to give hands-on training to students in their vocational-technical program. The students spend 96 hours training in specialty shops at Stennis. The students include carpenters, diesel mechanics, electricians, HVAC technicians, machinists, and welders.

The NASA Kennedy Space Center in Florida has enjoyed a beneficial working relationship with Brevard Community College (BCC) for nearly 30 years. The majority of contractors who work for Kennedy are trained through the BCC Space Technology program. This nationally recognized training program provides special technical training opportunities for both the KSC workforce and potential employees in specialities ranging from tile technology to quality control.

The National Space Grant College and Fellowship Program is helping to expand our partnerships with community colleges beyond the immediate area of the Centers. The Nevada Space Grant Consortium includes four community colleges, and the Colorado Space Grant Consortium includes one. Space Grant also has a significant public service component through which these institutions use NASA funds to promote scientific and technological literacy throughout their states.

All of NASA's community college initiatives have one factor in common—they directly address the future workforce needs of the space program by channelling more students into science, mathematics, and technology careers through career-specific coursework and hands-on work experience. The proliferation of these programs is a testament to the success of NASA's education program.

These examples are only a few of the many, many programs NASA offers to both the education community and the general public to promote science and technology literacy for all citizens of this Nation.

As I indicated at the beginning, Mr. Chairman, while we applaud the intent of this legislation, many of its objectives are already being achieved under existing programs and authorities. NASA does not need new legislative authority and already has funds to carry out many of the bill's activities. Therefore, H.R. 4726 should not be reported by the Subcommittee. In these times of shrinking budgets, agencies like NASA must carefully economize to ensure that they can conduct their missions, and not extend themselves beyond their ability to produce successful results. In addition, a joint program such as this would not yield appreciably greater results than existing efforts—at least not enough to justify another level of administration.

Again, I applaud the committee's concern for the state of our educational institutions, and pledge our continued efforts to further these objectives within the means provided to us.

Thank you, Mr. Chairman. I would be pleased to answer any questions you or the other members of the Committee may have.

Mr. THORNTON (presiding). Thank you, Dr. Brown.

We will proceed to hear from each of the opening statements before we have questions, and I do appreciate your fine testimony.

From my standpoint, it is easier to grasp the idea that when you have limited resources you should apply them to those areas that are really doing well and producing good results, but I do appreciate your concern about whether additional resources could be put to good use. We will come back to that at a later point.

Dr. Williams.

Dr. WILLIAMS. Mr. Chairman and members of the subcommittee, I too am pleased to be here today with my colleagues from NASA and the Department of Energy to discuss the activities of the Foundation regarding two-year colleges and informal science education centers as they relate to H.R. 4726, the Opportunities in Science and Technology Act of 1992.

The National Science Foundation recognizes and appreciates the critical issues concerning opportunities in science and technology raised by H.R. 4726, and accordingly certainly we are in agreement with and applaud the goals and objectives as proposed in the legislation.

To be sure, the two-year colleges have a broad central mission to provide access to quality education and achievement in science, mathematics, and technology to students in general and especially students drawn from their local communities. So, in my judgment, these institutions have a unique niche within the education program and activities of the National Science Foundation. Correspondingly, the science centers obviously make significant contributions to the achievement of our overall goals.

The Education and Human Resources Directorate of the National Science Foundation supports the purchase of equipment for science, engineering, technology programs through either science and technology centers or two-year colleges and institutions through primarily two existing programs. At the undergraduate level, the program is Instrumentation and Laboratory Improvement, obviously available to two-year as well as four-year institutions, and in the instance of the science centers, the Informal Science Education Program.

Despite these two programs, I will readily concede that there are many other needs and opportunities that must be met in order to more effectively address science and education needs and challenges before the country. We are committed to providing this support to the institutions consistent with our overall resources and program objectives.

I believe that the amount of funding which will realistically become available can be most effectively awarded through the existing programs of the National Science Foundation with emphasis on the following: where provision for the equipment is coupled with a program rather than creating an equipment program, per se.

To extend my comment, equipment purchase independent of a larger educational goal, in my judgment, will have an impact short of the intent. There may, for example, be no extensive plan for the use of the equipment, per se. Witness—while indeed this is not the case in two-year colleges and most assuredly science centers, but it is a relevant issue. Witness the substantial underutilization of hun-

dreds and, in some cases, thousands of computers donated to public school systems without the provision for placing those equipments in the context of an organized program.

We therefore have two programs in which we are making substantial contributions in this regard, but the equipment is supported in the context of an overall program. Through various programs focusing on the two-year colleges, we support instrumentation equipment as it relates to math and science education. To put that in context, in fiscal year 1990, within the total portfolio in the Directorate, we made 49 individual grants to the two-year college sector. In 1991, we were able to increase that level of support to some 85 grants. We clearly anticipate in the next year—in the current fiscal year, fiscal year 1992—to exceed those numbers.

I will readily concede that within the undergraduate arena of the Foundation in the case of math, science, engineering, and technology education, historically, the two-year sector has been underserved, and the results I just gave you represent a conscious effort on our part, starting about a year and a half ago, to increase the resource base to the two-year college sector. I anticipate that in the near term it simply will become a larger part of our portfolio, and most assuredly as a part of those programs we will address needed equipment.

The informal science education effort that is relevant to the bill, or what is proposed here, as I indicated earlier, provides a variety of educational resources in the form of exhibits, media, strategies for meetings—for addressing large numbers of individuals in order to stimulate parents and other adults to become informed advocates of higher education, high quality math and science education, to support the school curriculum as it relates to informal science education, and deal with the broad issue of science literacy.

We, in fact, provide funding under this program for the purchase of equipment, equipment that is integral to an exhibit or program of an institution that is involved in informal science education. Explicitly, so far for the current fiscal year, equipment purchases under larger programs have totaled about $1.5 million. To put that in context, the total informal science education budget for this fiscal year of the Foundation is $35 million. Of that amount, approximately $12 million goes to the development of exhibits. Broadly put, that is relevant in terms of science and technology centers.

In addition to that, the program has also supported over $4 million to three very large projects which are designed to enable developing, newly developed science centers to acquire a proven set of science museum exhibits from existing centers. Obviously equipment is involved.

For example, the Pacific Science Center in Seattle, Washington, has developed a traveling science program called Science Carnivals to bring science into experience, including exhibits, science demonstrations, and teacher workshops to rural areas in Washington, Idaho, Oregon, and Montana. Developing museums can acquire copies of the Science Carnival along with technical assistance and staff through this very large grant.

In summary, we have within the context of the informal science education program in the Foundation a substantial effort directed to science and technology centers.

With respect to the joint management obligated under the program, my general comment is essentially consistent with what was indicated by Dr. Brown from NASA. As I understand the proposal in fiscal year 1993, what would be authorized is roughly equal to what the NSF alone has expended in this area for our science and technology centers or under our informal science education program this fiscal year. Certainly there is less than enthusiasm as regards the overhead and associated administrative costs that each of us would have to mount to accomplish a goal that I suspect could be accommodated by collaboration between the three agencies if we elected to do so through the existing FCCSET education and human resources structure.

For all of the reasons indicated, those reasons being: one, we have a program that gives attention to the two-year institutions, that will certainly increase as a part of our portfolio; B, or second, there is a major effort under way supporting science and technology centers, the amounts I indicated earlier; third, it would appear to the Foundation that the proposed three-agency structure is not necessary. Rather, our position is that—certainly with encouragement of this proposal—is that we extend our existing efforts in supporting the two broad institutional sectors, science and technology centers on the one hand, and, two-year institutions on the other; and therefore, while, as I indicated earlier, we applaud and agree with the intent of the bill, we would not recommend that it be pursued further.

Thank you.

[The prepared statement of Dr. Williams follows:]

Dr. Luther Williams
Assistant Director for Education and Human Resources
National Science Foundation
before the
House Science Subcommittee
Committee on Science, Space and Technology
June 23, 1992

Mr. Chairman and Members of the Subcommittee, I am pleased to be here today with my colleagues from NASA and the Department of Energy to discuss the activities of the Foundation regarding two-year colleges and informal science centers and how these relate to H.R. 4726, the Opportunities in Science and Technology Act of 1992.

The National Science Foundation (NSF) recognizes and appreciates the critical issues concerning opportunities in science and technology raised by H.R. 4726. In large part because of the revolution in information-processing technologies, the nation is experiencing a virtual explosion of scientific discoveries and technological advances. For our nation to continue to benefit from the production of new knowledge, we must devise new and better ways to provide learners and teachers across the country with equitable access to the tools, expertise, materials, and methods of new information-processing technologies. We, therefore, applaud the goals and objectives of the legislation proposed.

Two-year colleges have a broad, central mission: to provide access to quality education and achievement in science, mathematics, and technology for all Americans within their local communities. Science centers also contribute significantly to these goals. The Directorate for Education and Human Resources (EHR) within NSF provides a variety of support for the incorporation of technological advances in two-year colleges and institutions involved in informal science education, as well as other institutions.

EHR currently supports the purchase of equipment for science-technology centers and two-year colleges and institutions involved in informal science education (e.g., science-technology centers, natural history museums, zoos, aquaria, botanical gardens, and other community-centered organizations) through two existing programs, the Instrumentation and Laboratory Improvement Program (ILI) and the Informal Science Education Program (ISE).

Despite these positive efforts, we recognize that there are many other needs and opportunities that must be met as we contribute to addressing the many science education challenges facing the nation. Two-year colleges and informal science education centers have a valuable role to play in these efforts and the Foundation is committed to providing support for these institutions within the existing program structure of the

Foundation. We believe that the amount of funding which will realistically become available can be most effectively awarded through these existing EHR programs where equipment is coupled with programmatic activities, rather than creating new programs.

Equipment purchased independent of a larger educational effort will have little impact. There may be no extensive plan for the use of the equipment and provisions for the maintenance and replacement of the equipment may be inadequate. Advanced technologies are of little use if educational applications have been poorly developed or if teachers or college faculty are not well-prepared to take advantage of the technologies; one need only note the poor utilization of hundreds of thousands of computers in our public school classrooms.

Existing funding mechanisms used by EHR for the support of advanced educational technologies have been effective. The equipment purchased through peer-reviewed grants from either the ILI or ISE programs must be part of a larger educational effort. This provides some assurance that the equipment will be effectively used and that its use will be dedicated to science and mathematics education, such as the reform of undergraduate science curriculum or as a part of a science museum exhibit. The grants made through the ILI programs have been effective in leveraging substantial non-Federal support for upgrading laboratory instruction at the undergraduate level. ISE grants involving technology have enhanced the experiences of millions of museum visitors and have stimulated the development of new exhibit techniques.

A third program in EHR, Applications of Advanced Technologies (AAT), must also be cited for its central role in the applications of technology to the improvement of science and mathematics education. The Office of Technology Assessment (OTA) stated in its recent report, Power On, (1988), the only known overview of Federal R&D in educational technology, "Nearly all the technological tools, pedagogies, and methodologies had their instructional origins in these early NSF projects -- telecommunications and computer networks, graphics, speech synthesis, programming languages such as Logo, laboratory instrumentation, instructional simulations, interactive dialogues, economics modeling and gaming, social science data analysis, interactive videodiscs, career counseling, and computer literacy for educators." Thus, projects funded through the AAT program and earlier programs have been largely responsible for the great advances which have been made in the use of advanced learning technologies.

TWO-YEAR COLLEGES

Through various programs, NSF supports the role that two-year colleges play in the preparation of transfer students, the training and retraining of the technological workforce, and the improvement

of the scientific literacy of other students. The Instrumentation and Laboratory Improvement Program supports projects to generate more effective and efficient approaches to laboratory and field-based instruction in two-year institutions.

ILI funding stimulates important laboratory instructional improvements and helps leverage significant non-Federal resources towards this end. Substantial cost-sharing is required and provided by the awardee institutions from their own resources, private foundations, states, equipment manufacturers, and other elements of the private sector. In FY 1990, 49 awards were made to two-year colleges through this program; in FY 1991, there were 52 awards. The typical ILI grant is relatively small by NSF standards, but the results are significant. Here are several examples:

- The Montgomery County Community College (Pennsylvania) received $43,183 to develop a computer laboratory with an intelligent tutoring system for algebra, providing students with opportunities to conduct experiments with mathematics, the piloting of new materials, and faculty training.

- Edison Community College (Ft. Myers, Florida) received $86,525 to develop a "living" laboratory, which provides undergraduates the opportunity to use sophisticated analytical equipment to analyze water samples and biological field data, which forms a substantial part of laboratory courses and which will ultimately provide an ecological baseline of the waters in the region.

- Saddlebrook College (Mission Viejo, California) received $23,985 to purchase equipment which will allow students to isolate cellular organelles and macromolecules in cell biology, microbiology, and introductory biology laboratory course, and to perform simple exercises in recombinant DNA technology. The equipment will be used in introductory biology courses and also in non-majors biology courses in an effort to increase the scientific literacy of general students in modern molecular biology.

Two-year colleges are also eligible to apply and receive support from EHR's Undergraduate Course and Curriculum Program, which provides funding for curriculum development, and Undergraduate Faculty Enhancement Programs, which provides funding for professional development for undergraduate faculty. (The following table provides a breakdown of NSF support of two-year colleges).

NSF Support to Two-Year Colleges
FY 1991

	Number of Awards	Dollars in Millions
Instrumentation and Lab. Improvement	53	$1.71
Course and Curriculum	6	$ .36
Faculty Enhancement	2	$ .08
Other EHR Programs	11	$ .64
EHR TOTAL	72	$2.79
NSF Research Programs	13	$ .56
NSF TOTAL	85	$3.35

EHR has taken significant steps to increase the role of two-year colleges in its programs. EHR is supporting the NSF/American Association of Community and Junior Colleges (AACJC) Fellows program, in an effort to better inform the two-year college community about NSF programs and funding opportunities. Through this program, eight two-year college faculty have served in-residence in EHR divisions where they have become familiar with the broad range of existing programs and ongoing projects. These Fellows will maintain contact with NSF and communicate with their colleagues through AACJC and other professional organizations. Through presentations at professional meetings and two-year colleges, NSF program staff are providing significant outreach to introduce science, engineering, and mathematics faculty at two-year colleges to funding opportunities within EHR. Workshops are also being held to improve the number and quality of proposals from two-year colleges.

EHR sought recommendations from two-year colleges in a workshop held in May, 1991, on science, engineering, and mathematics education at these institutions. An NSF report entitled Matching Actions and Challenges (1992) transmitted the recommendations of the workshop. Finally, members of the EHR Advisory Committee prepared a report at the request of EHR entitled "Suggestions to Increase Community College Participation with the National Science Foundation."

Based upon these reports, EHR is planning to strengthen the Undergraduate Course and Curriculum program to include a focus on curriculum development on technology education and to strengthen the current emphasis on curriculum development activities which seek to improve the science literacy of all students, not just those who are electing careers in science. This would capitalize

on the strengths of two-year college faculty members in such areas as collaborative learning, high quality teaching, hands-on experiences, and work with underrepresented groups.

INFORMAL SCIENCE EDUCATION

Within EHR, the Informal Science Education Program (ISE) supports the important role of informal science institutions by providing resources for educational exhibits, media, and strategies reaching participants in settings outside of school. The goals of ISE are to support projects which develop the interest of children and youth, especially those from underrepresented groups, in science, mathematics, and technology; stimulate parents and other adults to become informed advocates for higher quality science and mathematics education; support the school curriculum with related informal activities; and improve general science literacy. These projects are funded primarily through grants supporting the development of television and radio programs, science museum exhibits and programs, and educational efforts carried out through youth-serving and community organizations.

ISE has provided funding for the purchase of equipment integral to an exhibit or program of institutions engaged in informal science education. We estimate that about 10 percent of the funds awarded to non-profit institutions engaged in informal science education are for equipment, which would total approximately $1.5 million for FY 1992. For example, the New York Hall of Science is developing an exhibit on audio technologies. NSF funds purchased some of the computer hardware needed for the project, but the SONY Corporation is donating much equipment and technical assistance to the project.

More often, ISE has supported projects where NSF funds were directed towards the development of the software or programming involved in an exhibit or program. This funding has often leveraged the donation of substantial amounts of equipment from corporations or other non-Federal sources. For example, Ohio's Center of Science and Industry's "Mission to Mars" project lets visitors participate in a simulated space voyage, including science experiments. Apple Computer donated the hardware for the interactive computer stations in the exhibit; NSF funds supported the development of the software, which recently won first place in the annual competition sponsored by the Smithsonian and Computerworld Magazine.

In another project, ISE is supporting the development of the Playing to Win Network, which will provide technical assistance in the development of software and educational programs for "community computing centers", which provide low-income and minority communities with access to and training in the use of computers and other technology. Apple Computer and other corporations have

donsted hundreds of computers to over a hundred such programs across the country.

ISE has increasingly supported the development of the "infrastructure" of informal science education through professional development programs and through projects which help developing museums acquire the fundamental "equipment" used by museums, that is, high-quality, interactive science exhibits. Indeed, roughly one-third of all ISE-funding (approximately $12 million in FY 92) goes towards the development of exhibits. Professional development opportunities are now available for museum educators, staff and board members of developing science centers, and minority museum staff, through projects supported by ISE.

The program has also committed over $4 million to three projects which will enable developing science centers to acquire proven sets of science museum exhibits from existing science centers. For example, the Pacific Science Center (Seattle, WA) has developed a travelling science program called "Science Carnival", to bring the science center experience (including exhibits, science demonstrations, and teacher workshops) to rural areas in Washington, Idaho, Oregon, and Montana. Developing museums can now acquire copies of the "Science Carnival", along with technical assistsnce and staff training, through an ISE grant to the Pacific Science Center.

In summary, ISE supports a broad range of projects which involve the purchase of equipment, but more often supports the development of software, curriculum, interactive media, or other means which enable participants to make more effective use of computers, interactive media, and other technologies in relation to learning about science and mathematics. NSF support leverages considerable donations of computers and other high-technology to non-profit institutions engaged in informal science education.

JOINT PROGRAM MANAGEMENT

H.R. 4726 provides that program activities authorized would be jointly funded by the NSF, NASA, and DOE. The FCCSET process by its very nature encourages coordination, cooperation, and where appropriate, joint ventures between its member agencies. For example, NSF has, in fact, recently signed a formal memorandum of agreement with the NIH for joint funding of several programs. It can work. It also takes time to establish operating procedures which accommodate the idiosyncrasies of cooperating agencies.

CONCLUSION

Within the nation's public schools, two-year colleges, and universities, there are tremendous needs for funding to bring educational and research facilities up to date to meet the demands for the future. NSF's current programs in research and education are highly competitive. The Federal funding available cannot meet all the needs for these activities, nor is it primarily a Federal responsibility. In addition to equipment needs, continual research and development is needed to assure that our nation's classrooms benefit from the latest advances in technology; without such research, the return on the investments in new hardware will be minimal.

While we support the general intent of the bill, it is our belief that the National Science Foundation does not need new authority to accommodate the legislation's intent and already, to the extent that funds permit, carries out the activities described in the bill. Therefore, we recommend that no further action be taken on H.R. 4726. Thank you, Mr. Chairman for the opportunity to discuss these matters with you today.

Mr. THORNTON. Thank you very much, Dr. Williams, and the entire—without objection—the entire written statements of each of the witnesses will be included as a part of the record, and our next witness is Mr. Richard E. Stephens of the Office of Energy Research.

Mr. Stephens.

Mr. STEPHENS. Thank you, Mr. Chairman. It's a pleasure to be here. Actually, it is a rare opportunity for my Department to testify before this particular subcommittee, and we certainly appreciate the opportunity to do so.

As I'm sure members of the subcommittee know, however, DOE has been very deeply involved in support for education since the very earliest days of the Atomic Energy Commission. However, I also want you to know that beginning in 1989, from Admiral Watkins on down, the Department is absolutely firmly committed to doing whatever we can to assist in achieving the national education goals.

Since 1989, we have initiated a wide range of pre-university science education programs principally, but not exclusively, centered around our National Laboratories and research facilities. Many of our initiatives include formal partnerships between our laboratories and school districts at either the regional or in some cases State-wide levels. Just two examples perhaps for your edification.

We have a partnership under way now with the Oakland Unified School District in California involving all four of the DOE laboratories in the Bay area. It involves every school, both elementary, middle, and high schools,[1] and it involves most of the teachers. And the kinds of activities we are involved with include summer institutes for teachers; workshops; equipment loans; advice on development of experiments that they can use in chemistry, biology, and physics classes; internships for students; advice on curricula; and a whole range of other ancillary activities.

That is kind of an example of what we would classify as a full court press in some of our initiatives with school districts.

On the other hand, on the other end of the spectrum are what we might call a one-on-one program involving staff at our Continuous Electron Beam Accelerator Facility down in Newport News, where every week during the school year we bring in four entire classes of fifth-grade students from the Newport News school district.[2] They spend the entire week at the laboratory, eight hours, or basically a school day, learning about science—in this case, physics—and doing a lot of interesting hands-on experiments. Teachers are absolutely central to that particular program, and we propose to expand that over the next several years actually to a State-wide initiative in Virginia.

Many of these initiatives actually came out of a conference we sponsored back in 1989 at the Lawrence Hall of Science, and as the chairman of the committee, Mr. Brown, recalls, it was a three-day process, a very intense discussion on the role of DOE in achieving national education goals, and many of the initiatives we have started certainly began at that particular conference.

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[1] Mr. Stephens intended to add "in Oakland, California."
[2] Mr. Stephens intended to say "and the Hampton, Virginia school district."

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All of these activities, including our new programs, are described in our new education catalogue, of which I believe copies have been made available to members of the subcommittee. This is a fairly good representation of the range of programs the Department of Energy is currently involved with, but not all, because many of our activities involve individual volunteers at our laboratories working one-on-one with teachers, students, and parents in a very informal way of assisting in science and math education improvement.

Now as members of the committee certainly know, there are a number of serious issues which confront us in science and math education. Two are of particular concern in today's hearing. Let me phrase the one the following way. And that is the continued low representation of women, minorities, and those with disabilities in most scientific and technical disciplines must be corrected over the next 10 to 15 years, or we will have serious consequences for the continued vitality of U.S. science.

Community colleges, noted in H.R. 4726, are particularly well positioned to assist in this effort to better prepare more minority students particularly for future careers in science, engineering, and related fields.

The second issue is the appalling level—I need to underscore that word—the appalling level of scientific illiteracy on the part of the American public. This has serious implications for our ability to make public policy decisions on issues which are inextricably interwoven with science, technology, and even math.

Regarding our support for community colleges, we have several modest but growing initiatives that I do want to make sure Members are aware of. One is, we have a program that has gone on for a number of years called the Pre-freshman Enrichment Program, which is a series of summer institutes on campus for middle school women and minority students, enrichment programs in science and math. Beginning in fiscal year 1993, the eligibility will be changed so that community colleges will be eligible to compete directly for awards rather than partnering with four-year colleges with degreed programs.

We also provide equipment loans—actually, equipment grants, rather—to community colleges through our Used Energy-Related Equipment Program. DOE has somewhat unique legislative authority to provide access to excess scientific equipment at our National Laboratories to universities and colleges on a first come/first served basis. And we note over the last several years that many smaller and two-year colleges have really benefited from that particular program.

We also have started some interesting initiatives in one of the particular areas of growth in the Department, which is our Environmental Restoration and Waste Management Program, which, as you all know, deals with not only the science and technology of environmental cleanup but also the manpower required to achieve these goals. We find that we cannot literally identify the cadre of people that we need for our facilities for the next number of years without going back in and beginning to prime the pump, particularly at the community college level in establishing two-year degree programs on environmental waste management.

One unique initiative beginning in California involves the Lawrence Livermore National Laboratory and all the California community colleges as well as colleges in Nevada and Arizona, working together to develop new curricula at the two-year level in hazardous waste management.

Regarding our concerns with public science literacy, this concern cuts across all of the Department's pre-college initiatives. We strongly believe that the best defense against scientific illiteracy is a well educated, highly motivated, personally challenging math and science teacher beginning in the early primary grades all the way through high school. Every one of our pre-college initiatives involves teachers, and every one of those initiatives provides a background and focus for helping those teachers really begin to excite and challenge their students, many of whom will not go on to become scientists and engineers and ideally will become more literate citizens in this particular environment.

We also have three interrelated programmatic approaches to helping improve science literacy. Like NASA and the National Science Foundation, we also have a Museum Science Education Program we have started several years ago providing competitive awards to science museums and science centers. Attached to my formal testimony are the list of awards made both last year and just last week in this current fiscal year.

I do want to note that several of these awards are jointly sponsored with NSF and other private organizations. In fact, we continually seek out opportunities to leverage our funds with other agencies and with private organizations so that we can bring together an interesting overview of various issues in science and technology representing different perspectives.

Our second approach is also beginning to develop along the lines of assisting in the development of interesting instructional and public television programming on science and math. And my testimony has numerous examples of what we have done in the past; let me just cite two. One is the series called Futures, which involves Jaime Escalante, the award-winning teacher from Los Angeles, now in Sacramento, which is an instructional series—15-minute videos on how important math is, no matter whatever career you choose. The Department, along with NSF and ARCO and IBM,[3] is very much involved in supporting that series, and just recently PBS has indicated this is the most successful instructional TV series ever in the history of the system.

We also are involved in underwriting the production of education materials for a PBS series called The New Explorers, which is hosted and moderated by Bill Kurtis from Chicago. Bill essentially illustrates how scientists do science. What we have done through the Argonne National Laboratory, working in partnership with 14 Chicago-based educational institutions, have developed curricular materials for use in middle schools that illustrate how science is actually done, which includes a field trip for the students to actually see the science described in the particular video that they are watching.

[3]Mr. Stephens indicates that the Department of Labor also provides funding for Futures.

The Chicago education partners include all the museums in Chicago, the two zoos, the planetaria, several research laboratories, and, of all things, even one of the police precincts as one of the shows dealt with forensic science.

Both of these series, Futures and New Explorers, are designed to stimulate student interest in math and science, particularly to indicate how important to them science and particularly math will be to whatever future careers that they choose.

Finally, in our public science literacy, we have engaged our laboratories again in outreach programs to their local communities. Most of our Laboratories not only have partnerships with local school districts but, as part of that, have partnerships with community groups, parents organizations, churches—wherever there are organizations that would basically benefit from the type of involvement of our scientists in reaching out in a nontraditional way to parents and their students.

Many of our programs—for example, in Sandia in Albuquerque—require as a price of admission for a student to participate in a program, they have to bring a parent along. And that is absolutely an interesting way to underscore the connection we need to make with family life in terms of math and science.

Finally, let me talk briefly about H.R. 4726, which certainly has very laudable goals. As I have noted, we have continued to expand the involvement of both science museums and community colleges in our various programs, and we certainly are actively involved in seeking out potential collaborative opportunities with NSF, NASA, and other affiliated agencies involved and the Committee on Education and Human Resources that Dr. Brown referred to.

DOE currently has formal memoranda of understanding in science education with six Federal agencies—working on a seventh with the U.S. Department of Agriculture—where we have agreed to work with our resources, mainly people, to assist those agencies in achieving their own educational goals by providing the kind of input from our Laboratories that helps intensify the education experience provided by the other agencies.

We do believe that the intent of H.R. 4726 is certainly laudable, but it seems to us that the administrative provisions would be unwieldy at best and would not seem to bring any value added to what is already going on in the relationships between and among these three agencies.

To summarize, Mr. Chairman, the Department is very much involved, as I hope I have pointed out, in efforts to improve science and math education, both those that are focused on attracting more students into careers in science and engineering, but certainly more broadly based on the need to begin to raise public literacy in science and technology, which I do believe is certainly one of the more critical problems we face in this whole area of education.

Thank you for the opportunity to be with you.

[The prepared statement of Mr. Stephens follows:]

STATEMENT OF RICHARD E. STEPHENS

ASSOCIATE DIRECTOR FOR UNIVERSITY AND SCIENCE EDUCATION

OFFICE OF ENERGY RESEARCH

DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON SCIENCE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

HEARING ON H.R. 4726
THE OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992

JUNE 23, 1992

Mr. Chairman and Members of the Subcommittee:

I am pleased to represent the Department of Energy (DOE) in today's hearing on H.R. 4726, the Opportunities in Science and Technology Act of 1992.

In my testimony I would like to first highlight the involvement of the DOE in the national effort to improve mathematics, science, and engineering education at all levels. I would then like to summarize our concerns with and support for efforts designed to improve public literacy in science and technology, and finally, comment briefly on the purposes and provisions of H.R. 4726.

As Members of the Subcommittee know, the Department has been involved in support for education since the earliest days of the Atomic Energy Commission, the first predecessor agency to DOE. Some of the first Federally-supported programs DOE now conducts for undergraduate and graduate students were initiated by the Atomic Energy Commission in the early 1950s. This tradition of support for education continues today.

While historically DOE has always been deeply involved in university-level research and related education programs, beginning in 1989 the Department made a major commitment to programs at the pre-university level. This commitment was made based on the reality that DOE is both a major consumer and supporter of scientific and engineering talent. However, it is also clear to us that the current problems affecting the Nation's precollege science education system (which have been well documented in previous hearings by this and other Congressional committees) have major long-term implications for the Department's ability to find, recruit, and retain scientifically and technically educated personnel for future DOE missions. More broadly, a

scientifically literate public is needed to make well-reasoned decisions about energy options and to devleop, manage and properly use energy technologies. The Department, therefore, has a direct stake in the national effort to improve science and mathematics education at all levels in order to ensure that sufficient numbers of young people, including women, minorities, and those with disabilities, pursue careers in scientific and technical fields. The National Energy Strategy seeks to increase Americans' understanding of the role of energy in their lives, and its attendant costs and benefits, and to ensure a reliable supply of highly skilled scientists, engineers, and technicians in energy-related fields.

Much of the Department's current support particularly for precollege level education and related public science literacy programs has grown from recommendations developed at the "Math/Science Education Action Conference" held on October 8-10, 1989, at the Lawrence Hall of Science in Berkeley, California, and co-chaired by the Secretary of Energy, Admiral James Watkins, and Nobel Laureate Dr. Glenn Seaborg (former Chairman of the Atomic Energy Commission). This conference was undertaken in direct response to the Charlottesville Summit Conference on Education where the President and the Governors developed the National Education Goals. The Berkeley Conference produced a specific blueprint for action for DOE to become fully engaged in the effort to achieve the National Education Goals, particularly Goal #4: "By the year 2000, U.S. students will be the first in the world in science and mathematics achievement."

The DOE strategy for precollege science education heavily relies on the unique physical and human resources included in the Department's National Laboratories and contractor resear h facilities. The nine multi-program DOE National Laboratories and over 30 additional specialized research facilities are, therefore, directly involved in carrying out the Department's science education mission. This unparalleled collection of scientific and technical facilities and instrumentation along with the thousands of scientists, engineers, and technicians who work at these world-class institutions have extraordinary potential for exciting students, teachers, and adults about science and technology.

Increased use of DOE's facilities for precollege student and teacher programs became formal Department-wide policy on May 21, 1990, when Secretary Watkins issued a notice expanding the Department's education mission. This notice directed all DOE offices, facilities, and contractors to commit support to education through such activities as loans of equipment and staff to schools, education-oriented community service by DOE employees, and joint partnerships with Federal agencies, schools, businesses, science museums, and other community partners. As a result of this overall strategy and the full implementation of the Secretary's notice, DOE's precollege initiatives are fully supportive of the National Education Goals, the National Education Strategy as embodied in "America 2000," and the efforts undertaken by other Federal agencies in science education as coordinated by the Federal Coordinating Council for Science, Engineering, and Technology Committee on Education and Human Resources (FCCSET/EHR).

The array of DOE science education programs, including our efforts on behalf of public science literacy, is described in the "DOE Education Programs Catalog" (copies of which have been distributed to Members of the Subcommittee). Just to summarize, in 1991 alone, primarily through these laboratories and research facilities, DOE sponsored over 800 individually identified precollege programs that reached over one million students and educators. In terms of funding for science education, the Department's budget request for FY 1993 includes $113.2 million spread among individual DOE program offices for support of programs directly focused on mathematics, science, and/or engineering education. Within this total, we estimate that approximately $4.3 million will be directly spent on public science literacy-related programs and projects.

Let me now turn specifically to our public science literacy program. First, there is concern for public science literacy and the need to ensure that <u>all</u> students and their parents are able to effectively function in a world economy increasingly dominated by scientific and technical issues. This concern cuts across all DOE precollege programs. It is our firm belief that the first line of defense against scientific illiteracy is a well-trained, highly motivated elementary school teacher with the second and third lines of defense being teachers at the middle and high school levels.

There are three primary programmatic approaches being taken by DOE to support public science literacy efforts. These are as follows:

Museum Science Education Programs:

The Museum Science Education Program provides up to $1 million annually to museums for energy-related scientific and technical exhibits and related education programs. This program provides the Nation's museums, visited by more than 150 million people per year, an opportunity to increase public science literacy through funding for exhibits, programs, activities, and technology. The list of awards made in this program in FY 1991 and FY 1992 is provided for the record.

Public/Instructional Television Programs:

We are increasingly involved in co-funding public and instructional television programs that deal in whole or in part with energy-related scientific and technical subjects that are focused on increasing student awareness of the importance of mathematics and science in their future. These include:

FUTURES--FUTURES is an instructional television series designed to stimulate student interest in mathematics. Hosted by teacher Jamie Escalante, the program shows how mathematics plays an integral part in a range of exciting careers, from skateboard designs to architecture. The 1991 FUTURES Back to School Public Broadcasting System (PBS) special was the award-winning "Math . . . Who Needs It?" featuring Bill Cosby. The National Aeronautics and Space Administration (NASA) will be co-funding with DOE the 1992 Back to School PBS special that will focus on Space.

New Explorers--The "New Explorers" with Bill Kurtis will be entering its third successful year on PBS. With the help of local teachers and scientists and 14

institutional "Explorer Partners" (which are predominantly museums), the DOE Argonne National Laboratory has developed teaching materials to accompany each program in the series. Staff at Argonne are coordinating teacher workshops based at museums throughout the country to introduce the Explorers teachers' guides and to adapt them to the local community. The Knoxville Zoo and Boston Museum of Science are just two locations for these workshops.

Magic School Bus--The Magic School Bus is another PBS series, co-funded with the National Science Foundation (NSF), that will address key science concepts, systems, content areas, and facts typically taught in elementary schools. This animated series "stars" Mrs. Frizzle and her students who will take many exciting field trips through the solar system, to the bottom of the ocean and more. Due to the animated nature of the series, much of the often abstract information relevant to the topics will become alive and touchable to the cartoon characters and, consequently, be easy for the younger elementary school students to understand. This series will premiere next fall and is planned to go "head to head" with the traditional Saturday morning cartoons.

Space Age--Collaboratively, DOE is partially funding, along with NSF and NASA, the production of "Space Age," an eight part, one-hour documentary series for PBS produced by WQED/Pittsburgh and NHK/Japan in association with the National Academy of Sciences. This series will take its viewers on an exciting adventure rich with science, mathematics, engineering history, and new concepts that have and will continue to come from the space program.

Education Outreach Programs:

The third programmatic approach taken by the Department of Energy in supporting science literacy efforts is through the education outreach programs at the Department-sponsored laboratories. Many of these programs are described in the "Education Programs Catalog." Some examples include:

Brookhaven National Laboratory--Introduction to Computers is a 6-week course providing an opportunity for people of all ages to understand a computer's "thinking", hardware and software concepts, basic computer programming, introduction to word processing and spreadsheets, and hands-on software demonstrations. The program is sponsored jointly by Brookhaven National Laboratory, along with local churches and school districts with high minority enrollments.

Lawrence Berkeley Laboratory (LBL)--In their Hands-On Universe Program, LBL scientists work directly with high school science teachers nationwide. The teachers learn real science by using a high quality telescope for image acquisition and by analyzing the data using a professional image processing system. Sites for this project include the Boston Museum of Science, the Capitol Children's Museum, and the Harlem Community Computer Center. Further funding has been requested from NSF for this project. The Museum of Science in Boston is also receiving technical assistance in updating their planetarium education programs through spin-offs from the Hands-On Universe Program.

Stanford Linear Accelerator Center (SLAC)--As one of several DOE facilities, SLAC helped develop the "Standard Model of Fundamental Particles and Interactions." This wall chart is used in over 50 countries.

Comments on H.R. 4726:

H.R. 4726 cites the essential need for a "citizenry knowledgeable in science and technology as the United States enters the 21st century." The important roles played by both science museums/science centers and the two-year community colleges in addressing this need are illustrated in the proposed bill. The need for close interagency collaboration in helping to achieve public science literacy is also noted. As I have pointed out in my testimony, the Department is committed to assisting in the national effort to improve public science literacy, and our Museum Education Program is one approach towards this end. Community colleges also participate in a number of DOE education programs both through my office's Freshmen Enrichment Program (which sponsors summer math/science enrichment institutes on college campuses for middle school women and minority students) and through training and development programs related to the needs of the DOE Office of Environmental Restoration and Waste Management. We actively seek out potential collaborative opportunities with NSF, NASA, and other Federal and private sector agencies in these and many other science education programs. We have formal "Science Education" Memoranda of Understanding with six Federal agencies that serve as administrative vehicles for joint programmatic efforts. We have close working relationships with the education staff at the National Science Foundation and, as I have noted in my testimony, are involved in joint support for several public science literacy projects.

Therefore, while the intent of H.R. 4726 is laudable, the establishment of a new joint program administered together by NSF, NASA, and DOE would be administratively unwieldy at best and would also duplicate efforts already underway. One of the key "spin-offs" of the work of the FCCSET/EHR Committee has been the development of excellent and ongoing working relationships in science education between and among the Federal science agencies. We do not believe that the already strong working relationships among DOE, NSF, and NASA would be enhanced through this legislation. DOE does not need new authority to accommodate the legislative intent, and we are already devoting resources to the types of activities described in the bill. Therefore, H.R. 4726 should not be acted on favorably.

Mr. Chairman, this completes my statement and I would be pleased to respond to any questions that Members of the Subcommittee might have.

1991 Museum Science Education Program Awards

Exploratorium - San Francisco, CA "Exhibit-Based Energy Teaching" - Exhibits on physics and life sciences and guide to help teachers build table top versions	Goery Delacote Director
The Franklin Institution Science Museum - Philadelphia, PA "Greenhouse Earth: A Traveling Science Exhibit on Global Climate Change"	William Booth Vice President of Exhibits
St. Louis Science Center - St. Louis, MO "Ecology and the Environment" - Exhibition gallery and energy science backpack program	Dennis Wint President
E. Tennessee Discovery Center - Knoxville, TN "Recycling: You Are The Solution" -Travelling exhibit and educational program directed towards middle school students	David Sincerbox Executive Director
Austin Children's Museum - Austin, TX "'Go Power' A Lively, Interactive Exhibit on Energy"	Deborah Edward Executive Director
Oregon Museum of Science and Industry - Portland, OR "Global Cycles and Changes" - Interactive exhibits and programming on global issues	Marilynn Eichinger President
Scitech - Aurora, IL "Scitech Clubs for Girl Scouts"	Ernest Malamud Executive Director
The Discovery Museum - Bridgeport, CT "Project Energy: A Science Improvement Program for Middle Schools"	Mary Anne Freeman Director
California Museum of Science and Industry - Los Angeles, CA "Our Urban Environment" - A permanent exhibit about environmental issues in urban areas	Ann Muscat Deputy Director, C.M.S.I.
The Discovery Center of Idaho - Boise, ID "Hands On Energy" - Six energy-related exhibits and educational programming.	Lorette Williams Executive Director

1992 Museum Science Education Program Awards

Scitech - Aurora, IL "E=mc2, A Hands-On Exploration of Einstein's Famous Formula"	Olivia Diaz President of the Board
Exploratorium - San Francisco, CA "Exploring the Gene: Interactive Exhibits on Genetics and the Human Genome"	Robert Semper Executive Associate Director
New York Hall of Science - Flushing Meadows Corona Park, NY "Set Careers Program: An Interactive Science, Engineering, and Technology Career Education Exhibit"	Alan Friedman Director
New York Zoological Society - Bronx, NY "The Living Systems Energy Module" - Creates an understanding that human energy places demands on the environment	William Conway General Director
Science Museum of MN - St. Paul, MN "Green Street: A Comprehensive Urban Energy and Environmental Exhibit and Education Project"	Louise Casagrande Senior Vice President
Museum of Science - Boston, MA "Testing the Theory" - Focuses on learning through experiments	David Ellis President and Director
SD Discovery Center & Aquarium - Pierre, SD "Rural America Energy Exploratory" - One permanent and one travelling exhibit; emphasis on photovoltaic power	David Padgett President
LSU Museum of Geoscience - Baton Rouge, LA "Louisiana Subsurface: Geologic History, Resources, and Hazards"	Ralph Pike Associate Vice Chancellor
San Diego Space and Science Foundation - San Diego, CA "'STARPOWER', an OMNIMAX Film on Thermonuclear Fusion and the Process of Scientific Discovery"	Jeffrey Kirsch Executive Director
Lexington Children's Museum - Lexington, KY "Energy Quest" - Six permanent exhibits and 48 visitor hands-on workshops; examines all aspects of energy utilizing "age appropriate" teaching materials	Roger Paige Executive Director

Mr. THORNTON. Thank you, Mr. Stephens.

Let's begin by addressing that general issue. As I listened to the three witnesses this morning, I found a remarkable paralleling of ideas, and generally it appeared to me to be a willingness to think that collaboration and working together in a broader interest might be useful.

Do you gentlemen believe that you could collaborate in a program that would mesh the needs of your several agencies as called for by this bill?

Dr. Brown.

Dr. BROWN. Certainly we can, Mr. Chairman. Yes, I do believe that we can collaborate in programs because, in fact, we do. We do, not only through the FCCSET Committee on Education and Human Resources, which is newer, but we do collaborate in other aspects.

For example, we have a memorandum of agreement with the Department of Energy in which we carry out various activities. So the answer is yes, we do and we can.

Mr. THORNTON. That was the impression I had.

Dr. Williams?

Dr. WILLIAMS. I agree fully. You notice Mr. Stephens made reference to several projects that are jointly funded by NSF and the Department of Energy. That is quite deliberate. Actually, when we get proposals we seek collaboration and participation by other agencies.

But there is something else that we do that is very important, that is in my written testimony—is that typically for a project that is several million dollars, the initial award is made by one or more of the Federal agencies, and then, working with the grantee, what it also catalyzes is a significant investment from the private sector, without which—

Mr. THORNTON. It leverages additional support, doesn't it?

Dr. WILLIAMS. Absolutely, yes.

So we were doing this actually prior to the creation of the FCCSET structure, and, very frankly, as three of the five or six pivotal agencies in the FCCSET structure, we are essentially obligated to collaborate.

Mr. THORNTON. Well, ideally then, structures should follow experience and, as you learn to collaborate, perhaps have additional emphasis put on it by calling for a continuation of that.

Dr. WILLIAMS. Right.

Mr. THORNTON. Mr. Stephens.

Mr. STEPHENS. It actually—a week does not go past that we do not meet together, to be quite honest, through the FCCSET or through formal meetings, and collaboration is a natural way of doing business now in science—

Mr. THORNTON. So that portion of the bill that requires collaboration is not really—it really builds on the experiences that you already have been using.

Another thing that I would like to address, because I really agree with you, Dr. Williams, so much on this, that any advances in science, any programs, must be considered as a part of a larger educational goal, that you get in trouble when you put computers in classrooms and you have not trained the teachers how to apply

them. You need to have a larger goal, and I would like to ask each of you the question whether there is anything in this language of this bill that would in any way restrict or restrain you from applying the resources that are provided within the bill in accordance with an outline of a larger educational goal.

Would you like to begin, Dr. Williams, and then we will go to Dr. Brown and Mr. Stephens.

Dr. WILLIAMS. Well, if I remember the categories of the bill, it stipulates that 25 percent of the resources will go to the two-year colleges. That is not a problem. Twenty-five percent of the funds would go to science and technology centers. That isn't a problem.

The component of the bill that specifies specific items of equipment that one would purchase, now the only—that would be problematic only if it could not be folded in the context of a program, but if it could be put in the context of a program—I mean the audio-visual equipment, per se, NSF isn't going to—we don't do that. We don't provide categorical pieces of equipment. We try to provide a program for students, parents, and other participants. Now if that equipment is integral to it, that is not a problem.

Mr. THORNTON. And indeed that is something that the bill provides that is not presently done, and that is to move toward equipment or facilities that are needed.

Dr. WILLIAMS. That is right.

Mr. THORNTON. So it would encourage doing that, and then the question would be whether you all could provide the leadership to make sure that that equipment does not go into programs except those that have a broader educational base.

Dr. WILLIAMS. Yes.

Mr. THORNTON. Dr. Brown, how do you react to that?

Dr. BROWN. My views, Mr. Chairman, are essentially those of Dr. Williams. Yes, it can be accommodated within the existing programs. I don't see anything in there that is really counter to it.

I would say that in terms of our strategy in NASA, we have opted to place our emphasis on other kinds of activities in terms of loans of equipment and exhibits and technical assistance rather than upgrading facilities and equipment, per se. It isn't that we could not do so, but we chose to emphasize our strengths.

Mr. THORNTON. Yes.

Mr. Stephens.

Mr. STEPHENS. I think Dr. Brown has hit on a key point, and that is technical assistance. When we provide equipment loans or grants of equipment to schools, particularly K-12 schools, we really do need to follow up with assistance to help the teachers really utilize the equipment in their own classroom experiences. And that is not an easy task. It really does require fairly constant follow-on. That is something that our laboratories have been particularly good at, and something that I think we would want to make sure would be continued in whatever kind of equipment programs one might consider.

Mr. THORNTON. Speaking for myself, I'm very concerned at the lowering of interest in science and engineering as a career. As people move from the seventh grade level, where maybe a third of all students would like to pursue that, and as they get into high school grades and begin to make choices, that drops precipitously,

so that as a portion of our educated population base this country is faltering by comparison with some of our companions. And for that reason there are several of us who are looking for ways of really emphasizing at that formative time in a young person's career choice the excitement of being involved in science.

I think each of you are saying that, and yet, Dr. Williams, $12 million out of a $465 million funding to the Directorate, the appropriate figures for each of the others, I just wonder whether we are making enough of an emphasis upon attacking this question at this particular point in the development of our scientific base.

Mr. Stephens, would you like to begin with a response to that, and we will go back down the row.

Mr. STEPHENS. I think you are absolutely correct, in looking at the recent statistics on the lack of interest on careers in science and engineering by many of our best young people who score very highly on the SAT scores, particularly the math scores. And there is certainly evidence that even as early as third and fourth grade, students begin to turn off on math particularly and certainly that accelerates at the middle school years. And to tackle that problem does require a concerted interagency and private sector effort with the schools very much involved, and a critical element—it clearly comes down still to be teachers.

That is why I think you will find all three agencies here very much involved. And our first priority is providing support for teacher enhancement, and that is something that we have worked closely on together. And if you don't have a well trained, well motivated teacher, able to deal with that particular subject, then that will begin a turn-off of students earlier than we would care to admit.

Mr. THORNTON. And also leveraging of support from the community base is important, is it not?

Mr. STEPHENS. You are absolutely right, Mr. Chairman. Again, part of what I think DOE has been able to bring to the table here is a strong reliance on volunteerism. Our scientists and engineers at the Laboratories spend a lot of their time after hours—working after hours in schools and museums and community centers mentoring and counseling. So what we really are describing is an encompassing program that starts with a formal process of school education in the classroom, moves out into the community, museums, science centers, 4-H programs, for example, community housing programs.

You have got to get the kids where they are at, and if they are not at home, then they are going to be out in the community, and you need to deal with them there. And at home you hopefully have some interesting opportunities for family members to get involved in science and math, which is one of the reasons why we are very much involved in family-oriented programs around our Laboratories.

Mr. THORNTON. Thank you.

Dr. Williams.

Dr. WILLIAMS. In agreement with Mr. Stephens, there is no question that within at least NSF and, as you referenced, the total budget, the two highest priorities are as follows: increasing the skills, preparation, and knowledge base of elementary, middle, and

high school math and science teachers who are already in the work force. That is the highest priority. It takes the largest share of the resources.

That is immediately followed by provision, to the extent to which the Foundation can make a contribution here, provision for curriculum and instruction materials. So a substantial fraction of the budget is used for that consistent with our priorities.

That is followed by a host of other priorities, and certainly the broad issue of science literacy, science awareness, involving parents, et cetera, is important. But primacy is assigned, to use the hypothetical seventh grader, to what takes place in the day-to-day classrooms as that youngster attempts to learn science and mathematics, and that is the formal classroom.

Now if you go through this prioritize exercise, the resource base is not 400-odd million dollars once you get beyond those three or four priorities. And among the remaining activities, I want to assure this committee that undergraduate education in general, but especially the two-year college sector for the reason Mr. Stephens has indicated—the broad number of students that it serves—is a higher priority, as is the broad area of informal science education.

But I want to make it very clear that the highest priorities are the two that I just indicated, and that's where the lion's share of the resources go.

Mr. THORNTON. Dr. Brown.

Dr. BROWN. Mr. Chairman, if you would just indulge me for one second, something I forgot earlier: I would like to introduce Mr. Frank Owens immediately behind me.

Mr. THORNTON. We are delighted to have Mr. Frank Owens.

Dr. BROWN. Mr. Owens is the director of NASA's Education Division. He and I have worked together closely for the past nearly six years, and he is a very fine director of that program.

Mr. THORNTON. We are very pleased to have Mr. Owens here.

Dr. BROWN. With respect to the question, there are three points I would make on it. One is that I think that parents play a very critical role in encouraging students to be more scientifically and technologically literate, and I think we need to put more emphasis. I think if parents could understand how their microwave oven worked, if a father appreciates the fact that there are 70-some computers in his car, and develop a comfort level of the technology and science around them—I think that becomes a part of sort of the infrastructure of a family and kids are not so much afraid of it.

There are those who would say that perhaps our kids are out ahead of the parents, but I would make that case.

Secondly, I think that we need to put even more effort on making science and technology more user friendly by examples of how it applies, as Dr. Williams indicates, to everyday life, and I think as Federal agencies we need to continue to work hard to tie what we are doing into the courses that are being taught in school.

For example, one of our missions last year, the Astro-1 Mission, involves the electromagnetic spectrum. Well, that is a concept that is taught in middle school, and we developed teachers' guides and educational materials around that particular activity. So I think that is an example of something that we need to continue to do.

And then finally, when you look at our NASA budget for education, about 45 percent of our budget is devoted to informal education, and we think that is an appropriate mix.

Mr. THORNTON. Well, I don't want to take more time. We have other Members here who have questions. I do want to make the observation that I hear each of you expressing with enthusiasm the importance of the subject matter which is addressed by this bill and the capability of your agency, not only individually but working together, to move forward with this kind of a program. In fact, you are doing it on your own to some degree, though maybe not as much in facilities and equipment as the bill would need. And I really like that.

The only question I have is why, if that is such a good idea, you wouldn't like to have a little more money to do it with, and I believe I will just at this point recognize the gentleman from Maryland, Mr. Gilchrest, for such questions as he may have.

Mr. GILCHREST. Thank you, Mr. Chairman.

I'm not going to make any comment at this point about the validity of the bill, but what I would like to ask—and several of you have alluded to it—unless you have a schoolteacher—back up just a second. The parents are the ones that instill the curiosity in the children. I don't know how we pay for that. But a schoolteacher has to be motivated, has to have the skill, and has to have the knowledge, and there's many references to passing through fifth graders or seventh graders, and all of that needs to take place, and you emphasize that the teacher needs to be motivated.

How do you reach the teachers not only in two-year schools or four-year schools, but on a continuing basis five years later, six years later, 10 years later, when they begin to literally in some instances burn out or don't get motivated? The teacher that teaches those seventh graders has to, in my opinion, on an annual basis be exposed to the latest information available so that they can go back in September and be more motivated and more confident about what they have.

Is there a way—and I know it is pretty much up to the school district themselves to find ways to do this—but can some of this money be created or organized in such a way that colleges can participate throughout the country so that on an annual basis schoolteachers from kindergarten to the twelfth grade can have a workshop or a seminar for three or four days on a regular basis so that when they go back in September they are ready to go?

Dr. BROWN. Go ahead.

Mr. WILLIAMS. Please.

Dr. BROWN. All right. Yes, I would like to say a couple of things on that, on both aspects of the question, which I think you are right on target. One of our programs focuses on teachers who are planning to become teachers. We happen to believe—and I think we have some pretty good evidence of that—that aeronautics and space can be a stimulus not only for students but for adults as well. And we have awarded grants to several schools of education on a pilot basis to incorporate aeronautics and space concepts into the courses that the teachers are taking so that when those teachers graduate from college, regardless as to where they go or their specialty area, they will have been exposed to a body of knowledge

and information about aeronautics and space that they can integrate into the courses that they take.

Secondly, we have a rather extensive teacher workshop program where our mobile aerospace education specialists visit schools around the country during the year and conduct teacher workshops, particularly in summer. We reach about 20,000 or so teachers each year through these workshops.

And then finally, as an outreach to teachers who are actually in practice, we have a set of video conferences that are interactive, that we downlink to schools and teacher groups around the country. The most recent one we did, for example, was on the high speed civil transport aircraft that we are working on at our Langley Research Center, and we presented that to teachers in an interactive mode on our video broadcast.

So those are three examples of ways in which we seek to reach teachers both at the beginning of their careers and during their careers.

Dr. WILLIAMS. Just one addendum to Dr. Brown's comment. That is a very important program for exactly the purpose you have in mind. NSF has programs, as does Energy—in fact, almost all of the 16 Federal agencies involved in the education and human resources FCCSET structure. But there are also programs in other sectors. So if you take the total collage of activities that are being provided to teachers, it is impressive, but nonetheless there are gaps. There are still teachers, particularly in nonurban areas, who are not being served.

Under a recent memorandum of agreement that NSF entered to collaborate with the Department of Education, which has the Eisenhower Act math and science education monies—what we are attempting to do is essentially build what you are describing, working with the local communities which actually must take the initiative, but to make sure that there is at least one per year several-day workshops for elementary, middle, and high school mix teachers for this enrichment you just described, and it is integral to their employment. It takes place on an annual basis. It is not episodic; it is not occasional; it is not a function of whether one is interested or whether it is available.

We have a lot of programs—what I'm attempting to say—in place. We don't have an organized system for provision of those programs to the teachers, so that is what we are attempting to do presently.

The point you make is exceedingly important, because by these annual infusions one can essentially defer, probably permanently, the major expenditure that would be required for a substantial overhaul of a middle school math teacher five years hence who has actually not remained current.

Mr. STEPHENS. Just one modest way in terms of my Department helping in this problem: We do bring in teachers from all over the country to spend an entire summer actually doing research at DOE National Laboratories. And we have found that the school districts who carefully select those teachers select them on the basis of future leadership potential to become role models for other teachers in a particular area of, say, physics and chemistry or math. And providing them with a research experience, working hand in

glove with our scientists—that rubs off for quite a period of time both in recharging their batteries and enabling them to take advantage of what is going on in real science and putting it back into the classroom in ways that maybe the textbooks won't really deal with for 10, 15, maybe as long as 15 years.

It is a modest initiative but will be expanded next summer to include other Federal Laboratories. So over time we should be able to provide a fair number of teacher contacts, if you will, in real science, which I think is part of the whole process of change.

Mr. GILCHREST. Thank you, gentlemen. I leave here optimistic.

Thank you, Mr. Chairman.

Mr. THORNTON. Thank you, Mr. Gilchrest.

Next in order of appearance at our committee was the gentleman from Illinois, Mr. Fawell.

Mr. FAWELL. Thank you, Mr. Chairman.

I want to first of all congratulate the witnesses. I think a momentous occurrence has taken place this morning that I have observed, and that is that indeed as the chairman has indicated there is in a sense an offer of additional Federal funds, and each of you have indicated, though without any doubt in my mind, you are deeply concerned with science education and certainly doing a lot collaboratively in cooperation, et cetera, et cetera. But—and I don't remember many times that I have heard testimony like this where you have said such things as, there is duplication of efforts, we are already doing this, already strong working relationships in science education, would not be enhanced by this legislation, does not need new authority, already have funds to carry out many of the bill's activities, and even the statement, "In these times of shrinking budgets, agencies like NASA must carefully economize to ensure that they can conduct their mission."

Now I congratulate you, and I'm deeply interested too. We have a sci-tech private science center that was created really by the efforts of Fermi, and it is doing wonderfully, and it could use more equipment, no question about that, and they have a tremendous educational program going.

But I can't help but relate, there was a Dr. Payne—I don't know the full story—an academician, I believe, from Yale who recently came up with a study and said that in 99 percent of the hearings in Congress where people are asking for or where a bill proposes more spending—99 percent are people who support that bill—the administrators from agencies, lobbyists, groups, who understandably are there testifying on behalf of, yes, more money is needed and we know how to spend it, and so forth and so on. One percent of testimony comes from people who will give the negative view that the money ought not to be spent. Well, that percentage has just been thrown out the window in this hearing.

And I know, Mr. Chairman, you did observe in a very practical and correct observation—I can't quote you completely, but you had said that all of these gentlemen are testifying with enthusiasm.

But why—why you wouldn't want to have a little more money is baffling.

Mr. THORNTON. Would the gentleman yield for just a moment?

Mr. FAWELL. Yes.

Mr. THORNTON. And also the more fundamental question, and that is the direction of the resources and whether the education needs that these gentlemen are doing such a fine job with are receiving the proper emphasis within the budget allocations.

Mr. FAWELL. Yes, and I don't mean to be at all critical, but I just think it is—we do have a terribly difficult situation, and I would question whether or not Appropriations would ever pick up this authorization anyway.

But would you care to comment on my observation?

Dr. WILLIAMS. Yes, I would like to comment on it, and I mean this quite seriously. I was not sure that I was asked specifically the question of whether I desired more money without any other type of—the answer to that question is yes, to the extent to which it is obviously consistent with our priorities.

What I tried to convey is the following. We have given several examples, and, in fact, what we are doing is more substantial than that, because the FCCSET structure really obligates us to do it. We are all committed to a science literacy program, every agency, and each of us have to bring our budgets to that process. This is not an "if you desire to participate" process. NASA's total informal or science literacy budget for next year as a request, as is NSF's and Energy's and all the other agencies, are there to equal a total program, and we have agreed generally on what we hope to accomplish. So the collaboration among the agencies is occurring and actually is going to increase. So one issue in terms of why I thought the bill wasn't necessary was to create the structure.

You see, right now we are not obligated to go through joint reviews. I receive a proposal, my staff reviews it, I contact Stevenson and his people and ask if you want to cofund this project. So it is one review, it is not a three-agency process. So it has no bearing on his administrative cost if I handle it or vice versa. That was one issue, the creation of the structure, whether we could, in fact, do precisely what you are asking without the three-agency administration.

The other point was—that I made, was that indeed equipment is important, yes, but I insist that such expenditures are going to be—could lead to the desired outcome if they are put in the context of a program. So the bill did not necessarily say expand the programs in science and technology centers or community colleges, it spoke to specific equipment items. And I'm not disagreeing with those equipment items. I'm simply making the comment that, from our perspective, that should be framed in the context of what it is that you are attempting to do programmatically.

Those are the major points. I was not suggesting anything that is inconsistent with our current level of enthusiasm for this effort.

Mr. FAWELL. No, nor did I think so. I think it is just so unusual that people will pass up the opportunity to acquire more money. That seems to be a very human characteristic that we find all too evident in Congress, and I just wanted to make some observations on it.

Dr. Brown or Mr. Stephens, would you care to comment? You don't have to.

Mr. STEPHENS. If I might add just from our perspective, it doesn't take a lot of money to go a long way. Just one example: I men-

tioned the Chicago Science Explorers Program that Argonne has taken the lead on. That is about half a million dollars a year direct funds. It reaches 15,000 kids every year. That is quite a leveraging quotient, if you think about that, because most of the work is really done on a voluntary basis by folks who are going to be paid anyway to do their job, working with teachers, with museum experts, and what-have-you. So those limited funds go a very long way, and I think that probably describes many of our initiatives that essentially take advantage of basically the voluntary approach.

Dr. BROWN. Well, Congressman, I quite agree that when you look at the scope of the problem in this country and what we are trying to deal with, we certainly need all the resources that can be garnered to do that. However, we are very much aware that there is really a tough competition for resources in today's environment, and we find ourselves really looking for opportunities to leverage what we do and to do it better and differently without necessarily raising the price tag on it. So we have really taken that to heart, and it is difficult to do, but we are really taking it seriously.

We have a new administrator in our agency, Mr. Dan Goldin. And our new administrator talks almost daily about how we can do it smaller, faster, and cheaper, and so we are taking that to heart.

Mr. FAWELL. I think maybe the community colleges might have a different viewpoint and some of the very fine science centers also.

Well, thank you very much. I did enjoy your testimony.

Mr. THORNTON. Thank you very much, Mr. Fawell.

Our ranking member, Mr. Packard.

Mr. PACKARD. I'll be brief.

I think the realities are—and Mr. Brown perhaps expressed it well in answer to your question, Mr. Fawell—the realities are that these gentlemen know and understand the constraints that this committee has to deal with in terms of providing additional funds. We are doing, I think, rather well if we can simply keep level funding rather than sustained reductions in funding. And so, in fact, I think most of these three brethren realize that these requirements in this bill will come out of existing authorization very likely, and my question then would be what, in fact, would that requirement do to your existing programs and your existing efforts that you have already outlined. And I think that you could each outline how it would force you to perhaps reduce your flexibility and maybe even reduce some of your efforts, if you had to fulfill the requirements of this bill with existing authorizations.

Dr. Williams, you might—I'll only ask one of you to respond to that perhaps.

Dr. WILLIAMS. Well, we have taken, I think, as this committee is aware, a very careful and deliberate approach to all our programs. In trying to prioritize them, I stated earlier where we assign primacy, which I say without apology, first to teachers and second to curriculum and et cetera, finally to our sixteenth priority. Clearly it would require—it would reduce the flexibility, to be sure, but also it would certainly require reducing the budget for some ongoing activities so—which is important. So whatever the activity was, the scope of it would be reduced. That is the consequence.

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Now recall that in the relative scheme of things—now, remember it is not only science and technology centers—the program, the budget that, thanks to the responsiveness—the actions of the Congress that supports the activities, at least in the science and technology centers, that budget has essentially doubled in two fiscal years. So it is not a fixed situation against which we have tried to do more.

Is it adequate? Obviously not, to be sure. But one of the consequences of it is what Mr. Packard has just indicated, and that is all I would have. That is the only option I would have, because there is no discretionary component of our budget waiting to be applied to a priority. They are all committed to some existing operation.

Mr. PACKARD. Thank you very much.

Let me ask you a specific question with regard to your testimony, Dr. Williams. In your testimony, written testimony, you included a chart that outlines $3.35 million for community colleges or two-year colleges.

Dr. WILLIAMS. Right.

Mr. PACKARD. How did you come to that figure? Is it an adequate amount, and does it accomplish the goals that your agency has set for community colleges in this area?

Dr. WILLIAMS. No, it does not, sir. In fact, as I pointed out, and one of the reasons I wanted to exhibit it, I wanted to make a larger point, that this refers to the global needs of the two-year colleges—community—which two years ago was even a million dollars less than this. I have actually been—I have increased it, really almost doubled it, in two years, and I would submit, as I said in my opening testimony, we are in the early phases of what has to be a continuing, growing enterprise. It is a sector that did not receive adequate attention earlier, and I have to rebuild it. But that rebuilding has taken place— rebuilding and support—in the context of not a healthy, growing budget, but we have been creative in terms of funding it. I'm going to be substantially in excess of 85 [awards]—what I show on this table—at the end of fiscal year '92 and, as you probably know, we have in the directorate now, as Fellows, as visitors, eight faculty members from community colleges, two-year institutions, quite deliberately to assist us in programming for the future but also, quite frankly, for them to become expert in how to be successful in NSF grants exercise.

So it is inadequate, but our long-term plan to be realized following the next three to five years is to have that number three or four times its level.

Mr. PACKARD. Thank you.

Dr. Brown, I am aware of NASA's budgetary constraints, as most of our agencies have and I also know that your community college initiatives focus on the career-specific course work and the hands-on work experience programs. Are you satisfied with the focus that NASA has in terms of their community college initiatives?

Dr. BROWN. Mr. Packard, I am satisfied that we are increasing that effort. I think it would be fair to say that historically, across the board, we have not invested heavily in community colleges. The emphasis that I described in our testimony, with the exception of two or three places, represents a new emphasis that we have put in place in the past two to three years, and we have really become

more consciously aware of that aspect of academe, academe and the number of students that are involved in the process. And we have also looked very closely at our own requirements in terms of technicians that we rely on very heavily, and that is a very rich resource for it.

Mr. PACKARD. Do you seek out the community colleges, or do they apply to you for participation in your programs?

Dr. BROWN. I would say it has been a combination of both. I would say that more recently it has been perhaps more at our initiative.

Mr. PACKARD. And you pretty well—you try to identify those colleges that are doing or have programs that blend into your initiatives. Is that what I understand?

Dr. BROWN. That is correct. And it is not only those that already have programs, but we are interested in capacity building. Those who are interested, like the one I described at our Johnson Space Flight Center in Houston. In working with those community colleges, it involves industry, NASA personnel, and the community college faculty in designing a curriculum that would cover the areas of our interest.

Mr. PACKARD. Does that generally take on regional or geographic considerations?

Dr. BROWN. That one is more immediate to that area. The one that—the effort in community colleges that is more regional, it plays itself out in our National Space Grant College and Fellowship Program, to which I spoke earlier, where we have a consortia of colleges and universities. And in these consortia a number of community colleges are members.

Mr. PACKARD. Thank you, Mr. Chairman.

Thank you, gentlemen.

Mr. THORNTON. Thank you, Mr. Packard, and I want to thank each of our witnesses for your good testimony. I would like to clarify for the purpose of the record that unless one of you wishes to correct this, that there is no requirement for multiple peer review of grants, that it could be done collaboratively with one review rather than having a multiplicity. I do not think anyone said that, but yet there was—perhaps an inference might have been drawn from the testimony that that cumbersome mechanism would be needed.

Dr. WILLIAMS. Right.

Mr. THORNTON. I want to thank you again for your testimony and ask that you—would you be willing to respond to such questions in writing as the staff may direct to you?

Dr. BROWN. We certainly would. Thank you.

Mr. THORNTON. Thank you.

Our next panel will consist of Mr. Jeffrey Rudolph, the executive director of the California Museum of Science and Industry, Los Angeles, and he is a member of the board of directors of the Association of Science-Technology Centers; Mrs. Fran Rooker, who is chairperson of the Fund Raising Committee of the Council for Community Enrichment, of Radford, Virginia; and Dr. George Boggs, chairman-elect of the board of directors of the American Association of Community and Junior Colleges, and superintendent and president of Palomar Community College, San Marcos, California.

Mr. PACKARD. Mr. Chairman, before I let it slip, when I introduced Dr. George Boggs, I said he was the dean of the school. I recognize that that is a demotion, and I didn't intend to do that.

Mr. THORNTON. As a matter of fact, for academicians, being dean is considerably higher than being an administrator.

Mr. PACKARD. Well, I wanted to set the record straight. He is president of the college and has been president of the college for several years.

Mr. THORNTON. Indeed. And actually the highest rank in academia is not an administrative rank. It is a teaching rank. The professor, the teacher, is the person to whom all others defer, and I'm sure that Dr. Boggs would agree that at any institution the professor is where the action really centers.

Mr. PACKARD. I think the panel ought to know that that is spoken by a president of a college—a past president of a college, and I think he recognizes where the priorities really are.

Mr. THORNTON. Yes, sir. Yes, sir.

We will proceed by asking Mr. Rudolph to testify first, then Mrs. Rooker, and then Dr. Boggs.

Without objection, your prepared testimony as submitted to the committee will be received and made a complete and full part of the record of this hearing, and I would like to ask that each of you summarize, insofar as possible, your testimony.

Mr. Rudolph.

STATEMENTS OF JEFFREY RUDOLPH, EXECUTIVE DIRECTOR, CALIFORNIA MUSEUM OF SCIENCE AND INDUSTRY, LOS ANGELES, CALIFORNIA, AND MEMBER OF BOARD OF DIRECTORS, ASSOCIATION OF SCIENCE-TECHNOLOGY CENTERS; FRAN ROOKER, CHAIRPERSON, FUND RAISING COMMITTEE, COUNCIL FOR COMMUNITY ENRICHMENT, RADFORD, VIRGINIA; AND GEORGE BOGGS, CHAIR-ELECT OF THE BOARD OF DIRECTORS, AMERICAN ASSOCIATION OF COMMUNITY AND JUNIOR COLLEGES, AND SUPERINTENDENT/PRESIDENT, PALOMAR COMMUNITY COLLEGE, SAN MARCOS, CALIFORNIA

Mr. RUDOLPH. Mr. Chairman and members of the subcommittee, thank you for the opportunity to testify today on H.R. 4726. The California Museum of Science and Industry is situated in South Central Los Angeles and serves a visitor population that mirrors the ethnic diversity of California. We are accessible to all visitors, whether they come from across the street or across the Nation.

While recent events have focused national attention on the rebuilding of Los Angeles, we at the Museum of Science and Industry are ourselves rebuilding. Last year, in response to concerns about the seismic safety of our existing facilities, the State appropriated $41.3 million to renovate or replace existing museum buildings.

At the same time, we have formed a unique partnership with the Los Angeles Unified School District and the University of Southern California to build a science museum school designed to change the way children in Los Angeles learn about science. Rather than in a magnet school that selects only the highly talented and motivated, this will be an inner city, neighborhood elementary school where students will learn through active participation in a curriculum

that focuses on science and math. Thirty million dollars has been committed for construction of the school.

While the school is not a magnet school for children, we view it as a magnet school for teachers. In preparation for participation in the science museum science project, the University of Southern California's School of Education is adding a master's degree program in science education. They plan to use the science museum school as their professional practice school.

The partners also plan to seek funding for a science education resource center which would evaluate and disseminate the lessons learned in the school and museum. It is planned as a vital testing lab for new ideas, a training ground for teachers both pre-service and in-service, and as a center for improving the teaching of science and math throughout the district, the region, and beyond.

As a member of the Association of Science and Technology Centers, the California Museum of Science and Industry is one of more than 250 science and technology centers and museums committed to improving science education and enhancing science literacy. The membership of ASTC has grown dramatically, with the number of institutions serving the public doubling in a decade, and our audience is now reaching more than 75 million a year.

This growth has precipitated tremendous pressure on existing facilities and equipment. Much of the equipment installed when most of these centers opened in the 1970's and early eighties is now obsolete. Dramatic advances in equipment provide opportunities to present many topics in science and technology for the first time. Other improvements in equipment make educational programs portable or make them possible at far lower operating costs than before.

Numerous science centers and museums envision new experiential learning spaces and facilities. My written testimony includes examples of the potential uses of new equipment and facilities provided by science centers and museums from across the Nation.

While science centers are largely supported by private funding and earned revenue, Federal support has been important for the development of a number of new exhibits and programs, which you heard about earlier. One area not supported at the Federal level is that of facilities and equipment, except where that equipment is provided for as part of a specific exhibit.

We look forward to an extended partnership between science centers and the three major civilian-related Federal agencies in our efforts to increase science literacy and encourage children to pursue careers in science.

As an example, the California Museum of Science and Industry Partnership may look to the funds made available by H.R. 4726 to help build the science education resource center to ensure that what we learn in our school can be disseminated much more widely. With new state-of-the-art equipment and facilities, science centers can significantly expand innovative programs and reach audiences currently not served. We believe that the impact of H.R. 4726 will be extensive, creating new experience in science for students, teachers, and adults.

[The prepared statement of Mr. Rudolph follows:]

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OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992

H.R. 4726

Statement of

Jeffrey N. Rudolph

California Museum of Science and Industry

Association of Science-Technology Centers

Before the

Subcommittee on Science

of the

Committee on Science, Space, and Technology

U. S. House of Representatives

June 23, 1992

Jeffrey N. Rudolph is Executive Director of the California Museum of Science of Industry in Los Angeles. The museum is dedicated to stimulating the interest of young people in pursuing further education and careers in science and technology and serves an ethnically diverse audience of approximately 2 million visitors a year. He also serves on the Board of Directors of the Association of Science-Technology Centers.

The Association of Science-Technology Centers (ASTC) is an international, nonprofit organization of over 400 museums and affiliated institutions dedicated to increasing the public's understanding of science and technology. Science centers and museums engage over 75 million visitors annually in informal science learning through intriguing activities and interactive exhibits--they encourage hands-on explorations of scientific phenomena. In addition, science centers serve as educational resources to teachers and schools, families, and community groups.

SUPPORT FOR H.R. 4726

OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992

The California Museum of Science and Industry is situated in south-central Los Angeles and serves a visitor population that mirrors the ethnic diversity of California. It is accessible to all visitors whether they come from across the street or across the nation.

Recent events have focused national attention on the rebuilding of Los Angeles. The California Museum of Science and Industry is itself rebuilding. Last year, in response to concerns about the seismic safety of our existing facilities, the State appropriated $41 million to renovate or replace existing museum buildings.

At the same time, the Museum has formed a unique partnership with the Los Angeles Unified School District and the University of Southern California to build a Science Museum School designed to change the way the city's children learn about science. Rather than a magnet school that selects only the highly talented and motivated, this will be an inner-city, neighborhood elementary school where students learn through active participation in a curriculum that focuses on science and mathematics. The state has committed $30 million for construction.

Children are not the only focus of our efforts. In preparation for its participation in the Science Museum School, USC's School of Education is adding a master's degree program in science education and plans to use the School as its professional practice school.

The partners also plan to seek funding for a Science Education Resource Center which would evaluate and disseminate the lessons learned in the school and museum. It is planned as a vital testing lab for new ideas, a training ground for teachers (both pre-service and in-service), and a center for improving the teaching of science and math throughout the district and the state.

Across the Nation

As a member of Association of Science-Technology Centers (ASTC), the California Museum of Science and Industry is one of more than 250 science-technology centers and museums committed to improving science education and enhancing science literacy. The membership of ASTC has grown dramatically, with the number of institutions serving the public doubling in a decade, and audiences now reaching more than 75 million a year.

This growth has precipitated tremendous pressure on existing facilities and equipment:

1) Much of the equipment installed when most of these centers opened in the 1970's and early 1980's is now obsolete. Audio-visual equipment such as slide and film projectors, sound systems, and video equipment is now at the end of its useful life. Even equipment which continues to function has high maintenance costs. Replacing this equipment with up-to-date technology will improve the quality of presentations and reduce operating costs.

2) Dramatic advances in equipment provide opportunities to present many topics in science and technology for the first time. For example, computer simulations and large-scale video can show students and the public what happens in the heart of the atom, how a bumblebee flies, how a computer works, or what it is like in the far reaches of deep space. Other improvements in equipment make educational programs portable, or make them possible at far lower operating costs than before. For example:

- Starlab portable planetariums cost one-tenth what permanent facilities cost, and can be set up in schools, or even rented to individual teachers for classroom use.

- Easy-View microscopes are less expensive than comparable conventional microscopes, are nearly indestructible, and are easily used by children and adults.

- Digistar computer/video projectors present the night sky as seen not only from Earth but from out in the Milky Way looking back through the Big Dipper towards the Sun and Earth. The excitement of space research, the Hubble telescope, and cosmology can be represented with direct, easily understood graphic images for the first time.

- Video projection equipment allows images from a microscope, a telescope, or a live demonstration to be seen, not by one person or a small group, but by hundreds at the same time. The intellectual stimulation of live scientific observation is now available to vastly more people than ever before.

- Powerful new desktop computers and software manage school group reservations, billing, payroll, and teaching schedules more quickly, cheaply, and accurately than by hand, allowing museums to put more of their resources into delivering these services, and less into paper shuffling.

- Satellite communication systems permit students to witness scientific exploration on location and to interact with scientists around the world.

Telecommunication technology and CAD systems would substantially expand public program activities and benefit new exhibit design.

3) Numerous science centers and museums envision new, experiential learning spaces and facilities: technology labs where students develop and experience their own virtual reality environments; tech stations for simulation of scientific experiments at the bottom of the ocean or in outer space; chemistry and biology labs for exploring the sciences of materials and life; and places where the public can appreciate, even try out, the new advanced materials and products of technology transfer.

H. R. 4726 -- Catalyst for Improving Science Education

While science centers are largely supported by private funding and earned revenue, federal support has been important for the development of a number of new exhibits and programs. One area not supported at the federal level is that of equipment and facilities. The "Opportunities in Science and Technology Act of 1992" would authorize such support.

We look forward to a partnership between science centers and the three major science-related federal agencies in our efforts to increase science literacy and encourage children to pursue careers in science. For example, the California Museum of Science and Industry partnership may look to the funds made available by H.R. 4726 to help build the Science Education Resource Center. At most science centers, new state-of-the-art equipment and facilities can significantly expand innovative programs and reach audiences currently not served.

The impact of H.R. 4726 will be extensive; creating new experiences in science for students, teachers, and adults.

LOCAL NEWS / WEATHER / EDITORIAL PAGES

SECTION B

WEDNESDAY
APRIL 8, 1992

METRO

Los Angeles Times

Museum School to Be Education Showcase

■ Innovation: Elementary school planned for Exposition Park is designed to change the way children learn about science.

By AMY WALLACE
TIMES STAFF WRITER

Stacked atop a filing cabinet at the Los Angeles Unified School District, three architectural models and nine fanciful drawings are giving officials their first glimpse of a project designed to change the way this city's children learn about science.

Brought to life in bits of cardboard and balsa wood are three distinctive visions of the Manual Arts New Elementary School No. 1, to be located next to the California Museum of Science and Industry in Exposition Park.

Although the winning design is yet to be selected, educators already are predicting that, inside and out, from its clustered classrooms to its hands-on curriculum, the school will be unlike anything Los Angeles has ever seen.

The project, the nation's second museum-based school, is the focus of an ambitious effort to improve the teaching of science and math throughout the district. Developed as part of a broad makeover of Exposition Park, the school is scheduled to open in 1996 on a site where the Armory Building now stands.

Recently, participants in the project—a joint venture of the school district, the science museum and USC—have begun to map strategies to accomplish what studies indicate is a daunting goal: turning kids on to science.

Last month, the U.S. Department of Education's Science Report Card found, for example, that in 1990, few American fourth-, eighth- and 12th-graders had enough science knowledge to accomplish even relatively simple tasks requiring thinking skills. The study placed the blame on schools that did not make science a priority in the curriculum.

The Science Museum School will seek to remedy that, giving 900 students from kindergarten through fifth grade a thematic emphasis on science, math and technology.

The $30-million school, to be built with state "Space Saver" funds that reward neighborhood school projects that do not displace residents in crowded cities such as Los Angeles, will draw about 70% of its student body from the surrounding Exposition Park area. The remaining 30% of the slots will be open to pupils from other parts of the district.

But children will not be the only ones the school seeks

Please see SCIENCE, B4

SCIENCE: Innovative School Plan

Continued from B1

to educate. USC's School of Education, which is developing a master's degree program in science education, plans to use the Science Museum School as a teacher-training center for its students. The museum, meanwhile, is hoping to build a Science Education Resource Center for use by teachers throughout the state.

If there's a genius in the Science Museum School concept, its sponsors say, it is in this effort to educate children and teachers at the same time. Educators say a major obstacle that keeps youngsters from grasping scientific principles is that their teachers are baffled as well.

According to several surveys, including a USC study of the Los Angeles area, only one elementary school teacher in 100 has even minimal background in science. As a result, officials acknowledge, whatever science gets taught in the public school curriculum often is either intimidating or dull.

"We aren't preparing our youngsters in the areas of math and science the way we should be," said Andrew A. Cazares, the associate superintendent in the school district's office of instruction.

In fact, USC and science museum officials say, the current state of public science instruction not only fails to invigorate children, it scares them away.

"Most kids start elementary school with an interest in the world around them. But by fifth grade, half of them have negative attitudes about science," said Ann M. Mercat, deputy director at the museum, who laments that children have been taught to regard science not as a creative process of discovery but as a tedious exercise in memorization.

While the Science Museum School curriculum has yet to be designed, educators have agreed that a central goal will be to reverse that trend, convincing students that science and math can be fun. And that, educational scholars say, is where the museum can play a major and most vital role.

In his book "The Unschooled Mind: How Children Think and How Schools Should Teach," Harvard University professor Howard Gardner suggests that when it comes to imparting some of the information museums may have a distinct advantage over traditional schools.

"Certainly, there are exemplary schools and just as certainly there are poorly run museums," he writes. "Yet as institutions, schools have become increasingly anachronistic, while museums have retained the potential to engage students, to teach them, to stimulate their understanding, and, most important, to help them assume responsibility for their own future learning."

Fueled by visions like Gardner's, and inspired by the success of a similar school in Buffalo, N.Y., science museum officials have embraced the school project. They have timing on their side. The project dovetails with a planned $41 million rehabilitation of the museum itself, which lost much of its exhibition space when its main building was declared seismically unsafe in 1989.

Executive Director Jeffrey N. Rudolph says he hopes the new and improved museum will provide an informal complement to students' formal education, allowing them to test out ideas they encounter in class.

Depending on how the school's curriculum is structured, museum officials expect that some classes will be taught in the museum itself. In preparation, they are beginning to experiment with new exhibits that lure children into discovering scientific principles through play.

Science in Toyland, which goes on national tour April 26, reflects the direction in which the museum is trying to move. The exhibit resembles a well-stocked playroom and most days it is crowded with children steering model sailboats into the wind, assembling imaginary insects out of huge foam parts and sending cars hurtling through a loop-the-loop course.

Other activity-based exhibits the museum may seek funds to install an astronaut training center, a tidal pool, a rain forest that visitors explore in a glass elevator and a polar exhibit, complete with penguins.

The school building itself is expected to be innovative, incorporating state of the art technology and modular, clustered teaching areas to create what the district's written design criteria calls a "global teaching station."

The three architectural proposals being considered by the Los Angeles Board of Education—the winners of a recent design competition—seem to rise to the challenge. One has a central, walled courtyard, shaped like the elliptical path of an orbiting planet. Another places a huge outdoor classroom in the shadow of the DC-8 "Spirit of Los Angeles," which sits on the corner of Exposition Boulevard and Figueroa Street.

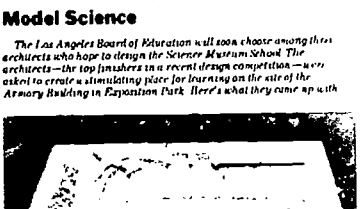
The school board is expected to choose among the three architects at its April 30 meeting, forwarding its recommendation to the State Allocation Board, which votes on construction.

RICK MEYER / Los Angeles Times

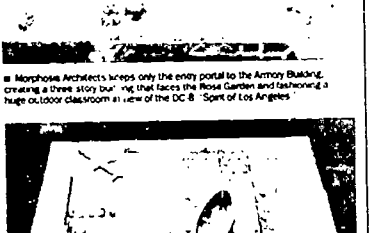
'Catch the Wind' hands-on exhibit reflects educational direction that Science Museum School will take.

Model Science

The Los Angeles Board of Education will soon choose among three architects who hope to design the Science Museum School. The architects—the top finishers in a recent design competition—were asked to create a stimulating place for learning on the site of the Armory Building in Exposition Park. Here's what they came up with.



■ Morphosis Architects keeps only the entry portal to the Armory Building, creating a three story building that faces the Rose Garden and fashioning a huge outdoor classroom at view of the DC-8 "Spirit of Los Angeles."

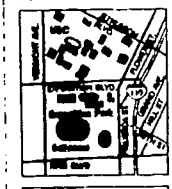


■ Siegel/Diamond Architects' adventurous design completely replaces the Armory Building with a modern complex marked by an elliptical, walled courtyard, designed to resemble the path of an orbiting planet.

■ Arthur Golding & Associates retains the armory's western facade as well as the structural frame of its main space, creating a translucent canopy over classrooms they described as a "3-D open canvas, protected yet stimulating."

Science School

The Science Museum School, which will be on the site of the Armory Building in Exposition Park, is scheduled to open in 1998. It is a joint venture of the California Museum of Science and Industry, the Los Angeles Unified School District and USC.



SOURCE: LAUSD / Los Angeles Times

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Making Schools More Like Museums

By Howard Gardner, Ph D

Editors Note This article is abstracted from Dr Gardener's book ***The Unschooled Mind. How Children Think and How Schools Should Teach.*** *Reprinted by permission of Basic Books a division of Harper Collins Publishing*

Imagine an educational environment in which youngsters at the age of 7 or 8 in addition to – or perhaps instead of – attending a formal school have the opportunity to enroll in a children's museum a science museum, or some kind of discovery center or exploratorium As part of this educational scene, adults are present who actually practice the disciplines or crafts represented by the various exhibitions Computer programmers are working in the technology center zookeepers and zoologists are tending the animals workers from a bicycle factory assemble bicycles in front of the children's eyes, and a Japanese mother prepares a meal and carries out a tea ceremony in the Japanese house Even the designers and the mounters of the exhibitions ply their trade directly in front of the observing students

No one flunks museum.

— Frank Oppenheimer
Exploratorium

During the course of their schooling, youngsters enter into separate apprenticeships with a number of these adults Each apprentice group consists of students of different ages and varying degrees of expertise in the domain or discipline

Most of the learning and most of the assessment are done cooperatively that is students work together on projects that typically require a team of people having different degrees of and complementary kinds of skills Thus, the team assembling the bicycle might consist of half a dozen youngsters, whose tasks range from locating and fitting together parts to inspecting the newly assembled systems to revising a manual or preparing advertising copy The assessment of learning also assumes a variety of forms, ranging from students monitoring their own learning by keeping a journal to the "test of the street"-does the bicycle actually operate satisfactorily, and does it find any buyers? Because the older people on the team, or "coaches," are skilled professionals who see themselves as training future members of their trade, the reasons for activities are clear, the standards are high and satisfaction flows from a job well done And because the students are enrolled from the first in a meaningful and challenging activity, they come to feel a genuine stake in the outcome of their (and their peers) efforts.

A reader's first thought on the possibility of youngsters attending such an intensive museum program rather than or in addition to the public school may be disbelief The connotations of the two types of institution could scarcely be more different

"Museums" means an occasional casual entertaining, enjoyable outing as Frank Oppenheimer, founder of San Francisco's Exploratorium, was fond of commenting. "No one flunks museum." School, in contrast connotes a serious, regular formal deliberately decontextualized institution Would we not be consigning students to ruination if we enrolled them in museums instead of school's?

I believe we would be doing precisely the opposite Attendance in most schools today does risk ruining the children Whatever significance schooling might once have held for the majority of youngsters in our society, it no longer holds significance for many of them Most students (and for that matter many parents and teachers) cannot provide compelling reasons for attending school The reasons cannot be discerned within the school experience nor is there faith that what is acquired in school will actually be utilized in the future Try to justify the quadratic equation or the Napoleonic wars to an inner-city high school student-or his parents! The real world appears elsewhere in the media in the marketplace and all too frequently in the demimonde of drugs violence and crime Much if not most of what happens in schools happens because that is the way it was done in earlier generations, not because we have a convincing rationale for maintaining it today The often heard statement that school is basically custodial rather than educational harbors more than a grain of truth

Museums have retained the potential to engage students, to teach them, to stimulate their understanding, and, most important, to help them assume responsibility for their own future learning

Certainly there are exemplary schools and just as certainly there are poorly run museums Yet as institutions, schools have become increasingly anachronistic while museums have retained the potential to engage students, to teach them, to stimulate their understanding, and, most important, to help them assume responsibility for their own future learning

Such a dramatic reversal of institutional significance has come about for two complementary sets of reasons On the one hand youngsters live in a time of unparalleled excitement, where even the less privileged are exposed daily to attractive media and technologies, ranging from video games to space exploration, from high-speed transportation to direct and immediate means of communication In many cases, these media can be used to create compelling products. Activities that might once have engaged youngsters – reading in classrooms or hearing teachers lecture about remote subjects – seem hopelessly tepid and unmotivating to most of them On the other hand science museums and children's

New Museum and Science Museum School

Plans for an on-site science museum school have moved closer to reality

The **Los Angeles Unified School District**, which will run the school in conjunction with **CMSI** and the **USC School of Education**, held a design competition among 11 architects familiar with school projects. The architects were challenged to plan a science museum school for grades K-5 to be located at the site of the present Armory Building

Submissions ranged from traditional to futuristic but each embodied innovative ideas on how school architecture can assist in the educational process Architects explored class room configurations moving away from the all-in-a-row approach to creative clustering and geometric shapes Roofs become sports courts, gardens or activity areas Globes, outdoor assembly areas or, in one case, a huge canted ellipse dominated central courtyards One design preserved the Armory facade and built classrooms beneath the skeleton of the old building Another set a futuristic tone with saucer shaped buildings

The recommendations of a professional jury have been forwarded to the Los Angeles board of Education and the State Allocation Board for selection of the winner

Progress has also been steady for museum building plans Significant steps are being taken on three fronts

- Museum staff is working with consultant **Joseph A. Wetzell Associates**, who has helped design numerous exhibits and science centers, to develop a comprehensive and cohesive exhibit plan
- Museum officials are working with the Los Angeles County Transportation Commission on the proposed Blue Line extension to Exposition Park
- Architects **Zimmer Gunsul Frasca Partnership**, the firm responsible for the Exposition Park Master Plan, have been selected to design the new museum building

The Temporary Museum

Early this summer two temporary structures totalling 35,000 square feet will occupy the southern portion of the museum parking lot

The buildings will house museum exhibits during construction of the new museum building The tent-like "sprung" structures similar to the ones used by the Los Angeles Convention Center prior to its expansion, consist of an internal aluminum frame covered by a PVC coated polyester material

The first exhibit to occupy the space will be **Our Urban Environment** The opening for that exhibit is tied to the erection of the temporary structures

Soon thereafter the **chick hatchery** will be relocated from the Ahmanson Building As the museum's construction plans move forward, most of the museum's other exhibits will be added to the space

Though dates have not been set for construction, museum officials hope the school and new building open in 1996

museums have become the place for exhibits activities and role models drawn precisely from those domains that do engage youngsters their customary wares represent the kinds of vocations, skills and aspirations that legitimately animate and motivate students

I have documented some of the difficulties exhibited by youngsters in coming to understand the topics of school. It is of course possible that, even if one cannot flunk museum, one might fail to appreciate the meanings and implications of exhibitions encountered there Indeed, I suspect such non-or miscomprehension often happens on "one-shot" visits to museums An active and sustained participation in an apprenticeship, however, offers a far greater opportunity for understanding In such long-term relationships, novices have the opportunity to witness on a daily basis the reasons for various skills, procedures concept . and symbolic and notational systems They observe competent adults moving readily and naturally from one external or internal way of representing knowledge to another They experience first hand the consequences of a misguided or misconceived analysis, even as they gain pleasure when a well-thought-out procedure works properly They undergo a transition from a situation in which much of what they do is based on adult models to one in which they are trying out their own approaches, perhaps with some support or criticism from the master. They can discuss alternatives with more accomplished peers, just as they can provide assistance to peers who have recently joined the team All these options, it seems to me, guide the student toward the state of enablement-exhibiting the capacity to use skills and concepts in an appropriate way-that is the hallmark of an emerging understanding

If we are to configure an education for understanding suited for the students of today and for the world of tomorrow, we need to take the lessons of the museum and the relationship of the apprenticeship extremely seriously Not, perhaps, to convert each school into a museum, nor each teacher into a master, but rather to think of the ways in which the strengths of a museum atmosphere, of apprenticeship learning, and of engaging projects can pervade all educational environments from home to school to workplace The evocativeness and open-endedness of the children's museum needs to be wedded to the structure, rigor, and discipline of an apprenticeship.

The basic features I have just listed may assume a central place in educational environments that span the gamut of ages from preschool through retirement and the full range of disciplines ■

All one-day sessions for Spring '92

Fun, Hands-on Science Workshops

Science Workshops, where children ages 5-13 discover that science and fun are one, celebrate 30 years of hands-on, child friendly courses with a spring schedule of Saturday and Sunday offerings. The program includes old favorites, interesting new classes and a parent-saving one day per class.

"We've been experimenting with one day classes and found them popular with parents and children. We also found that we could keep the educational value high," said Tania Mayer, workshop coordinator. She added that the one day sessions have an economic benefit — the average cost per course is about $28, about half previous fees.

- For a free course catalog call 213 744 7440
- Many courses can help meet Girl Scout Merit Badge Requirements
- Scholarships available based on financial need

Instructors come from Southern California schools and many of them serve as science specialists and resource teachers. To give children personal attention, enrollment is limited to 20. Sessions last from 9 a.m. to 1:30 p.m. with a lunch break.

A series of workshops using **LEGO** blocks debuts this Spring. Seven different workshops demonstrate basic scientific concepts such as friction, centrifugal force and leverage.

The popular Jerry Pepperwell returns to conduct a parent-child **rocketry workshop** for 8 year olds. Pepperwell and Lee Dodd, also an experienced and exciting instructor, lead additional rocketry workshops for 9 to 13 year olds. The rocketry workshops, which culminate with an early afternoon launch, are among the first workshops to fill up.

Long a favorite instructor, Paul Craig returns with his snakes, lizards, turtles and toads, including, if it is in a good mood, Cousin Harold, an 8 foot long boa constrictor. Craig leads **Reptile Round-Up** (Ages 8-10) and **Advanced Reptile Care** (Ages 10-13).

Horticulturist Elliot Panwar Pruitt, whose teaching style reflects his boundless enthusiasm for plants, will host **Green Thumb**. The session covers plant reproduction and the role of light, temperature, water and nutrients in their growth. Children learn by doing as they create a terrarium, take cuttings and sow seeds. The projects go home with the students so they can continue learning on their own.

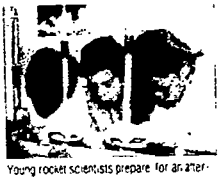
Three new workshops

Since the publication of the Science Workshop catalog three new workshops have been added to the Spring '92 session. All classes are $28, $25 for museum members.

Parent/Child Workshops

Soundoff! Explore the physics of sound. Ages 4-5. Meets twice: Sunday, April 16 and Saturday, May 16 at 9 to 11 a.m. (English) or 11:30 a.m. to 1:30 p.m. (Spanish).

Discover: Rocks! Team up with your child to experiment with rocks and create your own rules of classification. Ages 6-7. Meets once from 9:30 a.m. to 1:30 p.m. on Saturday, June 27 (English) and Sunday, June 28 (Spanish).



Young rocket scientists prepare for an afternoon launch at the museum.

For children only . . .

Incredible Physics Rub-off some electrons and get a real charge from this popular electricity and magnetism workshop. Ages 9-11. Meets once from 9 a.m. to 1:30 p.m. Saturdays, May 2, May 16 or June 6.

In this one a parachute to adults and kids alike, but it's really a science class about the properties of air.

IMAX Visits Niagara Falls

For 12,000 years the Niagara Falls have been emptying Lake Erie at a prodigious average of 200,000 cubic feet per second

That's more freshwater in a year than California uses in four years

The IMAX film **Niagara: Miracles, Myths and Magic** captures the overwhelming scale of the falls from the thundering roar of the water cascading over the rim to the dangerous swirling currents above and below the falls

A compelling rescue reenactment creates the most urgent human drama captured on IMAX film since the tree fall sequence in **Flyers**

Kieth Merrill, an Oscar winning documentary film maker, directed and co-wrote the screenplay with fellow Oscar winner Ben Burtt Merrill previously directed the popular **Grand Canyon: The Hidden Secrets** for the IMAX format

Teetering over the Niagara Gorge, tightrope walker Phillippe Petit recreates the 1859 feat of the Great Blondin

Filming took 55 days in and around Niagara Falls and the seven mile gorge carved out by the rushing waters To recreate authentic historical vistas "we had to carry a small nursery to create sets and block out structures," notes Merrill

The IMAX format, with its highly detailed images and wide angle views challenged the film crew to find angles and position set pieces to retain the mood and authenticity of the film

5

Earthquake Simulator Reopens

The deep-throated earthquake rumble once confined to the Ahmanson Building now echoes through Technology Hall It signals the return of the **Earthquake** exhibit which was closed when the Ahmanson Building was declared seismically unsafe by the State Architect

Most of the move was completed in April 1991 but relocating the exhibit's centerpiece the shaking table and earthquake simulation, proved a complex task That move was completed in late 1991 During the hiatus, the KABC-TV news team took the opportunity to update the video that accompanies the sound effects and shaking table

"The rumble draws people into the exhibit The simulation reminds them how dangerous earthquakes can be Then the information — from what to put in your earthquake preparedness kit to how continental drift causes quakes — reduces fear and replaces it with knowledge," said Exhibit Curator Eugene Gendel Ph D

The exhibit opened in November, 1986 and rapidly became one of the most popular museum exhibits Earthquakes that have occurred since its opening have reinforced the exhibit's importance It has been site of hundreds of classroom tours and served as the centerpiece for an international gathering of earthquake and disaster preparedness officials

Curator Gendel estimates that the shaking table has run slightly over 100 000 simulations since it opened The shaking table itself holds about 30 people The machinery was adapted from an industrial strength shaking table used by engineers to test construction designs

This Summer Explore Antarctica

This June, well into the six months of winter darkness that settles upon Antarctica, the California Museum of Science and Industry will host an exhibit and IMAX film about the continent — the coldest, windiest, highest and, surprisingly, driest continent on Earth

Despite an annual rainfall of less than an inch per year Antarctic ice contains 68 per cent of the earth's fresh water The ice also records millions of years of the earth's history helping scientists prove the theory of continental drift and document climate changes

The **Antarctica** exhibit comes from the Science Museum of Minnesota and is part of the Science Museum Exhibit Collaborative It opens May 29 and closes September 7 1992 The IMAX film, produced by Chicago's Museum of Science and Industry will open June 5 and run through the summer

Must close April 26

Science in Toyland Leaves on Tour

One of the most popular exhibits in the California Museum of Science and Industry's history, **Science in Toyland**, ends its six month run April 26, 1992 so it can leave on a five year national tour

"This has been one of the most popular exhibits we have created", said David Bibas Ph D, exhibit curator He added that he is particularly gratified by the amount of time children spend at each station and the parent-child interactions he observed

"It's a pleasure to watch children try out their ideas and figure out how things work Our experience with this exhibit has deepened our knowledge of how children learn That's going to show up in future exhibit design efforts," said Bibas

The museum designed and built the exhibit as part of its commitment to the Science Museum Exhibit Collaborative (SMEC) The eight member museums pool funding to build exhibits that they then share Recent museum visiting exhibits, such as **Bionics and Transplants, Robots and Beyond**, and **What Makes Music?**, came from fellow SMEC participants

Three museums that are not part of SMEC have also booked the exhibit Museum officials expect more bookings

The last CMSI exhibit prepared for SMEC **Special Effects**, will complete its 14 museum itinerary and return for a reprise at CMSI in February, 1993 It broke attendance records at several of its stops during its five year national tour

Science in Toyland Tour Schedule

Science Museums of Charlotte
June 1992-August 1992
Charlotte North Carolina

Center of Science and Industry
October 1992-December 1992
Columbus Ohio

Science Museum of Minnesota
February 1993-April 1993
St Paul Minnesota

Museum of Science
June 1993-August 1994
Boston Massachusetts

Franklin Institute Science Museum
February 1994-April 1994
Philadelphia Pennsylvania

Museum of Science and Industry
June 1994-August 1994
Chicago Illinois

Pacific Science Center
February 1995-August 1995
Seattle Washington

Bishop Museum
October 1995-December 1995
Honolulu Hawaii

Maryland Science Center
June 1996-August 1996
Baltimore Maryland

Teaming up to take the "Domino Challenge," three friends also learn some basic physics and the concept of cause and effect

Recent Major Donors

Ahmanson Foundation	$50 000	Educational Programs
BankAmerica Foundation	$50 000	Our Urban Environment
United Airlines	$20 000	Science Fair
Pacific Bell	$15 000	Communications
Times Mirror Foundation	$15 000	General Operating Support

Also providing support are National Health Foundation, MacNeal-Schwendler, Mabee Foundation, William Burke, U S Borax & Chemical Corporation, Spring Street Foundation, and the Santa Anita Foundation

Gayle Wilson, wife of California Governor Pete Wilson, will once again welcome students to the California State Science Fair. Mrs. Wilson is a former science fair winner.

1992 SCIENCE FAIR

The California State Science Fair set for May 19 promises to be the best ever. **Nestle USA** Inc. will be the presenting sponsor of the annual event with additional support from **United Airlines**.

Their efforts join those of the California Museum of Science and Industry's California Museum Foundation **Advisory Board**, which organizes the fair and co-chairs **Governor Pete Wilson** and **State Superintendent of Schools Bill Honig**.

The fair will be held in the Sports Arena with the ground floor reserved for presentation of the projects. The closure of two museum buildings in late 1990 and pending reconstruction dictated the move.

While fair officials emphasize that all entrants are winners and the judging process is more important than the results, over $40,000 will be distributed to approximately 125 of the students. State Science Fair awards range from the $5,000 Science Fair Student of the Year to $50 honorable mention awards for junior high school students in each of the 15 science categories. California Sea Grant uses the science fair to select the winner of the $10,000 John D. Isaacs Scholarship for the student with the best project relating to the marine environment.

Officials expect more than 600 entrants from among the finalists at 21 regional science fairs. Students who place first, second or third in their categories are eligible for the state wide event.

Simonian to Head Development Effort

Vahe H. Simonian, Re.D., now heads the California Museum of Science and Industry fundraising effort that will support new museum facilities.

The State of California has already committed $71 million to replace or rehabilitate buildings that don't meet earthquake safety standards and to construct a science museum school facility. Simonian will serve as Deputy Director for Development for the museum and also as Senior Vice President for Development for the California Museum Foundation, the non-profit museum affiliate.

Simonian most recently served as executive vice president of development at Saint John's Hospital and Health Center Foundation. He has also directed the corporate campaign for United Way fund development for Pacific Homes, and planned giving for the Los Angeles Area Council of Boy Scouts.

Simonian served as vice president of the American University of Beirut, Lebanon. Though based in New York, he made frequent trips to the Middle East until unsettled conditions led to his return to California.

Additionally Simonian served as a Presbyterian minister for over 30 years. He was a minister for the National Radio Pulpit, dean of the Near East School of Theology in Beirut, and adjunct professor

at the San Francisco Theological Seminary, Fuller Theological Seminary and Pasadena City College.

In 1977, the City of Pasadena awarded Simonian the "Arthur Noble Award for Outstanding Service." He was elected the 1969 "Citizen of the Year" in Pacific Palisades.

Born in Massachusetts, Simonian moved to Los Angeles with his family during junior high school. He received a bachelors degree from Pepperdine College and a bachelor of divinity degree from Princeton Theological Seminary. He was named a Merrill Fellow at Harvard Divinity School. He received his doctor of religion degree from the Claremont School of Theology.

Simonian resides in Alladena with his wife Ani. They have three grown sons.

7

Team Science Enters LA Marathon

The marathon may belong to Los Angeles, but the first mile has been claimed by the California Museum of Science and Industry. Over fifty runners signed up for **Team Science** and over 250 more museum members volunteered to staff the first mile of the race.

Most team science members took advantage of the 5K option, but about a half dozen ran the full 26.2 miles. Team Science members collected pledges, spurred on by the Hawaiian vacation that goes to the runner who raises the most money.

Museum special events coordinator Chris Wagman estimates the museum will net $15,000 from the event.

The traditional free breakfast for museum volunteers and the families of Team Science members was supported by generous in-kind contributions from Hughes Markets and the Western Bagel Company.

Temporary Exhibits

- **Science in Toyland/**The science behind common toys and how toys enhance a child's ability to observe and reason **Closes April 26**
- **Our Hispanic Heritage/**The annual McDonalds student art contest explores the rich heritage of toys and games **Closes March 29, 1992**
- **Visions and Images/**Juried student art display sponsored by UNO CAL **Opens April 22, 1992; closes May 31, 1992**

Educational Programs

- **Creative Computer/**Daily demonstrations of computer graphics and design 10 30 and 11 30 a m 1 30 and 2 30 p m
- **Science Workshops for Children/**Fun one-day hands-on science sessions with some of the finest teachers in Southern California Call (213) 744-7440 for free catalog and registration form

Volunteer Opportunities

- Join the museum family and help promote science literacy by volunteering to help at the museum Call (213) 744-2327

IMAX Theater:

Please call (213) 744-2014 for current schedule

- **Niagara/**The thunder of the falls provides dramatic counterpoint as the IMAX camera explores this 12 000 year old wonder **Opens March 28, 1992**
- **Ring of Fire/** Volcanoes and earthquakes ring the Pacific Rim with its 1 billion inhabitants Dramatic IMAX footage puts you front row center for nature's awesome displays
- **Blue Planet/**Takes you aboard the space shuttle for a moving and informative exploration of Earth, our only home
- **To The Limit/**The human body at peak performance proves a fascinating subject in this NOVA produced IMAX film that combines magnificent action photography with riveting internal views of the body at work **Closes March 27, 1992**
- **Rolling Stones At The Max/**Larger than live, this 90 minute IMAX feature captures the Urban Jungle/Steel Wheels Tour in Surround Sound Special Event Price $15/adults, $13/children seniors

Coming Attractions

- **Antarctica/**A visit to the southernmost continent which is proving to have important influence on the world's climate A major travelling exhibit by the Science Museum of Minnesota **Opens May 29, 1992**
- **Antarctica/**A new IMAX film by the Chicago Museum of Science and Industry that complements the Antarctica exhibit **Opens June 5, 1992**

California Museum Foundation
700 State Drive, Los Angeles, California 90037

Mr. THORNTON. Thank you, Mr. Rudolph, for that excellent summary of a fine prepared statement.

And Mrs. Rooker.

Mrs. ROOKER. Thank you for the opportunity to speak today.

I'm here as a representative of parents and as one voice from a small but successful nonprofit informal education institution whose volunteer work addresses the issues to which this bill speaks.

I don't know much about Government red tape, but I do know about needs. I'm a parent of three children whose educational needs range from gifted to learning disabled, and I share the deep concern of parents for the present condition of America's educational system. As parents, we see first-hand how science is taught in classrooms from ditto sheets, how the teachers are forced to work within the confines of not enough equipment and materials in their classrooms and not enough training, and how they have difficulty in meeting each individual student's needs.

This scenario is typical for students in small town areas, and it is made more than clear in Mr. Frank Taylor's statement to me the other day. Mr. Taylor is a science teacher at Radford High School and the 1992 recipient of the President's Award for Excellence in Teaching. And he commented to me about his own third-grader who carried home a teacher's request to borrow 25 magnifying glasses for a science class study. This deficiency exists in a school system that has a reputation for instructional excellence in our own area.

As parents, we are also aware that educational reform won't happen overnight, that schools located in small town areas may be the last to receive such assistance, that informal education institutions may be the only opportunity for educational enrichment for students during a time of transition. And we believe that early exposure to the interdisciplinary teaching of sciences and technology, arts and humanities leads more easily to a world class educational system.

Now knowing this, many people in under-served areas are taking responsibility upon themselves to form community-based initiatives to provide educational opportunities in an informal manner in the particular areas that they find lacking in their own regions, and for this reason in 1987 Council for Community Enrichment was incorporated.

The members of this nonprofit, volunteer organization saw a need to address the scientific and cultural literacy of the children of our own area, and we began with—don't laugh—a $600 budget. We have developed a proposed budget for 1992/93 of $117,000, and we have developed corporate and annual fund-raising campaigns to the extent that we meet each yearly budget and add to our contingency reserve.

At present, we service a four-county area. This past year, over 15,000 persons attended 101 activities, which included in-school performing arts programs twice yearly to 18 schools in our region at no cost to students; after-school classes were held in sciences and arts; a youth theater workshop; and Discovery Works, our annual summer sciences and arts camp. Last fall, we raised over $21,000 to bring the Pereslava-Zalevsky Youth Ensemble from Russia to be

housed in our area and to perform in 16 schools and several public concerts.

As you can see, our focus has always been to enhance the exposure that children receive to sciences, arts, and humanities. We have begun development of a children's museum emphasizing the interrelatedness of science, technology, arts, and humanities in a facility that has been donated generously to our organization. And now we find ourselves, because of this, in the transition state typical to organizations of our nature in that we are located in an area with a population base of 150,000 people. And funding for such demographic areas is very scarce, and we also find ourselves in the "chicken or the egg" position of who funds first in that corporations want to see an established facility before they will fund and Government criteria for funding requires proof of corporate support before funding.

In our short history, the history of CCE Discovery Works, volunteers have worked thousands and thousands of hours to fill the needs of children in our area with informal education programs. And I would like to highlight three of our eight suggestions in our written report for modifications which would allow this bill to address more fully the needs of volunteer-based institutions such as ours.

Given that community colleges have access to funding which is not available to nonprofit organizations and that volunteer organizations most often aren't staffed with salaried grant writers and large administrative staffs, the pairing of these two unequal entities to meet the same criteria for a merit-based competitive award is an unequal combination. And this is the basis for our first modification in which we speak of establishing separate selection criteria for science-technology centers and community colleges.

I would like to emphasize also our modification number four where we speak of targeting the bill's funding and ask you to particularly keep in mind the special needs of those populations under 200,000; also number seven, where we speak of ensuring that organizations submitting proposals for review are evaluated by a panel of our peers.

It really appears that we have reached the same point at the same time because you are aware of the positive impact our facilities have on addressing scientific literacy, and our institutions need your funding support. We don't believe it out of place for the Government to provide start-up grants. We do believe such facilities should not continually depend on Federal funds, and I would like for you to remember that an institution like ours is like a child who has successfully ridden a pony and now we are ready for a horse. And if you can provide a hand to help guide our foot into the stirrup, we will take care of the horse, and we will ride it well, and we will make sure that it is of service to others.

[The prepared statement of Mrs. Rooker follows:]

COUNCIL FOR COMMUNITY ENRICHMENT/DISCOVERYWORKS
1115 NORWOOD STREET, RADFORD, VIRGINIA 24141

WRITTEN STATEMENT TO U.S. HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON SCIENCE, REGARDING THE OPPORTUNITIES IN SCIENCE AND TECHNOLOGY ACT OF 1992, H.R. 4726

ACCOMPANYING ORAL TESTIMONY PRESENTED JUNE 23, 1992

Introduction and Background

Council for Community Enrichment/DiscoveryWorks, a children's museum located in Southwest Virginia, extends its appreciation to Representative Rick Boucher for soliciting its input into the subcommittee's consideration of H.R. 4726. Because it typifies the science-technology centers targeted by the bill and because it is currently grappling with issues addressed in the bill, CCE/DiscoveryWorks' representatives feel particularly well suited to comment on its provisions. A brief summary of the organization's development will provide the context for our discussion of H.R 4726. A more comprehensive description of its structure and programs is located in Appendix 1 of this document.

The organization that is now known as DiscoveryWorks was created in 1987 by a group of parents in a small town in rural southwest Virginia (population approximately 16,000) who were concerned about the quality of their children's education. In particular, these parents wanted to have available in the community opportunities for enriching experiences that would help develop children's self esteem, creative skills and talents, and scientific curiosity. Finding no suitable existing vehicle addressing these issues, the parents formed a non-profit organization called the Council for Community Enrichment which offered classes in the arts, sciences, and humanities and sponsored, with financial support from the Virginia Commission for the Arts, performing arts programs in the local schools. From this beginning, the small group of volunteers, primarily interested parents, grew into an organization reaching children and schools throughout the New River Valley area. (See Appendix 2 for information about the New River Valley.) It acquired a facility providing office and meeting space; an executive director and a program director, both part-time; and a 1991-92 budget in excess of $90,000. During its most recent year of operation, the organization served over 15,000 people in classes, performing arts, and festival events. The bulk of its work continues to be performed by volunteers.

The organization's mission and goals have evolved with experience. Its members have read and reflected upon the various reports on the status of American education and recommendations for educational reform. They have seen the evidence indicating our students' poor performances in the areas of science and mathematics and our nation's lack of scientific and technical literacy. They have observed their children's behavior and have noted the availability, and absence, of opportunities for them to acquire genuine understanding of, and appreciation for, the importance of scientific, technical, and artistic skills to the quality

of their current and future lives. They have seen the differences that participation in enriching experiences can make in people's lives. As a result, the organization has come to value the interrelationships among the arts, sciences, and humanities, and to believe that sustained exposure to a variety of types of activities that highlight these interrelationships is necessary for our children to develop into positive and fully competent adults. To reflect its evolving values and goals, the organization decided this past year to change its name to DiscoveryWorks and to channel its activities through a children's museum featuring interactive exhibits that emphasize interrelationships among the arts, sciences, and humanities.

This decision places CCE/DiscoveryWorks among the science-technology centers addressed in H.R. 4726. Facilities such as ours are large and growing mechanisms for providing early intervention, early exposure to, and early stimulation of interest in the arts, sciences, and humanities. We see ourselves as complementary to the schools and as an essential part of the process of educational reform. Because we are community-based, we can readily meet the unique needs of children and families, teachers, and schools within our area. Our structure allows us the flexibility to provide formal and informal educational experiences that interrelate subject areas and to form partnerships with other formal and informal educational institutions. Furthermore, the types of organizations named in the bill as science-technology centers are accustomed to collaborating with similar organizations to provide more economical and broad-ranging services to the public by rotating programs, exhibits, and materials.

These characteristics underscore the potential of CCE/DiscoveryWorks and other, similar organizations to contribute significantly to the reform of education, and science education, in particular. Indeed, it seems as though many of the recommendations in Project 2061: Science for All Americans (American Association for the Advancement of Science, 1989) were made with science-technology centers in mind. Within the geographic area immediately surrounding the DiscoveryWorks facility are two universities, a community college, a regional service center of the Virginia Department of Education, and a regional high school for students talented in science and mathematics. Imagine the creative potential if the resources of these institutions could be combined and channeled into coordinated educational experiences! CCE/DiscoveryWorks can provide the mechanism for synthesizing the contributions of these distinct, yet related, agencies into unique learning opportunities for the children of our region. And, our experiences lead us to believe that similar potential exists in many, many communities like ours across the nation.

Bringing meaningful reform to the education offered to America's children requires more than tinkering with the organizational structure of schools. Schools alone cannot successfully provide the comprehensive, continuing learning experiences that are needed to nourish the development of skills, abilities, and habits of thinking we all want our children to possess. Families and communities must shoulder an equitable portion of the responsibility for ensuring that all our children have access to experiences that will unleash their creative

potential, develop their problem-solving skills, enrich the quality of their lives, and enhance the quality of their contributions to our society.

The best means we have uncovered for providing parents and communities with an avenue for achieving direct input into the quality and variety of educational experiences afforded their children is grassroots development and support of informal educational organizations like CCE/DiscoveryWorks. These organizations allow parents and members of the community to become involved in identifying and developing the types of enriching opportunities most needed in their area. They also benefit local formal educational institutions by complementing their curricula and by providing additional resources. They can play a critical role in our nation's efforts to upgrade its performance in the scientific and technical arenas and to ensure that future generations are able and willing to continue making contributions to the quality of life on this planet.

Ann W. Lewin, Director of the Capitol Children's Museum of Washington, D.C. likened these types of organizations to "vast shopping malls of ideas, materials and techniques to spark inquiry and encourage discovery" and described their potential "to kindle individual intelligence and to light the bright torch of a child's mind." (In Hand to Hand, Association of Youth Museums, Winter 1991-92.) We urge you to support our efforts to bring alternative and enriching experiences to all of the children living in communities across our nation.

Need for Funding Assistance

Having summarized CCE/DiscoveryWorks' history, philosophy, and purpose, we will discuss now some of the obstacles retarding progress toward our goal of achieving a fully endowed children's museum for our geographic region. Of course, our major problems can be described with one familiar word: funding. However, organizations like CCE/DiscoveryWorks encounter unique difficulties in establishing and maintaining a funding base.

First of all, our size and economic resources inhibit our overall fundraising ability and restrict its stability. Individuals cannot provide large contributions when their financial futures are uncertain. Local governments and businesses cannot afford to include us as line items in their budgets when they are unable to provide basic services at adequate levels. Our small population base excludes us from most federal funding sources, which require a service area of at least 200,000. Private foundations can provide some assistance, but this is also limited by our size and economic means.

Secondly, procuring start-up funding for an informal education facility is difficult. Potential corporate sponsors want to see an operational facility before committing funds. Federal funding sources require a history of successful grantsmanship and proof of sufficient corporate support prior to funding. Sources willing to provide the level of funding necessary to initiate high quality programs are rare.

Thirdly, a comprehensive funding strategy is difficult to achieve for hybrid organizations like CCE/DiscoveryWorks that attempt to eliminate subject matter boundaries and present the relationships of the arts, sciences, and humanities to each other and to life in general. Most sources are prepared to fund activities in a particular subject, requiring the organization to artificially divide its programs or to emphasis those subjects for which the most funding exists.

Because of these difficulties in securing and maintaining stable funding, informal educational facilities tend to be located in major metropolitan areas that have access to larger populations and broader funding opportunities. In an article in the March 1992 issue of Museum Development, Ted Silberberg and Gail Lord note that a survey of children's museums carried out by LORD Cultural Resources Planning and Management Inc indicated that 70% to 80% of visitors come from within a 25-mile radius. This means that most children living in small towns outside metropolitan areas are denied access to the types of informal educational experiences that are necessary to the development of higher level thinking skills and of interests in scientific and technical careers. Can we as a nation afford to dismiss the needs of so large a proportion of our population? H.R. 4726 represents an initial step toward providing the necessary opportunities for all children, regardless of the location of their homes.

Analysis of H.R. 4726

We will now offer our comments on the current draft of H.R. 4726. CCE/DiscoveryWorks applauds the efforts of the sponsors of the bill to enhance the nation's levels of scientific and technological literacy. We believe that the bill addresses current gaps in funding and image perception by targeting non-profit science-technology centers and community colleges as providers of science instruction. Although their purposes may appear to be quite different, both types of organization attempt to serve broadly based populations with open door programs based upon identified needs. Each is community based and flexible in accommodating the characteristics of the local population. Science-technology centers and community colleges can use unique methods to reach audiences outside those typically served by educational institutions. Thus, the bill has the potential to influence educational reform efforts far beyond its proposed funding level by expanding the definition of the educational community to include nontraditional facilities occupying unique niches in the overall structure of education.

At the same time, we will voice a concern that pairing science-technology centers with community colleges may result in an unequal partnership because of some of the inherent differences in the two types of organizations. Community colleges are formal educational institutions with large administrative staffs and access to official avenues of funding. Science-technology centers are informal educational facilities staffed primarily with volunteers and responsible for generating their own sources of funding. Requiring both types of organizations to meet the same criteria for merit-based, competitive awards may favor one type of organization and penalize the other.

CCE/DiscoveryWorks also approves of the intent to fund instructional materials and equipment acquisition rather than operational expenses such as salaries. We believe that educational institutions, particularly informal educational facilities, should not depend primarily upon federal funds to continue operating. The best use of federal money, in our opinion, is to encourage initiative and innovation by providing start-up funding for new and expanding programs.

CCE/DiscoveryWorks recognizes that providing for joint administration of the program by the National Aeronautics and Space Administration, the National Science Foundation, and the Department of Energy is an attempt to stimulate cooperation and to blur the artificial lines separating disciplines and areas within disciplines. However, we question the efficiency of such an arrangement and wonder about the potential it poses for additional layers of bureaucratic red tape. We also question the understanding and empathy these agencies might have for the philosophies and goals of organizations defined as science-technology centers. We have reservations about how the traditional emphasis these agencies have placed on research and development, as opposed to application and service, will affect the criteria established for selecting proposals for funding and will influence the decisions of the proposal review committee.

Finally, CCE/DiscoveryWorks acknowledges the cut-backs occurring in levels of federal funding, including existing National Science Foundation research grants. This reality underscores the need for funding like that proposed in this bill to help organizations that are attempting to serve groups and areas that traditionally have been unserved or underserved and that are willing to assume responsibility for continued funding after receiving help in getting started.

Recommendations for Modifications of H.R. 4726

Having voiced its concerns for and observations of the potential impact of H.R. 4726, CCE/DiscoveryWorks offers the following suggestions for modifying the bill:

1. Establish separate selection criteria for science-technology centers and community colleges. This would provide avenues for funding to both types of organizations while allowing each to emphasize its unique features without fear of penalty.

2. Provide for equitable distribution of awards to different educational levels (early childhood as well as secondary and post-secondary). Programs that provide for early and continuing intervention may be most successful in promoting long-term outcomes and should be encouraged.

3. Target the bill's funding to start-up or expansion of instructional delivery or service programs rather than to long-standing programs that focus on research.

4. Target the bill's funding to organizations developing non-traditional means of providing innovative experiences in science and technology, and keep in mind the special needs of those serving populations under 200,000.

5. Impose an upper limit on the dollar amount that can be included in a single award. This will allow funds to be widely distributed and discourage submissions from big-budget operations seeking major funding.

6. Restrict equipment funding to programs providing access to the general public so as to avoid the use of funds to outfit existing classrooms.

7. Ensure that organizations submitting proposals for review are evaluated by a panel of their peers. This would require including professional associations representing the various types of informal educational organizations, representatives of science-technology centers, or representatives of community colleges in the review committees convened to select award recipients.

8. Clarify the rationale and basis for dividing awards among the three federal agencies chosen to administer the program. Consider an alternative administrative structure that is less cumbersome and that includes agencies affiliated with informal educational institutions

Appendix 1

COUNCIL FOR COMMUNITY ENRICHMENT
DISCOVERYWORKS . . . a children's museum

An Organizational Profile

Council for Community Enrichment/DiscoveryWorks is a community-based, non-profit organization established in 1987 by individuals who wanted to provide enriching educational experiences in the arts, sciences, and humanities for area children and youth. Specifically, CCE/DiscoveryWorks' mission is to offer unique, interactive educational experiences that emphasize the interrelationships of the arts, sciences, and humanities. These experiences for children, youth, and their families will be developmentally appropriate, intellectually stimulating, and creatively enriching.

CCE/DiscoveryWorks serves a four-county region of southwest Virginia known as the New River Valley. The organization is governed by a Board of Directors which receives guidance from an Advisory Board composed of community leaders from across the service area. These bodies establish policies and set goals that are implemented by two part-time employees, an Executive Director and a Program Director, with assistance from Board members and other volunteers. Its 1991-92 operating budget of approximately $90,000 is composed of income derived from tuition and fees (12%), private and corporate contributions (60%), savings and investments (22%), and grants from the Virginia Commission for the Arts and the Thurman Foundation (6%). These funds are disbursed over the following areas of expense: salaries and contracts (38%), marketing and promotion (3%), Board committee expenses (6%), program supplies (6%), operational expenses (23%), travel (less than 1%), and contingency reserve (24%).

Over the past four years, CCE/DiscoveryWorks has provided Fall, Winter, and Spring Classes for children and youth; Performing Arts Programs for area schools and communities; Annual Youth Theatre Production Workshop; DiscoveryWorks summer day camp; hands-on activities at area festivals; and special events. This mix of programs has evolved from the organization's goal of ensuring community access to experiences in the areas of arts, sciences, and humanities.

Classes have addressed requests for instruction in the areas of arts and sciences. Typical arts classes have covered Appalachian folk craft media (e.g., cornhusk objects); European Easter egg decorating; Impressionistic art (e.g., creating Claude Monet picture frames); and origami. Typical science classes have dealt with such topics as endangered species; ornithology; local geologic formations (e.g., caves); ecological status of local streams and rivers; insects; astronomy; and conservation.

Performing arts programs have included performances by professional artists in such areas as puppetry, magic, jazz, folk music, and theatre; and by local children who were provided opportunities to prepare and participate in theatre and opera productions. These programs have been held in schools and in community locations throughout the service region.

Through its Community Events programs, CCE/DiscoveryWorks has participated in and co-sponsored activities in annual area festivals such as SeptemberFest and RiverFest; and in special events such as Earthday, a steam-engine train excursion, and local artists' shows. In 1991-92, CCE/DiscoveryWorks sponsored a visit by "Pereslava," a Russian folk music ensemble composed of students from the Pereslava-Zalevsky Music School in Russia.

The DiscoveryWorks summer day camp has provided an excellent forum for presenting activities that interrelate the arts, sciences, and humanities. This week-long half-day camp offers art, science, music, drama, and recreational activities organized around a theme. Themes for past camps include The Jungle and The Ocean.

Area response to CCE/DiscoveryWorks programs is evident in the numbers of persons participating in various activities. In 1990-91, over 7,300 individuals participated in 81 separate activities. In 1991-92, more than 15,000 persons attended 101 activities offered by CCE/DiscoveryWorks. Given a service area population of approximately 150,000, it is apparent that CCE/DiscoveryWorks enjoys widespread support in the region.

Currently, the CCE/DiscoveryWorks Board is in the process of developing a children's museum offering interactive exhibits that interrelate the arts, sciences, and humanities. A facility has been secured and strategic planning is underway, with a goal of opening the museum within the upcoming year.

Numbers and programs are, however, not our only focus; quality of life is the primary issue. CCE/DiscoveryWorks' programs help children and youth to appreciate things that have value and beauty and to develop curiosity, sensitivity, and fascination with the world. These attributes are essential to the development of critical and creative thinking and problem-solving skills that provide the basis for scientific and cultural literacy. They are also precursors to the development of a sense of responsibility for conscientious and caring stewardship of the environment. Our children must develop these attributes to the fullest extent possible if they are to enjoy a future that meets our hopes and expectations for them.

CCE/DiscoveryWorks also enhances quality of life in our communities. Its programs help add a special dimension to the area atmosphere that can attract new industry, just as cultural and educational opportunities attract business and industry to major urban areas. CCE/DiscoveryWorks' programs provide experiences for families that help them celebrate being a community and take pride in residing in an area such as ours. Our communities are better places to live because of CCE/DiscoveryWorks' programs.

Appendix 2

An Economic Profile of
The New River Valley Region
of Southwest Virginia

Location and Population

-comprises the counties of Montgomery, Pulaski, Giles, and Floyd and the City of Radford

-located adjacent to the Blue Ridge Mountains southwest of Roanoke, Virginia

-contains a population base of approximately 150,000

-major population centers are the towns of Blacksburg (pop. apprx. 23,000) and Christiansburg (pop apprx. 15,000), both located in Montgomery County, and the City of Radford (pop. apprx. 16,000)

Economic Characteristics

-area unemployment rate of 9.8% in May 1991 (state rate of 5.5%)

-median income level of $24,166 (state median of $31,202)

-Montgomery County classified by the U.S. Department of Commerce as a designated poverty area

-taxable retail sales of $144,312,218 in 1991

-of the roughly 59,000 persons employed in 1980, 21% were in managerial and professional specialty occupations; 25% were in technical, sales, and administrative support occupations; 30% were in service occupations; and 24% were in operator, fabricator, and laborer occupations

Educational Characteristics

-approximately 20,000 children attend 43 elementary, middle, and high schools located in 5 separate systems throughout the region

-educational institutions in the area include Virginia Polytechnic Institute and State University; Radford University; New River Community College; Virginia Department of Education Southwest Regional Service Center; and Southwest Virginia Governor's School for Science and Mathematics

-more than 40% of the adult population in the area did not graduate from high school

-average per pupil expenditures in area schools range from $4062 to $4657 (state average of $4878)

Figures for per pupil expenditures in public schools taken from [illegible], Superintendent's Annual Report for Virginia, 1990-91. All other information taken from 1991-92 Regional Fact Book of the New River Valley Economic Development Alliance.

Appendix 3

BIOGRAPHICAL SKETCH OF CCE/DISCOVERYWORKS REPRESENTATIVE

Mrs. Fran Rooker
PO Box 430
Radford, Virginia 24141

Mrs. Rooker was born in Yokohama, Japan, and is the daughter of an Army officer, retired at thirty years. She has lived in several foreign countries and is widely traveled.

She is married to D. Gregory Rooker, IV, President and Publisher of Family Community Newspapers. They reside on Claytor Lake, in Pulaski County, Virginia, with their three children: Jennifer (12), Stephanie (10), and Jason (6 1/2).

She completed coursework in Music Education and Foreign Languages (Spanish/German) at West Virginia University and Radford University. Her musical experience includes teaching piano, professional singing, and directing youth choirs. Her foreign language experience includes private tutoring and teaching children's classes (Spanish/German/Italian) as an adjunct faculty member of New River Community College. She also has training and experience in direct sales, having worked for five years as a Sales Director with Mary Kay Cosmetics. She retired after winning a pink car and having her third child.

Her civic/religious affiliations include:

George Mason University, Fairfax, Virginia - three-year member of the Mason Scholar Selection Committee

Radford University, Radford, Virginia - three-year participant in the Host Family Program for international students

LOGOS, Radford, Virginia - two-year member of the founding Board of Directors of an interdenominational youth program involving four area churches

St. Jude's Catholic Church, Radford, Virginia - instructor of religious education for high school student classes

Council for Community Enrichment/DiscoveryWorks, Radford, Virginia - three-year member of the Board of Directors; elected September 1988 to the Board as Publicity Committee Chair; appointed January 1989 to present position as Fundraising Committee Chair

Mr. THORNTON. Mrs. Rooker, I can understand why our chairman, Rick Boucher, has spoken to me so enthusiastically about the fine work that you are doing, because indeed you are leveraging community involvement even before you have the resources available with which to match and to encourage. And I think your activities are exemplary, and we appreciate your bringing them to our attention.

Dr. Boggs.

Dr. BOGGS. Thank you, Mr. Chairman and committee members.

I am very pleased to have this opportunity to testify on behalf of the American Association of Community and Junior Colleges and its member institutions in support of H.R. 4726, the Opportunities in Science and Technology Act of 1992, and to thank you for your consideration of it.

I would be remiss if I were not first to thank all of you for all you have done to get the Price bill, H.R. 2936, the Scientific and Technical Education Act, through your committee. H.R. 4726 would complement the Price bill in providing building blocks that are essential to the restoration of our Nation's competitiveness.

In our struggle to compete globally, the United States must develop new initiatives which strengthen our scientific and technical education systems which attract more of our most capable students to careers in these areas and which broaden public understanding of science and technology and their importance to our Nation's economy.

I believe that the Nation's community colleges are in a unique position to provide the leadership necessary to move our Nation ahead. Community colleges enroll 40 percent of the college undergraduates in the Nation, including a larger proportion than other institutions of women and minority groups which are currently under-represented in science, engineering, and technology careers.

The Nation's community colleges are accessible to most of the citizens of our country. In addition to the transfer in technical or vocational programs they offer, most of the colleges have community education or extension offerings to serve the continuing education needs of their citizens. All of the colleges have libraries, many have planetariums or other science facilities which are open to the public, and some colleges are able to host local school science fairs.

My college, for example, has a seismograph, a solar telescope, and a planetarium available for public viewing. We have an arboretum, also open to the public, displaying plants, trees, and shrubs from all over the world. Many of our faculty members serve as speakers at community clubs and organizations, and some have served as judges at school science fairs.

Like other community colleges, we are close to the communities we serve, and we interact in many ways with our public. Each year, in addition to the regular community college students, over 5,000 school children from preschool to grade 12 attend shows in the Palomar College Planetarium. Evening planetarium shows serve another 500 to 600 people annually.

The planetarium projector, however, is about 30 years old and in desperate need of replacement. Current budget restrictions will not permit us to replace the projector, and if it finally breaks down beyond repair, we will have to close the facility. Your bill could

provide the resources to update equipment like ours, which is heavily used in support of science education but badly in need of updating.

The Nation's community college student enrollment continues to grow each year. The colleges provide the most cost-efficient way for both students and the public to support the first two years of a four-year higher education. As a result, more than half of all Americans who start college are served by community colleges.

The quality of science education in these institutions is important since it influences students' career choices and may provide the only exposure to science that most of these students receive in their college studies. The colleges also touch the lives of many of our citizens indirectly. Data from Florida point out that 65 percent of that State's classroom teachers were community college transfers.

Enrollment is also growing in community colleges in response to changes in the work force and the current economic recession. The colleges are providing retraining to many people who are developing new employment skills. Unfortunately, the pressures associated with this enrollment growth are now being compounded by leaner State budgets. Funds for instructional equipment and equipment replacement have been cut dramatically. Your bill can help to offset the losses caused by the recession and perhaps help with the economic recovery.

In conclusion, Mr. Chairman and committee members, I believe that the challenge of improving our global competitiveness cannot be met without the involvement of the Nation's community colleges. If we are to improve the public understanding of science and technology, we should look to the educational institutions which are closest to the public. If we are to influence the Nation's freshmen and sophomores, we must support the colleges which enroll most of them.

If we are to attract more women and minorities to careers in science and technology, let us recognize that we must provide their colleges—the Nation's community, technical, and junior colleges—with the necessary funding to do so. The national interest will best be served if science and technical education at the institutions which have the greatest potential impact the American community colleges are supported.

Mr. Chairman and members of the committee, thank you again for this opportunity to address this important bill. I appreciate your efforts to improve our country and wish you well.

[The prepared statement of Dr. Boggs follows:]

Testimony Provided to the
U.S. House of Representatives
Committee on Science, Space, and Technology
June 23, 1992
George R. Boggs

Mr. Chairman and members of the committee, I am George Boggs, Superintendent and President of the Palomar Community College District in San Marcos, California. Palomar College is a public community college serving more than 26,000 students per semester in northern San Diego County. I am also chair-elect of the Board of Directors of the American Association of Community and Junior Colleges (AACJC). AACJC is the voice and representative organization of the nation's public and private community, technical, and junior colleges. Its 1100 member colleges serve more than 5 million credit students per term.

I am very pleased to have this opportunity to testify on behalf of AACJC and its member colleges in support of H.R. 4726, the Opportunities in Science and Technology Act of 1992, and to thank you personally, Mr. Chairman, for your sponsorship of it.

I would be remiss if I were not to first thank you for all you have done to get the Price bill, H.R. 2936, the Scientific and Technical Education Act, through your committee. I encourage each of you to urge your colleagues on the Education and Labor Committee to report H.R. 2936 to the House. If the House approves the Price bill this summer, there is a good chance for its passage by this Congress.

Your bill, Mr. Chairman, would complement the Price bill in providing building blocks that are essential to the restoration of our nation's competitiveness. Both of the bills are responsive to the serious "pipeline" problem confronting science education and its resulting effect on our economy.

In our struggle to compete globally, the United States must develop new initiatives which strengthen our scientific and technical education systems, which attract more of our most capable students to careers in these areas, and which broaden public understanding of science and technology and their importance to our nation's economy. I believe that the nation's community colleges are in a unique position to provide the leadership necessary to move our nation ahead.

Community colleges enroll forty percent of the college undergraduates in the nation, including a larger proportion than other institutions of women and minority groups which are currently underrepresented in science, engineering, and technology careers. The nation's community colleges are accessible to most of the citizens of our country. In addition to the transfer and technical or vocational programs they offer, most of the colleges have community education or extension offerings to serve the continuing education needs of their citizens. All of the colleges have libraries, many

have planetariums or other science facilities which are open to the public, and some colleges are able to host local school science fairs.

Palomar College, for example, has a seismograph, a solar telescope, and a planetarium available for public viewing. We have an arboretum, also open to the public, displaying plants, trees, and shrubs from all over the world. Many of our faculty members serve as speakers at community clubs and organizations, and some have served as judges at school science fairs. Like other community colleges, we are close to the communities we serve, and we interact in many ways with our public.

Each year, in addition to regular community college students, over 5000 school children, from pre-school to grade 12 attend shows in the Palomar College planetarium. Evening planetarium shows serve another 500-600 people annually. The planetarium projector, however, is about 30 years old and in desperate need of replacement. Current budget restrictions will not permit us to replace the projector, and if it finally breaks down beyond repair, we will have to close the facility. Your bill could provide the resources to update equipment like ours which is heavily used in support of science education but badly in need of updating.

The nation's community college student enrollment continues to grow each year. These colleges provide the most cost efficient way for both students and the public to support the first two years of a four-year higher education. As a result, more than half of all Americans who start college are served by community colleges. The quality of science education in these institutions is important since it influences students' career choices and may provide the only exposure to science that most of these students receive in their college studies. The colleges also touch the lives of many of our citizens indirectly. Data from Florida points out that 65 percent of that state's classroom teachers were community college transfers.

In addition to the transfer programs, community colleges offer a wide range of vocational and technical programs. These programs prepare students to enter the work force in two years or less. They also provide graduates with specific courses needed for retraining or certification. In order to offer the most effective programs, many colleges have formed partnerships with their local employers. These partnerships provide the colleges with access to the most up-to-date equipment, and the employers benefit through the education of their employees and potential employees. However, the access to this equipment is often limited to students in specific technical programs, sometimes only directly involved in the partnership. A comprehensive community college may be able to extend its resources through partnerships, but would be badly handicapped in serving its broader needs if it did not have its own state-of-the-art equipment. Unfortunately, many colleges cannot afford to replace out-of-date instructional equipment.

Enrollment is also growing in community colleges in response to changes in the work force and the current economic recession. The colleges are providing retraining to many people who are developing new employment skills. Unfortunately, the pressures associated with this

enrollment growth are now being compounded by leaner state budgets. Funds for instructional equipment and equipment replacement have been cut dramatically. Your bill can help to offset the losses caused by the recession and perhaps help with the economic recovery.

In conclusion, Mr. Chairman and committee members, I believe that the challenge of improving our global competitiveness cannot be met without the involvement of the nation's community colleges. If we are to improve the public understanding of science and technology, we should look to the educational institutions which are closest to the public. If we are to influence the nation's freshmen and sophomores, we must support the colleges which enroll most of them. If we are to attract more women and minorities to careers in science and technology, let us recognize that we must provide their colleges, the nation's community, technical, and junior colleges, with the necessary funding to do so. The national interest will best be served if the National Science Foundation, the National Aeronautics and Space Administration, and the Department of Energy combine forces to support science and technical education at the institutions which have the greatest potential impact, the American Community Colleges.

Mr. Chairman and members of the Committee, thank you again for the opportunity to address this important bill. I appreciate your efforts to improve our country and wish you well.

Mr. THORNTON. Thank you very much. We have had very fine summaries of each of the testimonies here.

I think that the underlying question goes to whether there is presently a sufficient national recognition of the important role of community colleges and education centers in developing the scientific base that our Nation depends upon to be competitive.

I hear each of you saying from your perspective that you can do much more if you have additional resources and additional help from the Federal Government.

Dr. Boggs.

Dr. BOGGS. Yes, thank you, Mr. Chairman. I was encouraged this morning to hear the testimony from the Federal agencies indicating an increased awareness in the potential for community colleges, but I did hear their admission that historically they have not supported community colleges well. And currently the support provided to community colleges is not significant. So I believe we can do better.

Mr. THORNTON. Mrs. Rooker.

Mrs. ROOKER. Thank you.

I guess I deal with the area of population under 200,000, and I heard today the gentlemen speaking of areas such as Chicago and Greenville and Jackson and Oakland and Newport News. We feel our areas under 200,000 population are under-served, and there are strong forces of volunteers who are willing to put forth the effort to increase scientific literacy, given the chance with this funding.

Mr. THORNTON. It is very important point. I don't think we should neglect areas which are geographically remote or where the population is not as compact as it is in areas that may be more easily reached but very difficult to be served.

Mr. Rudolph.

Mr. RUDOLPH. Yes, we also believe that the opportunity created by this bill will enable institutions which have grown dramatically over the past few years to better serve the public and to reach many more families and children than we have been able to now and will serve as a catalyst, because the Federal funding tends to really help generate increased excitement and support from private sector and other sources.

Mr. THORNTON. The function to catalyze and to develop additional support, it would seem to me, has been repeated by each of you as being very important. The question I have relating to that is what your experience shows with regard to the importance of having a facility or a facility that is kept in good repair. Does it help to have facilities and equipment provided by the Federal Government in order to encourage community participation and utilization of those facilities and equipment?

Mr. Rudolph.

Mr. RUDOLPH. Again, I think very clearly that the Federal support can provide a very important start for that effort and that when the facilities and equipment are available the community support is increased, the potential to use those facilities and equipment is significantly increased. And we believe the record is very clear that when facilities exist—and I know we can speak on behalf of my own institution and others—that the startup support for the facility then catalyses the support in the community and generates

that, and I think Mrs. Rooker can probably speak to that very effectively from what she has said.

Mr. THORNTON. And Mrs. Rooker, please.

Mrs. ROOKER. I agree with Mr. Rudolph that the startup funding is an important part for smaller areas like mine. We have had so many requests from not only professors at Virginia Polytechnic Institute and Radford University and New River Community College but also Virginia Department of Education Regional Office in our area for us to work further on establishing a facility not only for children in our area but to work in collaboration with these institutions as a teacher resource.

So yes, it would be.

Mr. THORNTON. So there would be a certain amount of excitement attendant upon having some new instrumentation that would be an opening to astronomy or to an understanding of the way molecules work, all of the devices that—

Mrs. ROOKER. It would provide a more first-hand experience, and also our emphasis would be to teach the interrelatedness of the sciences and arts.

I also want to point out that, as Mr. Rudolph is in a larger area, Lord Cultural Resources and Planning and Management recently did a survey which pointed out that 70 to 80 percent of visitors to children's museums come from within a 25-mile radius. So having a facility such as ours in a smaller small-town area could also add to scientific and cultural literacy for that area.

Mr. THORNTON. Dr. Boggs, before the hearings began you and I had an opportunity to discuss very briefly the comparable difficulty in getting a grant or enthusiasm about starting something like a planetarium the first time, as contrasted with the very important task of keeping it up to date, of replacing it when it gets broken, of having an ability to maintain an advanced cutting edge. Would you comment on that.

Dr. BOGGS. Yes, Mr. Chairman, that certainly is a consideration, and I mention in my testimony that our planetarium has a projector which is more than 30 years old and in danger of being lost. We are very concerned about that. We know that modern projectors are made with solid-state equipment, which is easier to maintain and probably would have a longer lifetime than the equipment we have currently.

Also, I might mention that the projector we have, in relation to the testimony given by the National Science Foundation representative this morning, our projector is—our planetarium is part of an educational program. It is not a stand-alone piece of equipment. It is an integral part of our educational program at our college and an integral part of our community education program. Even though it may not be part of a National Science Foundation program currently, it is part of a program.

Mr. THORNTON. Well, indeed, would you not, as head of an institution, try to assure that any equipment be folded into a part of a broader program?

Dr. BOGGS. Yes, very much so.

Mr. THORNTON. Thank you.

Mr. Packard.

Mr. PACKARD. Thank you, Mr. Chairman.

Dr. Boggs, as the incoming president of the American Association of Community Colleges and Junior Colleges—and I want to congratulate you on that new appointment—what are your plans in that Association to stimulate an interest in science and math and engineering and the things that this bill would do?

Dr. BOGGS. Thank you, Mr. Packard.

Yes, we do have an interest in stimulating the interests of our students in science and technology, and we do see that as important to the future of our country.

As I mentioned, we are institutions which are accessible to most Americans. We have 1,100 community and junior colleges in our Association. We believe we can have a significant impact. So that is part of our agenda, to stimulate science and technological careers.

Mr. PACKARD. Are you planning to develop a strategy on doing that throughout your Association, or is it too early, I presume, for you to elaborate on what your plans are. But I presume that you will be developing some strategy then to promote science and engineering.

Dr. BOGGS. Yes. I don't have before me the plans for our Association, but that, I can assure you, is a priority.

Mr. PACKARD. What is your funding at your college, and I presume at any community college—what are the funding sources, the level of funding, and how is that determined, and what are your sources of funding?

Dr. BOGGS. Major funding sources for community colleges in the country are primarily State funds, local tax—property tax funds, and student tuition funds. In California, the student fees have been kept relatively low, so the major sources of funding there are State and local property tax funds.

Mr. PACKARD. And your current programs at your institution to emphasize science and math and engineering—do they come out of those existing funds, or are there special pots of money available either through the State or Federal sources to emphasize those disciplines?

Dr. BOGGS. Most of the funds for those disciplines also come out of the State and local funds. We have made application for Federal assistance for some of our programs. In general, the competition is pretty fierce. As we heard from the National Science Foundation representative, less than 1 percent of the contributions from NSF go to community colleges as opposed to other institutions of higher education, and yet we are serving more than half of the freshmen and sophomores in the country. So we would like to see more Federal support for our science and technology programs.

Mr. PACKARD. So under the current system you have to take—if you wanted to, for instance, upgrade your planetarium and particularly your projector with an up-to-date state of the art—you would have to take that out of the sources that you have outlined that come for general curriculum and operational activities.

Dr. BOGGS. That is correct, and that is very difficult for us to do.

Mr. PACKARD. This bill, you would anticipate, would give you access, or at least give you a competitive opportunity, to apply for funds to do some of those things that now are taken out of your existing resources.

Dr. BOGGS. Yes, that is the encouraging part of this bill, and the recognition that we heard this morning from the agencies that community colleges can play an important role.

Mr. PACKARD. I have not as carefully reviewed the technical aspects of this bill as I perhaps should. To your knowledge, does it specify what equipment you can apply for, or does it give you flexibility that you could apply for those pieces of equipment that would apply to your needs?

Dr. BOGGS. It looks like there is flexibility within the bill. It is a very simple, short bill, which I applaud you for.

Mr. PACKARD. Yes.

Dr. BOGGS. And it looks very straightforward.

Mr. PACKARD. Thank you, Mr. Chairman. I appreciate these witnesses. Some have traveled some distance to come and talk to us.

Mr. THORNTON. And thank you very much, Mr. Packard. It is always a pleasure to participate with you in one of these important hearings.

Mrs. Rooker, I wanted to explore just a little bit with you whether you have run into this 200,000 population base on occasion. Has that been a barrier to you in any of your efforts to contact agencies or to get support?

Mrs. ROOKER. Yes, it has. We considered applying for a grant to NSF, and it would have been based on a research project of the effect of informal education in the science area and the schools in our region, and their figure for population base was 250,000. Most of the agencies we have researched other than that have a population base figure of 200,000 or up, and we feel like across the country there is such an enormous amount of students—the figure I could not get from the Department of Education—who are underserved because of this particular reason.

Mr. THORNTON. And pursuing that just a bit further, have you been successful in getting any grants from NSF or from NASA or the Department of Energy?

Mrs. ROOKER. No, not at this point. We are successful in getting other grants from other sources, but we have not applied to the Department of Energy or to NASA. Our focus is the interrelatedness of sciences, and because of that it limits us to different—to specific agencies to which to apply.

Mr. THORNTON. Mr. Rudolph, can you address that question as to an institution with which you are associated? I am sure you have a broader—you probably do not have immediately at hand the figures for all of the institutions with which you are associated, but has there been an interaction with NSF, NASA, and Energy on programs of this kind?

Mr. RUDOLPH. I think that clearly there has been support for science and technology centers from NASA, NSF, and the Department of Energy, all of them, as outlined earlier. Those programs tend to be very heavily focused on wanting to do new and innovative exhibits and programs and not so much focused on necessarily the greatest needs in facilities and equipment, which may not always be the new and innovative.

Two years ago, Congressman Brown authored legislation which you heard about today providing support for new science centers, which didn't necessarily mean doing new things but meant provid-

ing what was already done and developed elsewhere to those science centers, and that has proven very effective, as you heard earlier today.

So the primary thing we might look at in this is that it allows a little more flexibility and less of the focus than the agencies tend to put now on having to do the new and creative things but perhaps trying to use the resources more—

Mr. THORNTON. To spread the knowledge and the excitement to a broader constituency, it seems.

Mr. PACKARD. Mr. Chairman, would you yield on that?

Mr. THORNTON. I would be pleased to yield.

Mr. PACKARD. I would be interested to know also by expanding the chair's question to the private sector as well. Dr. Boggs and Mr. Rudolph particularly, I would be interested if you have tried to access equipment and contributions from the private sector that might have an interest in what you are doing in terms of science and engineering and math at your institutions.

Mr. Rudolph.

Mr. RUDOLPH. Yes, we consider ourselves at my institution a public and private partnership as a State museum with a nonprofit foundation, and more than half of our funds come from earned income and private contributions. And that is particularly true for capital projects as well.

What we have found is that having, in our case, a start through the State of California's commitment just recently, last year, that I referred to earlier, of earthquake bond funding to rebuild our buildings, has made a significant impact in the private community. The fact that we have a major project and that we have support from the State has really helped gel the private sector support and brought about significant interest from the civic leadership in the whole Los Angeles region behind our project. This is something which I think in this bill the Federal support can do the same thing. It puts a stamp of approval on a project, the peer review, and it shows that the project is worthy of private support.

Mr. PACKARD. And I would be interested, Dr. Boggs, in your perspective on that component of opportunity as it relates to the community college.

Dr. BOGGS. Yes, thank you, Mr. Packard.

We have been very active in securing equipment and developing partnerships with business and industry. We have even been able to work with the University of California too. We received a donation of an electron microscope a couple of years ago that they were no longer using that we put to very good use.

We have secured donations from other—from private businesses in our area, and we are now currently working with many of our private employers to develop partnerships which educate not only their employees but also their potential employees or our students. And it gives our students a chance to learn using the most modern and up-to-date equipment, usually on the site of the employer. Those are limited programs in electronics and technology usually.

So we are working with business and industry to get donations to the college and also to have our students have a chance to use equipment on their campuses.

I might also add that we do have a request in to the National Science Foundation currently for funding a mathematics center on our campus. If that happens to be funded, it requires a 50 percent match. We would be going to our community to get support for that 50 percent match from private donors.

Mr. PACKARD. Thank you.

Mr. THORNTON. And I thank you for your excellent additions to the question, and I again want to express my appreciation to each of our witnesses and ask if you would respond in writing to such questions as the staff may address to you in writing.

Thank you, and the hearing is adjourned.

[Whereupon, at 12:02 p.m., the subcommittee was adjourned.]

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