Union Calendar No. 510
107th Congress, 2d Session – – – – – – – – – – – – – – – House Report 107–809

SUMMARY OF ACTIVITIES

OF THE

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

FOR THE

ONE HUNDRED SEVENTH CONGRESS

JANUARY 2, 2003

JANUARY 2, 2003.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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***Ranking Minority Member appointments/Full Committee and Subcommittee assignments.**
****Vice Chair appointments/Full Committee and Subcommittee assignments.**
+ The Chairman and Ranking Minority Member shall serve as Ex-officio Members of all Subcommittees and shall have the right to vote and be counted as part of the quorum and ratios on all matters before the Subcommittees.

LETTER OF TRANSMITTAL

U.S. House of Representatives
Committee on Science
Washington, DC 20515

January 2, 2003

The Honorable Jeff Trandahl
The Clerk
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Trandahl:

In compliance with Rule XI, Clause 1(d) of the Rules of the House of Representatives, I hereby submit the Summary of Activities for the Committee on Science for the 107th Congress.

The purpose of this report is to provide the Members of the House of Representatives, as well as the general public, with an overview of the legislative and oversight activities conducted by this committee, as defined by Rule X, Clause 1(n) of the Rules of the House of Representatives.

This document is intended as a general reference tool, and not as a substitute for the hearing records, reports, and other committee files.

Sincerely,

SHERWOOD L. BOEHLERT
Chairman

Enclosure

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107th Congress, 2001–2002

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107th Congress *2d Session* } HOUSE OF REPRESENTATIVES { REPORT 107–809

SUMMARY OF ACTIVITIES—COMMITTEE ON SCIENCE

JANUARY 2, 2003.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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

R E P O R T

HISTORY OF THE COMMITTEE ON SCIENCE

The Committee on Science has its roots in the intense reaction to the Soviet launch of Sputnik on October 4, 1957. Early in 1958 Speaker Sam Rayburn convened the House of Representatives, and the first order of the day was a resolution offered by Majority Leader John McCormack of Massachusetts. It read, "Resolved that there is hereby created a Select Committee on Astronautics and Space Exploration. . ."

The Select Committee performed its tasks with both speed and skill by writing the Space Act creating the National Aeronautics and Space Administration (NASA) and chartering the permanent House Committee on Science and Astronautics, now known as the Committee on Science, with a jurisdiction comprising both science and space.

The Science and Astronautics Committee became the first standing committee to be established in the House of Representatives since 1946. It was also the first time since 1892 that the House and Senate acted to create a standing committee in an entirely new area.

The Committee officially began on January 3, 1959, and on its 20th Anniversary the Honorable Charles Mosher said the Committee "was born of an extraordinary House-Senate joint leadership initiative, a determination to maintain American preeminence in science and technology. . ."

The formal jurisdiction of the Committee on Science and Astronautics included outer space—both exploration and control—astronautical research and development, scientific research and development, science scholarships, and legislation relating to scientific agencies, especially the National Bureau of Standards[1], NASA, the National Aeronautics and Space Council, and the National Science Foundation.

The Committee retained this jurisdiction from 1959 until the end of the 93rd Congress in 1974. While the Committee's original emphasis in 1959 was almost exclusively astronautics, over this 15-year period the emphasis and workload expanded to encompass scientific research and development in general.

In 1974, a Select Committee on Committees, after extensive study, recommended several changes to the organization of the House in H. Res. 988, including expanding the jurisdiction of the Committee on Science and Astronautics, and changing its name to the Committee on Science and Technology.

Jurisdiction over energy, environmental, atmospheric, civil aviation R&D, and National Weather Service issues was added to the general realm of scientific research and development.

In addition to these legislative functions, the Committee on Science and Technology was assigned a "special oversight" function, giving it the exclusive responsibility among all Congressional standing committees to review and study, on a continuing basis, all laws, programs, and government activities involving Federal nonmilitary research and development.

In 1977, with the abolition of the Joint Committee on Atomic Energy, the Committee was further assigned jurisdiction over civilian nuclear research and development, thereby rounding out its jurisdiction for all civilian energy R&D.

A committee's jurisdiction gives it both a mandate and a focus. It is, however, the committee's chairman that gives it a unique character. The Committee on Science and Technology has had the good fortune to have nine very talented and distinctly different chairmen, each very creative in his own way in directing the Committee's activities.

Representative Overton Brooks was the Science and Astronautics Committee's first chairman, and was a tireless worker on the Committee's behalf for the two and one-half years he served as chairman.

When Brooks convened the first meeting of the new committee in January of 1959, Committee Member Ken Hechler recalled, "There was a sense of destiny, a tingle of realization that every member was embarking on a voyage of discovery, to learn about the unknown, to point powerful telescopes toward the cosmos and unlock secrets of the universe, and to take part in a great experiment." With that spirit the Committee began its work.

Brooks worked to develop closer ties between the Congress and the scientific community. On February 2, 1959, opening the first official hearing of the new Committee, Chairman Brooks said, "Although perhaps the principal focus of the hearings for the next sev-

[1] Now named the National Institute of Standards and Technology (NIST) (P.L. 100–418, Title V, Part B, Subpart A, Sections 5111 through 5163, enacted August 23, 1988.)

eral days will be on astronautics, it is important to recognize that this committee is concerned with scientific research across the board." And so, from the beginning, the Committee was concerned with the scope of its vision.

Overton Brooks died of a heart attack in September of 1961, and the chairmanship of the Committee was assumed by Representative George Miller of California.

Miller, a civil engineer, was unique among Members of Congress who rarely come to the legislature with a technical or scientific background. He had a deep interest in science, and his influence was clearly apparent in the broadening of the charter of the National Science Foundation and the establishment of the Office of Technology Assessment. He pioneered in building strong relationships with leaders of science in other nations. This work developed the focus for a new subcommittee established during his chairmanship, known as the Subcommittee on Science, Research and Development.

Just a few months before Miller became Chairman, President John F. Kennedy announced to a joint session of Congress the national commitment to land a man on the moon and return him safely to Earth before the end of the decade. Thus, during Miller's 11-year tenure as chairman, the Committee directed its main efforts toward the development of the space program.

Chairman Miller was not reelected in the election of 1972, so in January of 1973, Representative Olin E. Teague of Texas took over the helm of the Committee. Teague, a man of directness and determination, was a highly decorated hero of the second World War. He was a long-standing Member of Congress and Chairman of the Veterans Committee before assuming the chairmanship of the Science and Technology Committee.

Throughout the 1960's and early 1970's, Teague chaired the Science Committee's Manned Space Flight Subcommittee, and in that capacity firmly directed the efforts to send a man to the moon.

As chairman of the Committee, Teague placed heavy emphasis on educating the Congress and the public on the practical value of space. He also prodded NASA to focus on the industrial and human applications of the space program.

One of Teague's first decisions as chairman was to set up a Subcommittee on Energy. During his six-year leadership of the Committee, energy research and development became a major part of the Committee's responsibilities.

In 1976, Chairman Teague saw the fruition of three years of intensive committee work to establish a permanent presence for science in the White House. The Office of Science and Technology Policy was established with a director who would also serve as the President's science advisor.

Throughout his leadership, he voiced constant concern that the complicated technical issues the Committee considered be expressed in clear and simple terms so that Members of Congress, as well as the general public, would understand the issues.

After six years as chairman, Teague retired from the Committee and the Congress due to serious health problems and was succeeded as chairman by Representative Don Fuqua of Florida.

Fuqua became chairman on January 24, 1979, at the beginning of the 96th Congress.

Don Fuqua came to the Congress after two terms in the Florida State Legislature and was, at age 29, the youngest Democrat in Congress when he was elected in 1962.

Fuqua's experience on the Committee dated back to the first day of his Congressional service. Since 1963, he served as a Member of the Committee's Manned Space Flight Subcommittee. When Olin Teague became chairman of the Full Committee in 1973, Fuqua took Teague's place as chairman of the Subcommittee.

As the Subcommittee chairman, he was responsible for major development decisions on the Space Shuttle and the successful Apollo-Soyuz link-up in space between American astronauts and Soviet cosmonauts. Later, the Subcommittee's responsibility was expanded to cover all other NASA activities and was renamed the Subcommittee on Space Science and Applications.

As chairman of the Committee, Fuqua's leadership could be seen in the expansion of committee activities to include technological innovation, science and math education, materials policy, robotics, technical manpower, and nuclear waste disposal. He worked to strengthen the Committee's ties with the scientific and technical communities to assure that the Committee was kept abreast of current developments, and could better plan for the future.

During the 99th Congress, the Science and Technology Committee, under Fuqua's chairmanship, carried out two activities of special note.

- The Committee initiated a study of the Nation's science policy encompassing the 40-year period between the end of the second World War and the present. The intent was to identify strengths and weaknesses in our nation's science network. At the end of the 99th Congress, Chairman Fuqua issued a personal compilation of essays and recommendations on American science and science policy issues in the form of a Chairman's Report.
- The second activity was a direct outgrowth of the Space Shuttle "Challenger" accident of January 28, 1986. As part of the Committee's jurisdictional responsibility over all the NASA programs and policies, a steering group of Committee Members, headed by Ranking Minority Member Robert Roe, conducted an intensive investigation of the Shuttle accident. The Committee's purpose and responsibility were not only the specific concern for the safe and effective functioning of the Space Shuttle program, but the larger objective of insuring that NASA, as the Nation's civilian space agency, maintain organizational and programmatic excellence across the board.

Chairman Fuqua announced his retirement from the House of Representatives at the termination of the 99th Congress. He served 24 years on the Committee on Science and Technology and 8 years as its chairman.

Congressman Robert A. Roe of New Jersey, a long-time Member of the Committee, became its new chairman at the beginning of the 100th Congress. Congressman Roe was trained as an engineer and

brought that broad knowledge and understanding to bear on the Committee's issues from the first day of his tenure.

Congressman Roe's first official act as chairman was to request a change in the Committee's name from the Committee on Science and Technology to the Committee on Science, Space, and Technology. This change was designed not only to reflect the Committee's broad space jurisdiction, but also to convey the importance of space exploration and development to the Nation's future.

In the 100th Congress, under Chairman Roe's stewardship, the Committee kept close scrutiny over NASA's efforts to redesign and reestablish the space shuttle program. The successful launch of the Shuttle Discovery in September, 1988 marked America's return to space after 32 months without launch capability.

The vulnerability of having the Nation's launch capability concentrated singularly in the Space Shuttle, and the rapid increase of foreign competition in commercial space activities, precipitated strong committee action to help ensure the competitive posture of the Nation's emerging commercial launch industry.

Chairman Roe's leadership to stabilize and direct the Nation's space program led to the Committee's first phase of multi-year authorizations for research and development programs with the advent of three-year funding levels for the Space Station.

Within the national movement to improve America's technological competitiveness, Chairman Roe headed the Committee's initiative to expand and redefine the mission of the National Bureau of Standards in order for it to aid American industry in meeting global technological challenges.

The Science Committee has a long tradition of alerting the Congress and the Nation to new scientific and technological opportunities that have the potential to create dramatic economic or societal change. Among these have been recombinant DNA research and supercomputer technology. In the 100th Congress, Members of the Committee included the new breakthroughs in superconductivity research in this category.

Several long-term efforts of the Committee came to fruition during the 101st Congress. As the community of space-faring nations expanded, and as space exploration and development moved toward potential commercialization in some areas, the need arose for legal certainty concerning intellectual property rights in space. Legislation long advocated by the Science Committee defining the ownership of inventions in outer space became public law during this Congress.

Continuing the Committee's interest in long-range research programs for renewable and alternative energy sources, a national hydrogen research and development program was established. The mission of the program was to foster the economic production of hydrogen from renewable resources to its use as an alternative fuel.

At the end of the 101st Congress, the House Democratic Caucus voted Representative Roe Chairman of the Public Works and Transportation Committee.

The hallmark of Representative Roe's four-year tenure as Chairman was his articulation of science, space, and technology as the well-spring for generating the new wealth for America's future economic growth and long-term security.

At the beginning of the 102nd Congress in January, 1991, Representative George E. Brown, Jr. of southern California became the sixth chairman of the Science, Space, and Technology Committee. Trained in industrial physics, Brown worked as a civil engineer for many years before entering politics.

Elected to the Congress in 1962, Brown was a Member of the Science, Space, and Technology Committee since 1965. During his more than two-decade tenure on the Committee before becoming its chairman, he chaired subcommittees on the Environment, on Research and Technology, and on Transportation and Aviation R&D.

Whether from his insightful leadership as a subcommittee chairman or from the solitary summit of a futurist, Brown brought a visionary perspective to the Committee's dialogue by routinely presenting ideas far ahead of the mainstream agenda.

George Brown talked about conservation and renewable energy sources, technology transfer, sustainable development, environmental degradation, and an agency devoted to civilian technology when there were few listeners and fewer converts and he tenaciously stuck to those beliefs.

Consistent with his long-held conviction that the Nation needed a coherent technology policy, Brown's first action as chairman was to create a separate subcommittee for technology and competitiveness issues. During his initial year as chairman, Brown developed an extensive technology initiative which was endorsed by the House of Representatives in the final days of the 102nd Congress. The work articulated Brown's concept of a partnership between the public and private sectors to improve the Nation's competitiveness.

The culmination of the 102nd Congress saw Brown's persistent efforts to redirect our national energy agenda come to fruition. The first broad energy policy legislation enacted in over a decade included a strong focus on conservation, renewable energy sources, and the expanded use of non-petroleum fuels, especially in motor vehicles.

In Brown's continuing concern to demonstrate the practical application of advances in science and technology, he instituted the first international video-conferenced meetings in the U.S. Congress. In March of 1992, Members of the Science Committee exchanged ideas on science and technology via satellite with counterparts from the Commonwealth of Independent States. This pilot program in the House of Representatives resulted in a decision to establish permanent in-house capacity for video-conferencing for the House.

As a final activity in the 102nd Congress, Brown issued a Chairman's Report on the Federally funded research enterprise. The work was intended as the starting point for a comprehensive review and revision of federal science policy currently in the planning stage.

The 1994 congressional elections turned over control of the Congress to the Republican Party. The House Republican Conference acted to change the official name of the Committee from the Committee on Science, Space, and Technology to the Committee on Science. Representative Robert S. Walker of Pennsylvania became the Science Committee's first Republican chairman, and the seventh Committee chairman. Walker had served on the Science Com-

mittee since his election to Congress in 1976, and had been its ranking minority member since 1989.

Chairman Walker acted to streamline the subcommittee structure from five to four subcommittees: Basic Research; Energy and Environment; Space and Aeronautics; and Technology. This action reflected the new Congress' mandate to increase efficiency and cut expenses, and also reflected Walker's personal desire to refocus the Committee's work. Due to the reduction in the number of subcommittees and a sharper focus on the issues, the number of hearings was reduced, while the number of measures passed by the House and signed into law increased.

Chairman Walker chose to use the Full Committee venue to hold hearings exploring the role of science and technology in the future. The first hearing, *Is Today's Science Policy Preparing Us for the Future?,* served as the basis for much of the Committee's work during the 104th Congress.

For the first time in recent Science Committee history, the Committee and the House of Representatives passed authorizations for every agency under the Committee's jurisdiction. To preserve and enhance the core Federal role of creating new knowledge for the future, the Science Committee sought to prioritize basic research policies. In order to do so, the Committee took strong, unprecedented action by applying six criteria to civilian R&D:

1. Federal R&D efforts should focus on long-term, non-commercial R&D, leaving economic feasibility and commercialization to the marketplace.
2. All R&D programs should be relevant and tightly focused to the agencies' missions.
3. Government-owned laboratories should confine their in-house research to areas in which their technical expertise and facilities have no peer and should contract out other research to industry, private research foundations and universities.
4. The Federal Government should not fund research in areas that are receiving, or should reasonably be expected to obtain, funding from the private sector.
5. Revolutionary ideas and pioneering capabilities that make possible the impossible should be pursued within controlled, performance-based funding levels.
6. Federal R&D funding should not be carried out beyond demonstration of technical feasibility. Significant additional private investment should be required for economic feasibility, commercial development, production and marketing.

The authorization bills produced by the Science Committee reflected those standards, thereby protecting basic research and emphasizing the importance of science as a national issue. As an indication of the Science Committee's growing influence, the recommendations and basic science programs were prioritized accordingly.

During the 104th Congress, the Science Committee's oversight efforts were focused on exploring ways to: make government more efficient; improve management of taxpayer resources; expose waste,

fraud and abuse; and give the United States the technological edge into the 21st century.

The start of the 105th Congress brought another change in leadership to the Committee. Representative F. James Sensenbrenner, Jr., a Republican from Wisconsin, became the eighth chairman after Chairman Walker retired from Congress. Sensenbrenner had been a Member of the Committee since 1981 and prior to his appointment as Committee head, he served as chairman of the Subcommittee on Space and Aeronautics.

At the start of the 105th Congress, the Speaker of the House charged the Science Committee with the task of developing a long-range science and technology policy. Chairman Sensenbrenner appointed the Committee's vice chairman, Representative Vernon Ehlers of Michigan, to lead a study of the current state of the Nation's science and technology policy. The National Science Policy Study, *Unlocking Our Future: Toward A New National Science Policy,* was unveiled in September 1998 and was endorsed by the House on Oct. 8, 1998. The Science Policy Study continues to serve as a policy guide to the Committee, Congress and the scientific community.

The Science Committee played a crucial role in numerous issues of national and international significance during Chairman Sensenbrenner's tenure. Acting in accordance with the Committee's jurisdiction over climate change issues, Chairman Sensenbrenner was chosen by the Speaker of the House to lead the U.S. delegation to the Kyoto (December, 1997), Buenos Aires (November, 1998), and The Hague (November, 2000) global warming conferences. Under Chairman Sensenbrenner's leadership, the Committee examined the science supporting the Kyoto Protocol and the economic impacts the treaty could have on the Nation.

Much of the world anxiously awaited midnight of January 1, 2000 to see if the Year 2000 (Y2K) computer problem would cause the catastrophe that some had predicted. The Science Committee through the Subcommittee on Technology, chaired by Representative Constance Morella of Maryland, held its first hearing on the Y2K problem in 1996 and held or participated in over 30 hearings on the subject. The Committee's aggressive oversight pushed Federal agencies to meet their deadlines to ensure the safety and well being of American citizens. Thankfully, the U.S. and the world experienced very minor problems associated with the Y2K rollover.

Over many years, and during the tenure of several chairmen, the Science Committee closely monitored development of the International Space Station. In October of 2000, a crew of American and Russian astronauts became the first inhabitants of the space station.

One of Chairman Sensenbrenner's priorities was to achieve a steady and sustained growth in Federal R&D investments. During his tenure, funding for civilian Federal R&D increased by 39 percent. Funding for the National Science Foundation increased 23 percent, including its highest ever appropriation in FY 2001.

The start of the 107th Congress brought another change in the Committee's leadership. Representative Sensenbrenner was elected Chairman of the Judiciary Committee and on January 3, 2001, Representative Sherwood L. Boehlert from New York's 23rd Con-

gressional District became the new chairman of the Committee on Science.

Boehlert had served on the Science Committee since first taking office in 1983 and had earned a reputation for independence, moderation and thoughtful leadership. In his first speech as chairman, Boehlert pledged to "build the Science Committee into a significant force within the Congress," and "to ensure that we have a healthy, sustainable, and productive R&D establishment—one that educates students, increases human knowledge, strengthens U.S. competitiveness and contributes to the well-being of the Nation and the world."

With those goals in mind, Boehlert laid out three priorities for the Committee—the *Three E's:* science and math education, energy policy and the environment—three areas in which Boehlert believed the resources and expertise of the scientific enterprise could be brought to bear on issues of national significance. Under Boehlert's leadership, the Committee succeeded in getting important legislation on these and other priority areas signed into law.

Boehlert also reorganized the Subcommittees to reflect these new priorities. The four Subcommittees became Research; Energy; Environment, Technology, and Standards; and Space and Aeronautics.

In the energy realm, the Committee unanimously approved the research and development portions of the House-passed Energy bill (H.R. 4). Committee provisions were designed to reduce U.S. dependence on foreign oil by investing in energy efficiency, renewable energy technologies, improved nuclear energy technologies, and new fossil fuel technologies, including clean coal.

On education, the Committee saw its major initiatives in both K–12 and undergraduate education signed into law as part of H.R. 4664, the National Science Foundation Authorization Act of 2002. Among the education initiatives were the Committee's version of President George W. Bush's proposal to establish National Mathematics and Science Partnerships that will put our nation's universities and businesses to work to help improve science and math education.

On the environment, the Committee passed legislation strengthening science at the Environmental Protection Agency and brought attention to the science behind several controversial issues, including arsenic in drinking water, particulate air pollution and global climate change.

After the terrorist attacks on September 11, 2001, terrorism moved to the forefront of the Committee's agenda. Heeding Chairman Boehlert's admonition that "the war on terrorism will be won in the laboratory as much as on the battlefield," the Science Committee worked to ensure that the Federal Government was investing in the science and technology necessary to combat terrorism over the long-term.

The Committee first turned its attention to cyberterrorism. Boehlert's legislation to address these challenges had broad bipartisan support in Congress, and on November 27, 2002, the Cyber Security Research and Development Act was signed into law.

Under Boehlert's leadership, the Committee also took the lead in responding to the concerns of family members of September 11th victims, regarding the investigation into the collapse of the World

Trade Center. After two high-profile hearings into the matter, the Committee introduced legislation to enable the government to respond more quickly to building failures and to overcome the problems that plagued the World Trade Center investigation. Signed into law on October 1, 2002, the legislation gives the National Institute of Standards and Technology jurisdiction over all future building failure investigations and the requisite authority to conduct such investigations unimpeded.

The Committee also played a key role in the development of legislation establishing the Department of Homeland Security, and led the push to make science and technology a priority in the new department. Committee proposals creating an Under Secretary in charge of science and technology, and a Homeland Security Advanced Research Projects Agency were included in the final legislation, signed into law on November 22, 2002.

The Committee also held hearings on how to strike the proper balance between the need for openness to conduct research successfully and the need for secrecy to protect homeland security.

Finally, continuing the six-decade commitment of the Science Committee "to maintain American preeminence in science and technology," the Committee successfully enacted legislation that sets the National Science Foundation (NSF) on a path to doubling its budget over five years. Chairman Boehlert and Subcommittee on Research Chairman Nick Smith of Michigan led the bipartisan, bicameral effort to ensure that future generations will continue to reap the benefits of NSF's invaluable basic research.

Chapter I—Legislative Activities of the Committee on Science

1.1—P.L. 107–50, Small Business Technology Transfer Program Reauthorization Act of 2001 (H.R. 1860)

Background and Summary of Legislation

Amends the Small Business Act to: (1) increase and extend through FY 2009 the authorization of appropriations for the Small Business Technology Transfer (STTR) Program; (2) increase to $750,000 the maximum award for small businesses participating in the second phase of an STTR Program; (3) require each Federal agency that is required to establish an STTR Program to implement an outreach program to research institutions and small businesses; (4) require the Administrator of the Small Business Administration (SBA) to modify a certain SBA policy directive with respect to Federal funding awards; (5) require each of the above agencies to collect and maintain information necessary to assess its STTR Program; (6) require STTR information to be included in agency databases currently maintaining Small Business Innovation Research (SBIR) program information; and (7) require STTR information to be included in such agencies' congressional reporting requirements.

Section 6—STTR Program Data Collection

Requires the Administrator to include within an annual report on SBIR and STTR programs the number of proposals received from, and total amounts awarded to, HUBZone small businesses under each program.

Section 7—STTR Program-Wide Model Agreement for Intellectual Property Rights

Directs the Administrator to promulgate regulations to establish a single model agreement for use in the STTR program that allocates between small businesses and research institutions intellectual property rights and any rights to carry out follow-on research, development, or commercialization. Requires each Federal agency that adopts an STTR program to adopt such model agreement.

Section 8—Fast Program Assistance for Women-Owned and Minority-Owned Small Business Concerns and Concerns Located in Areas Not Participating in SBIR and STTR

Revises provisions concerning the Federal and State Technology Partnership Program (a program to strengthen the technological competitiveness of small businesses) to require the Administrator and the SBIR Program managers to consider whether an SBIR Program proposal addresses the needs of small businesses owned and

controlled by women and minorities located in areas not participating in SBIR and STTR programs. Requires the Administrator to promulgate regulations establishing standards for the consideration of such proposals.

Legislative History

Representative Vernon Ehlers, Chairman of the Subcommittee on Environment, Technology, and Standards, introduced H.R. 1860 on May 16, 2001 and it was referred to the Committees on Small Business and Science. On May 18, 2001, the Science Committee referred the bill to the Subcommittee on Environment, Technology, and Standards. It was discharged from the Committee on September 21, 2001. The House considered the bill under suspension of the rules on September 24, 2001 and it was agreed to by voice vote.

The measure was received in the Senate on September 25, 2001 and it passed without amendment by unanimous consent on September 26, 2001. On October 15, 2001, the President signed the bill and it became P.L. 107–50.

1.2—P.L. 107–74, To prevent the elimination of certain reports (H.R. 1042)

Background and Summary of Legislation

Prohibits the application of the Federal Reports Elimination and Sunset Act of 1995 with respect to specified reports relevant to the jurisdiction of the House Committee on Science, including certain reports originating from the National Aeronautics and Space Administration, the National Science Foundation, and the National Oceanic and Atmospheric Administration.

Legislative History

H.R. 1042 was introduced in the House by Representative Felix Grucci on March 15, 2001 and was referred to the Committee on Science. The House considered the bill under suspension of the rules on March 21, 2001 and it was agreed to by Y–414, N–2 (Roll Call No. 54).

The measure was received in the Senate on March 22, 2001 and was referred to the Committee on Governmental Affairs. It was reported without amendment by the Committee on October 31, 2001 and passed the Senate by unanimous consent on November 25, 2001.

H.R. 1042 was signed by the President on November 28, 2001, becoming P.L. 107–74.

1.3—P.L. 107–107, National Defense Authorization Act for FY 2002 (S. 1438)

Background and Summary of Legislation

On October 17, 2002, the Speaker appointed Science Committee Chairman Sherwood Boehlert, Subcommittee on Research Chairman Nick Smith, Representative Lamar Smith, and Science Committee Ranking Minority Member Ralph Hall as additional conferees to S. 1438, the National Defense Authorization Act for Fiscal

Year 2002, for consideration of Sections 1071 and 1124 of the Senate bill. Subcommittee on Environment, Technology and Standards Chairman Vernon Ehlers was appointed by the Speaker in lieu of Representative Smith for consideration of Section 1124.

These conference committee deliberations, contained in H.Rept. 107–333 (Conference Report to accompany S. 1438), resulted in the enactment of Sections 1061 and 1115 of the National Defense Authorization Act for Fiscal Year 2002 (P.L. 107–107), which was signed into law by the President on December 28, 2001. Descriptions of these provisions follow.

Section 1061—Assistance for Firefighters

The Senate bill contained a provision (Section 1071) that would increase the authorization of appropriations for federal grants to state or local firefighters in section 33 of the Federal Fire Prevention and Control Act of 1974, as added by title XVII of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, from $300.0 million to $600.0 million in fiscal year 2002, and would extend and increase the authorizations to $800.0 million in fiscal year 2003 and $1.0 billion in fiscal year 2004. The House amendment contained a provision (Section 1049) that would name the program after the late Floyd D. Spence and would state the sense of Congress that the grant program should be reauthorized at increased funding levels. The House receded with an amendment that would increase the authorization of appropriations for these grants to $900.0 million per year for fiscal years 2002, 2003 and 2004, clarify that grants under this program would be available for training and equipment to respond to terrorism or the use of weapons of mass destruction, and specify that up to three percent of the funds authorized for these grants could be used for administration of the grant program by the Federal Emergency Management Agency.

Section 1115—Participation of Personnel in Technical Standards Development Activities

The Senate bill contained a provision (Section 1124) that would amend the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 3701) to allow appropriated funds to be used by Federal employees to participate in meetings to set technical standards for products, manufacturing processes, and management practices. The House amendment contained no similar provision. The House receded and the provision was adopted.

1.4—P.L. 107–171, Farm Security and Rural Investment Act of 2002 (H.R. 2646)

Background and Summary of Legislation

On March 7, 2002, the Speaker appointed Science Committee Chairman Sherwood L. Boehlert, Subcommittee on Energy Chairman Roscoe G. Bartlett and Committee Ranking Minority Member Ralph Hall as additional conferees to H.R. 2646, the Farm Security Act of 2001 for consideration of provisions in the Senate-passed bill relating to certain forestry activities (Sections 808 and 811), agricultural energy measures (Section 902 and 903) and the Office of

a Veterinary Advisor (Section 1079). The conference committee deliberations contained in H.Rept. 107–424 (Conference Report to accompany H.R. 2646), resulted in the enactment of sections 8003 and 9001–9009, which was signed into law by the President on May 13, 2002. Descriptions of these provisions follow:

Title VIII: Forestry—

Section 8003—Enhanced Community Fire Protection

Amends section 10 of the Cooperative Forestry Assistance Act of 1978 with the following changes:

(a) *Cooperative Management Related to Wildfire Threats*—Authorizes the Secretary of Agriculture (the "Secretary") to cooperate with State forester and equivalent State officials in the management of lands in the United States to: (1) aid in wildfire prevention and control; (2) protect communities from wildfire threats; (3) enhance the growth and maintenance of trees and forests that promote overall forest health; and (4) ensure the continued production of all forest resources, including timber, outdoor recreation opportunities, wildlife habitat, and clean water, through conservation of forest cover on watersheds, shelterbelts, and windbreaks;

(b) *Community and Private Land Fire Assistance Program*—Directs the Secretary to establish a Community and Private Land Fire Assistance program to: (1) focus the Federal role in promoting optimal firefighting efficiency at the Federal, State, and local levels; (2) augment Federal projects that establish landscape level protection from wildfires; (3) expand outreach and education programs to homeowners and communities about fire protection; and (4) establish space around homes and property of private landowners that is defensible against wildfires;

Directs that the program be administered by the Forest Service and implemented through State foresters or equivalent State officials;

Authorizes the Secretary, in consultation with the State forester or equivalent State official, to undertake on non-Federal lands: (1) fuel hazard mitigation and prevention; (2) invasive species management; (3) multi-resource wildfire planning; (4) community protection planning; (5) community and landowner education enterprises, including the FIREWISE program; (6) market development and expansion; (7) improved wood utilization; and (8) special restoration projects; authorizes specified FY 2002 through 2007 appropriations.

Title IX: Energy—

Title IX of the bill, includes provisions intended to improve commercial markets for agricultural products which can be used to generate energy or where their substitution for petroleum-based products can assist in reducing domestic consumption of foreign oil. In addition, the title provides Federal financial assistance and other incentives to encourage agricultural producers to implement energy conservation and efficiency measures.

Section 9001—Definitions

Establishes a number of definitions of key terms used in the title, including "Administrator," "biobased product," "biomass," "rural small business," and "Secretary."

Section 9002—Federal Procurement of Biobased Products

Requires Federal agencies to give preference to items containing the highest percentage of biobased products practicable unless such items are not comparable in price, performance and availability to non-biobased products. Calls for the development of Federal guidelines for use by procuring agencies. Directs the Secretary (defined in section 9001 as the Secretary of Agriculture) to develop a labeling program for biobased products similar to the EPA's Energy Star program. Provides program funding through October 1, 2007.

Section 9003—Biorefinery Development Grants

Directs the Secretary to make grants to eligible entities to develop and construct biorefineries for projects that demonstrate the commercial viability of biomass conversion to fuels or chemicals. Provides funding through October 1, 2007.

Section 9004—Biodiesel Fuel Education Program

Directs the Secretary to make competitive grants to eligible entities to educate governmental and private entities that operate vehicle fleets, other interested entities, and the public about the benefits of biodiesel fuel use.

Section 9005—Energy Audit and Renewable Energy Development Program

Directs the Secretary to make competitive grants to eligible entities to carry out a program to assist farmers, ranchers, and rural small businesses in becoming more energy efficient and in using renewable energy technology and resources.

Section 9006—Renewable Energy Systems and Energy Efficiency Improvements

Directs the Secretary to make loans, loan guarantees and grants to farmers, ranchers, and rural small businesses to (1) purchase renewable energy systems, and (2) make energy efficiency improvements.

Section 9007—Hydrogen and Fuel Cell Technologies

Directs the Secretary and the Secretary of Energy to enter into a memorandum of understanding under which they shall (1) cooperate in the application of hydrogen and fuel cell technology programs for rural communities and agricultural producers, and (2) work together to disseminate information to rural communities and agricultural producers on potential applications of hydrogen and fuel cell technologies.

Section 9008—Biomass Research and Development

Amends the Biomass Research and Development Act of 2000 to provide funding through October 1, 2007 and extend authority through September 30, 2007.

Section 9009—Cooperative Research and Extension Projects

Amends section 221 of the Agricultural Risk Protection Act of 2000 with the following changes:

(d) *Cooperative Research*—Directs the Secretary to establish a carbon sequestration research and development program to promote understanding of: (1) the net sequestration of organic carbon in soil, plants and trees; and (2) the net emissions of other greenhouse gases from agriculture;

Directs the Secretary to: (1) carry out carbon sequestration-related research in the areas of agronomy, agricultural economics, forestry, and other agricultural sciences; and (2) develop benchmark standards for measuring soil and plant carbon content;

(e) *Extension Projects*—Authorizes the Secretary, in cooperation with departments and agencies participating in the U.S. Global Change Research Program and other defined entities, to implement extension projects to monitor the carbon sequestering benefits of conservation practices and the exchange of greenhouse gas emissions from agriculture; and

Authorizes FY 2002 through 2007 appropriations for both subsections.

Legislative History

H.R. 2646 was introduced in the House on July 26, 2001 by Representative Larry Combest and was referred to the Committee on Agriculture. It was reported out on August 2, 2001 and was sequentially referred to the Committee on International Relations where it was reported (amended) on September 10, 2001. The House adopted an amendment in the nature of a substitute as agreed to by the Committee of the Whole House on the State of the Union; the measure passed on October 5, 2001 by: Y–291, N–120 (Roll Call No. 371).

The measure was received in the Senate on October 9, 2001. By unanimous consent, the Senate struck all after the enacting clause and substituted the language of S. 1731 and passed the amended bill by: Y–58, N–40 (Roll Call No. 30).

A House-Senate conference negotiated a compromise and the Conference Report (H.Rept. 107–424) was filed on May 1, 2002. On May 2, 2002, the House agreed the Conference Report by: Y–280, N–141 (Roll Call No. 103) and the Senate agreed to the report on May 8, 2002 by: Y–64, N–35 (Roll Call No. 103). The President signed the measure on May 13, 2002 and it became P.L. 107–171.

1.5—P.L. 107–231, National Construction Safety Team Act (H.R. 4687)

Background and Summary of Legislation

The aftermath of the collapse of the World Trade Center (WTC) revealed serious flaws in how the Federal Government carries out investigations of major building failures. The National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute of Standards and Technology (NIST) all were involved in investigating this disaster in some way. However, none of these agencies was prepared to conduct a comprehensive and thorough investigation immediately following the

collapse of the WTC buildings. In addition, the Federal efforts that were undertaken to study the building failures were hindered by many impediments: no Federal agency was clearly charged with investigating building failures; nothing ensured that an investigation would begin quickly enough to preserve evidence; no Federal agency had the investigative authority to ensure access to all needed information; nothing ensured that the public was kept informed of the progress of the investigation; and inadequate funding limited the efforts that were undertaken. Families of the victims, outside experts, and NIST itself have called for future investigations to be given additional investigative authorities like those used by the National Transportation Safety Board.

The National Construction Safety Team Act authorizes the Director of NIST to establish National Construction Safety Teams to investigate building failures in the wake of an event that causes significant loss of life or had the potential to cause the significant lose of life. The legislation also builds on the procedures followed by FEMA to investigate building failures and on the existing building authority Congress vested in NIST. The Act is designed to address each of the impediments that hindered the WTC investigation.

The purpose of a Team's investigation is to improve the safety and structural integrity of buildings in the United States. It requires Teams to: (1) establish the likely technical cause(s) of the building failure; (2) evaluate the technical aspects of evacuation and emergency response procedures; (3) recommend specific improvements to building standards, codes, and practices; (4) recommend research and other appropriate actions needed to improve the structural safety of buildings and evacuation and emergency response procedures.

In carrying out an investigation Teams are authorized to: (1) enter property where a building failure has occurred or where relevant materials are located; (2) inspect related records, facilities, and building components and materials; (3) move appropriate records, components, and materials; and (4) subpoena necessary witnesses and evidence.

When conducting an investigation Teams must: (1) conduct investigative actions in a way that does not interfere unnecessarily with building services or materials and that preserves evidence related to the building failure; (2) coordinate investigations with search and rescue efforts and with qualified researchers conducting engineering or scientific research relating to the building failure; and (3) cooperate with State and local authorities carrying out any activities related to a Team's investigation.

The legislation directs NIST to enter into a memorandum of understanding with the head of each Federal agency that may conduct or sponsor a related investigation, providing for coordination of investigations. It grants a Team investigation priority over any other investigation of any other Federal agency, with the exception of related investigations conducted by the National Transportation Safety Board or building failures that may have been caused by criminal acts.

Further the legislation requires: (1) the Director, on behalf of a Team, to hold public briefings on investigations, including final briefings after public reports required by this Act are issued; and

(2) Teams to issue public reports after completing investigations, including an analysis of the cause of the building failure and any recommendations for changes to evacuation and emergency response procedures, improvements to building standards, and actions needed to prevent future failures. Requires NIST to review such reports, to conduct or encourage appropriate recommended research, and to promote adoption of Team recommendations by the Federal Government and other agencies and organizations.

The legislation also requires the Director to: (1) report to specified congressional committees on Team investigations and recommendations, including on the extent to which those recommendations have been implemented, and on NIST actions to improve building safety and structural integrity in response; and (2) establish an advisory committee to advise the Director on carrying out this Act and to review the procedures developed for the establishment and deployment of Teams and Team reports. It also requires such advisory committee to transmit to Congress annual reports that include: (1) an evaluation of Team activities, along with recommendations for improving Team operation and effectiveness; and (2) an assessment of the implementation of Team recommendations.

Finally the legislation states that the authorities and restrictions applicable under this Act to the Director and Teams shall apply to NIST activities in response to the attacks of September 11, 2001, and it authorizes NIST to use funds otherwise authorized by law to carry out this Act.

Legislative History

H.R. 4687 was introduced by Science Committee Chairman Sherwood Boehlert on May 9, 2002 and it was referred to the Committee on Science.

The House Science Committee met on May 22, 2002 to consider H.R. 4687. Chairman Boehlert offered several technical amendments to the bill, which were considered en bloc and adopted by voice vote. The Committee favorably reported the bill as amended, by voice vote.

The Committee on Science filed H.Rept. 107–530 on June 25, 2002.

The House considered H.R. 4687 on July 12, 2002. An amendment was offered by Chairman Boehlert to clarify that members of investigative teams should be treated as contract employees; clarify that team members not recommend code changes or further research in the unlikely event that they do not believe any code changes or further research is necessary; expand the types of criminal investigations that would require NIST to stop serving as the lead agency at the site of a building collapse; clarifies how certain decisions of the Director of NIST can be enforced; clarifies that all expenditures in the bill are subject to appropriations; clarifies in two separate places that the bill gives NIST no regulatory authority over the adoption of building standards, codes and practices; and changes the authorization to "such sums as may be necessary." The amendment was adopted by voice vote.

The House then passed H.R. 4687, as amended, by: Y–338, N–23 (Roll Call No. 295). It was received in the Senate on July 15,

2002. Senator Ernest Hollings offered an amendment to clarify several technical provisions in the legislation. The measure passed the Senate, as amended, by a voice vote on September 9, 2002.

The House considered H.R. 4687 as amended by the Senate on September 17, 2002 and adopted the measure by voice vote.

The President signed the measure on October 1, 2002, and it became P.L. 107–231.

1.6—P.L. 107–252, Help America Vote Act of 2002 (H.R. 3295)

Background and Summary of Legislation

H.R. 3295, the Help America Vote Act, is a comprehensive election reform bill passed in response to the numerous problems that surfaced during the 2000 election. It establishes a new entity, the Election Assistance Commission, to provide assistance to states in administering Federal elections.

The bill also includes provisions from H.R. 2275, the Voting Technology Standards Act, that establish a Technical Standards Development Committee to assist the Election Assistance Commission by recommending standards to ensure the usability, accuracy, security, accessibility, and integrity of voting systems and voting equipment.

Additional language from H.R. 2275 incorporated into the Help America Vote Act directs the Commission to provide for the testing, certification, decertification, and recertification of voting system hardware and software by accredited laboratories, which are recommended for accreditation by the National Institute of Standards and Technology. The bill also authorizes the Commission, assisted by the National Institute for Standards and Technology, to make grants to entities for voting equipment and technology research and development, and grants for pilot programs to try out new voting systems and equipment technologies.

Legislative History

On November 14, 2001, Representative Bob Ney introduced H.R. 3295, the Help America Vote Act, which incorporated provisions from H.R. 2275, the Voting Technology Standards Act, introduced on June 21, 2001 by Representative Vernon Ehlers. H.R. 3295 was referred to the Committees on House Administration, Judiciary, Science, Government Reform, and Armed Services. The House Administration Committee ordered the measure reported, as amended on December 10, 2001 and filed H.Rept. 107–329.

The Committee on Science discharged the bill on December 10, 2001, as did the Judiciary, Government Reform and Armed Services Committees.

On December 12, 2001, the measure passed the House, as amended, by: Y–362, N–63 (Roll Call No. 489). It was then received in the Senate and referred to the Senate Committee on Rules and Administration.

On April 11, 2002, the Senate Committee on Rules and Administration discharged the measure. The measure passed the Senate the same day with an amendment substituting the text of S. 565, the Equal Protection of Voting Rights Act, in place of the House-passed bill.

On October 8, 2002 the Conference Committee filed H.Rept. 107–730. The House agreed to the Conference Report on April 11, 2002 (Roll Call No. 462), and the Senate on October 8 (Record Vote No. 238). H.R. 3295 was signed by the President on October 29, 2002 and became P.L. 107–252.

1.7—P.L. 107–253, Inland Flood Forecasting and Warning System Act of 2002 (H.R. 2486)

Background and Summary of Legislation

In 1999, Hurricane Floyd killed 48 people and caused nearly $3 billion in property damage, primarily through the flooding of inland communities. In 2000, Tropical Storm Allison unexpectedly dumped more than 35 inches of rain in Texas and traveled from Texas eastward through much of the Southeast United States resulting in more than 50 deaths, again primarily as a result of inland flooding. While the National Weather Service has the ability to accurately predict most flood events, it has difficulty in forecasting coastal and estuary-inland flooding events that are caused by tropical cyclones. In addition, the flood warning index (or scale) currently used by the National Weather Service does not include enough information about the potential risks and dangers posed by expected floods.

The United States Weather Research Program (USWRP) is a $9 million multi-agency collaborative effort of research communities, academia, and government. The focus of the program is to integrate weather-related research and new developments in technology with current operational weather products. The government participants include the National Oceanic and Atmospheric Administration (NOAA), which houses USWRP, the National Science Foundation, the National Aeronautic and Space Administration (NASA), and the Department of Defense.

H.R. 2486, the Inland Flood Forecasting and Warning System Act of 2002, requires NOAA, through the USWRP, to: (1) improve the capability to forecast accurately inland flooding through research and modeling; (2) develop, test, and deploy a new flood warning index that will give the public and emergency management officials fuller, clearer, and more accurate information about the risks and dangers posed by expected floods; (3) train emergency management officials, National Weather Service personnel, meteorologists, and others regarding improved forecasting techniques for inland flooding, risk management techniques, and use of such flood warning index; (4) conduct outreach and education activities for local meteorologists and the public regarding the dangers and risks associated with inland flooding and the use and understanding of such index; and (5) assess the long-term trends in frequency and severity of inland flooding and how shifts in climate, development, and erosion patterns might make certain regions vulnerable to more continual or escalating flood damage in the future.

H.R. 2486 authorizes $6.05 million in appropriations to NOAA for carrying out this Act for FY 2003 through 2007. Of the total amounts authorized, $250,000 shall be available each year to institutes for higher learning to develop models that can improve the ability to forecast the coastal and estuary inland flooding that is influenced by tropical cyclones. In addition, $100,000 shall be avail-

able from FY03 to FY05 for institutes of higher education to carry out the activities described in (5) above.

H.R. 2486 requires NOAA to report to the House Science and Senate Commerce, Science and Transportation Committees: (1) annually through FY 2007 on its activities under this Act and the success and acceptance of the new inland flood warning index by public and emergency management professionals; and (2) by January 1, 2006, on the likely long-term trends in inland flooding, the results of which shall be used in the outreach activities, especially to alert the public and builders to flood hazards.

Legislative History

Representative Robert Etheridge introduced H.R. 2486 on July 12, 2001. On October 11, 2001, the Environment, Technology, and Standards Subcommittee held a hearing on the legislation. On December 12, 2001, the Subcommittee met to consider H.R. 2486. Subcommittee Chairman Vernon Ehlers offered an amendment in the nature of a substitute, which was adopted by a voice vote. The amendment: (1) designated NOAA, acting through the U.S. Weather Research Program, as the entity designed to carry out the activities associated with creating a new inland flood index, rather than the National Weather Service; (2) deleted references to tropical cyclones to broaden the scope of the new flood index to include all inland flooding, not just that caused by tropical cyclones; and (3) changed the date associated with the legislation from fiscal years 2002 through 2006 to fiscal years 2003 through 2007 to reflect the end of the fiscal year 2002 appropriations process for the Department of Commerce. The Subcommittee favorably reported the bill, H.R. 2486, as amended, by a voice vote.

On May 22, 2002, the Committee on Science considered H.R. 2486. No amendments were offered and the Committee favorably reported the bill, as amended by the subcommittee, by a voice vote in H.Rept. 107–495.

On July 11, 2002, H.R. 2486 was considered by the House. During consideration Representative Sheila Jackson Lee offered an amendment to authorize $100,000 for the National Oceanic and Atmospheric Administration to conduct a three-year study to assess the long-term trends in frequency and severity of inland flooding and to determine how shifts in climate and other factors might make certain regions vulnerable to escalating flood damage in the future. The amendment was agreed to by voice vote. The measure was then considered and passed by: Y–413, N–3 (Roll Call No. 294).

H.R. 2486 was received in the Senate on July 12, 2002, and was referred to the Committee on Commerce, Science, and Transportation. On September 19, 2002, in an executive session, the bill was ordered to be reported without amendment to the Senate by voice vote. On October 10, the Committee filed S.Rept. 107–310. On October 16, 2002, the measure was considered by the Senate without amendment and was passed by unanimous consent. H.R. 2486 was signed by the President on October 29, 2002 and it became P.L. 107–253.

1.8—P.L. 107–277, ENTERPRISE INTEGRATION ACT OF 2002 (H.R. 2733)

Background and Summary of Legislation

Enterprise integration—the ability to seamlessly exchange information up and down the supply chain of an industry without error or loss—can increase efficiency in every business along the supply chain, from the largest manufacture to the smallest supplier. It can also provide significant economic benefits for industries that are fully integrated.

For example, with a fully integrated supply chain, if Ford were to change a design for a bumper, every one of the suppliers that contributes parts to Ford for that bumper would be able quickly and easily to see how the new specifications would affect its component. Each supplier would be able to redesign the component knowing that information does not have errors or was lost along the way. This integration will help large and small businesses improve efficiency by reducing costs and design cycles times.

Achieving this level of integration, however, is complex and requires a substantial amount of research regarding what information exchange standards need to be developed and implemented for different supply chains. The purpose of H.R. 2733, the Enterprise Integration Act of 2002 is to capitalize on the existing knowledge of the National Institute of Standards and Technology (NIST) in this field by authorizing the agency to work with major manufacturing sectors (such as automotive, aerospace, electronics, shipbuilding, etc.) to (1) reach a consensus on what standards are needed to integrate supply chains, (2) support the development of those standards, and (3) help smaller businesses in those industries integrate. Specifically, the legislation authorizes NIST to:

- Work with major manufacturing industries to identify current enterprise integration standardization and implementation activities within the United States and abroad, and assess the current state of these activities within any given industry;
- Work with individual industries to develop roadmaps that will outline goals and milestones aimed toward fully integrating the industry's supply chains;
- Support the develop, testing, promulgation, integration, adoption, and upgrading of standards related to enterprise integration efforts; and
- Provide technical assistance to small and medium-sized business carrying out enterprise integration efforts.

The legislation gives NIST a four-year authorization for this program starting with $2,000,000 in Fiscal Year 2002, $10,000,000 in Fiscal Year 2003, $15,000,000 in Fiscal Year 2004, and $20,000,000 in Fiscal Year 2005.

Legislative History

On August 2, 2001, Ranking Minority Member James Barcia and Chairman Vernon Ehlers of the Subcommittee on Environment, Technology, and Standards, introduced H.R. 2733. The bill was referred to the Committee on Science and its Subcommittee on Envi-

ronment, Technology, and Standards. The Subcommittee marked up the bill on December 12, 2001 and ordered the bill reported, as amended, to the Committee by a voice vote. H.R. 2733 was then ordered reported, as amended, by the Committee on Science on May 22, 2002.

The Committee on Science filed H.Rept. 107–520 on June 20, 2002.

H.R. 2733 passed the House by a vote of 397–22 (Roll Call No. 293) on July 11, 2002. It was received in the Senate and referred to the Senate Committee on Commerce, Science, and Technology. The Committee met in Executive Session on September 19, 2002, and ordered the bill reported, without amendment, and filed S.Rept. 107–319.

On October 17, 2002, H.R. 2733 passed the Senate without amendment by unanimous consent and was cleared for the White House. The President signed H.R. 2733 on November 5, 2002, which became P.L. 107–277.

1.9—P.L. 107–296, HOMELAND SECURITY ACT OF 2002 (H.R. 5005)

Background and Summary of Legislation

The tragic events of September 11, 2001, and the Congressional oversight that followed, brought home the need to improve the coordination of federal counter-terrorism prevention, preparedness, response, and recovery efforts. President George Bush proposed the establishment of a new Department of Homeland Security that would consolidate under one organization many of the disparate agencies responsible for these efforts. H.R. 5005 authorizes the establishment of the new Department.

SUMMARY OF SCIENCE COMMITTEE PROVISIONS

Section 2.

Contains definitions for the terms "appropriate congressional committee," "critical infrastructure," and "key resources."

TITLE I—Department of Homeland Security

Section 102(f).

Requires the Secretary to appoint a Special Assistant to the Secretary with various responsibilities, including working with federal laboratories, federally funded research and development centers, universities and other entities to produce and deploy the best available technologies for homeland security missions and to assist in the development and promotion of private sector best practices to secure critical infrastructure.

Section 102(g).

Clarifies that all standards activities of the Department are to be conducted in accordance with the National Technology Transfer Advancement Act of 1995 and OMB Circular A–119.

Section 103(a).

Authorizes the appointment by the President, by and with the advice and consent of the Senate, of various officers including an

Under Secretary for Information Analysis and Infrastructure Protection and an Under Secretary for Science and Technology.

TITLE II—Information Analysis and Infrastructure Protection

Section 201.

Authorizes the appointment of an Assistant Secretary for Infrastructure Protection and requires the development of a comprehensive national plan for securing key resources and critical infrastructure, including information technology and telecommunications systems (including satellites).

Section 202(g).

Transfers the functions, personnel, assets, and liabilities of various agencies to the Department of Homeland Security but does not permit the transfer of the Computer Security Division of the National Institute of Standards and Technology as originally proposed by the Administration.

Section 223.

Authorizes the Under Secretary for Information Analysis and Infrastructure Protection to provide state and local governments and private entities that own or operate critical information systems with threat and vulnerability assessments and warnings, crisis management support, and technical assistance with respect to emergency recovery plans.

Section 224.

Authorizes the Under Secretary to establish a national technology guard, to be known as "NET Guard," comprised of local teams of volunteers with expertise in relevant areas of science and technology, to assist local communities to respond and recover from attacks on information systems and communications networks.

Section 231.

Establishes within the Department of Justice an Office of Science and Technology Policy to carry out research, development, testing, evaluation, and cost-benefit analysis in fields that would improve the safety, effectiveness, and efficiency of law enforcement technologies, to support research fellowships, to establish and maintain performance standards in accordance with the National Technology Transfer and Advancement Act of 1995 and to establish and maintain programs to certify and validate products that conform with such standards and to serve on the Technical Support Working Group of the Department of Defense.

Section 235.

Authorizes the operation, through a merit-based, competitive process, of National Law Enforcement and Corrections Technology Centers to support research and development, technology transfer and implementation, and the development and dissemination of guidelines and technological standards for law enforcement technologies.

TITLE III—Science and Technology in Support of Homeland Security

Section 301.

Authorizes the establishment of a Directorate of Science and Technology headed by an Under Secretary for Science and Technology.

Section 302.

Authorizes the Under Secretary to:

- serve as the principal advisor to the Secretary on research and development efforts;
- develop a national policy and strategic plan for identifying priorities, goals, objectives and policies for, and coordinating the Federal Government's civilian efforts to identify and develop countermeasures to chemical, biological, radiological, nuclear, and other emerging terrorist threats;
- support the Under Secretary for Information Analysis and Infrastructure Protection, by assessing and testing homeland security vulnerabilities and threats;
- conduct intramural and extramural basic and applied research, development, demonstration, testing, and evaluation activities that are relevant to any or all elements of the Department;
- establish priorities for directing, funding, and conducting research, development, test and evaluation, and procurement of technology and systems for preventing the importation of weapons of mass destruction and detecting, preventing, protecting against, and responding to terrorist attacks;
- establish a system for transferring homeland security developments or technologies to Federal, State, and local governments and private sector entities;
- enter into work agreements, joint sponsorships, contracts, or other agreements with the Department of Energy regarding the use of the national laboratories;
- collaborate with the Secretary of Health and Human Services and the Attorney General regarding the inclusion of biological agents and toxins on the "select agents" list;
- support U.S. leadership in science and technology;
- establish and administer the primary research and development activities of the Department;
- coordinate and integrate all research, development, demonstration, testing, and evaluation activities of the Department;
- coordinate with other appropriate executive agencies in developing, carrying out and disseminating the science and technology agenda of the Department;
- develop and oversee the administration of guidelines for merit review of research and development projects throughout the Department, and for the dissemination of research conducted by the Department.

Section 303.

Authorizes the transfer to the Department of the functions, personnel, assets, and liabilities of the following entities:

- the chemical and biological national security and supporting programs and activities of the nonproliferation and verification research and development programs of the Department of Energy (excluding programs related to the strategic nuclear defense posture of the U.S.);
- the nuclear smuggling programs and activities within the proliferation detection program of the nonproliferation and research verification program;
- the nuclear assessment program and activities of the assessment, detection and verification research and development program of the international materials protection and cooperation program;
- life sciences activities of the biological and environmental research program related to microbial pathogens that are designated by the President for transfer;
- the Environmental Measurements Laboratory;
- the advanced scientific computing research program and activities at Lawrence Livermore National Laboratory;
- the National Bio-Weapons Defense Analysis Center of the Department of Defense.

Section 304.

Authorizes the Secretary of Health and Human Services, in collaboration with the Secretary of Homeland Security, to set priorities, goals, objectives and policies for civilian human health related research and development activities for chemical, biological, radiological, nuclear and other emerging threats carried out by the Department of Health and Human Services. The section adds a new provision to the Public Health Service Act related to the administration of smallpox countermeasures by health professionals.

Section 305.

Authorizes the Secretary to establish or contract with one or more federally funded research and development centers to provide independent analysis of homeland security issues.

Section 306.

Requires that to the greatest extent practicable, research conducted or supported by the Department shall be unclassified, clarifies that other Under Secretaries of Homeland Security may carry out research, development, demonstration, and deployment activities so long as they are coordinated through the Under Secretary for Science and Technology, authorizes the Secretary to issue necessary regulations with respect to research, development, demonstration, testing, and evaluation activities of the Department, and requires the President to notify Congress prior to effecting any transfer of Department of Energy life sciences activities.

Section 307.

Authorizes the Secretary to establish a Homeland Security Advanced Research Projects Agency to award competitive, merit-reviewed grants, cooperative agreements or contracts to public or private entities to:

- support basic and applied homeland security research to promote revolutionary changes in technologies that would promote homeland security;
- advance the development, testing, evaluation and deployment of critical homeland security technologies; and
- accelerate the prototyping and deployment of technologies that would address homeland security vulnerabilities.

Section 308.

Authorizes the Secretary to conduct both extramural and intramural research programs, establish university-based centers for homeland security, and draw upon the expertise of any laboratory of the Federal Government.

Section 309.

Authorizes the Secretary to utilize the Department of Energy national laboratories and sites to carry out the missions of the Department and requires that any research, development, test, and evaluation activities conducted within the Department of Energy that are directly or indirectly related to homeland security are fully coordinated with the Secretary of Homeland Security.

Section 310.

Transfers the Plum Island Animal Disease Center of the Department of Agriculture to the Department of Homeland Security.

Section 311.

Establishes a Homeland Security Science and Technology Advisory Committee to advise the Under Secretary of Science and Technology and to identify research areas of potential importance to the security of the Nation.

Section 312.

Establishes a federally funded research and development center to be known as the Homeland Security Institute to:

- provide systems analysis, risk analysis, and simulation and modeling to determine the vulnerabilities of the Nation's critical infrastructures;
- conduct economic and policy analysis to assess the distributed costs and benefits of alternative approaches to enhancing security;
- evaluate the effectiveness of measures deployed to enhance the security of institutions, facilities, and infrastructure;
- identify instances when common standards and protocols could improve the inter-operability and effective utilization of tools developed for field operators and first responders;

- assist federal agencies and departments in establishing test beds to evaluate the effectiveness of technologies under development and to assess the appropriateness of such technologies for deployment;
- design and apply metrics to evaluate the effectiveness of homeland security programs, throughout the Federal Government;
- design and support the conduct of homeland security-related exercises and simulations; or
- create strategic technology development plans to reduce vulnerabilities in the Nation's critical infrastructures.

Section 313.

Establishes a technology clearinghouse to encourage and support innovative ways to enhance homeland security.

TITLE IV—Directorate of Border and Transportation Security

Section 428(h).

Requires the Director of the Office of Science and Technology Policy to submit to Congress a report on how the visa issuance provisions of H.R. 5005 will affect procedures for the issuance of student visas.

TITLE V—Emergency Preparedness and Response

Section 403.

Transfers the Federal Emergency Management Agency and the Integrated Hazard Information System of the National Oceanic and Atmospheric Administration to the Department of Homeland Security.

Section 507.

Describes the functions of the Federal Emergency Management Agency.

TITLE VIII—Coordination with Non-Federal Entities; Inspector General; United States Secret Service; Coast Guard; General Provisions

Section 831.

Authorizes the Secretary to carry out a pilot program under which the Secretary may utilize "other transactions" authority when carrying out basic, applied, and advanced research and development projects when a determination is made that a contract, grant, or cooperative agreement is not feasible or appropriate. The Secretary is also authorized to utilize special authorities when carrying out prototype projects.

TITLE X—Information Security

Section 1001.

Authorizes the Director of OMB to oversee agency information security policies and practices, by:

- promulgating information security standards;
- overseeing the implementation of policies, principles, standards and guidelines on information security;
- coordinating the development of standards and guidelines under section 20 of the National Institute of Standards and Technology Act;
- overseeing agency compliance with the policies, standards and guidelines.

Each agency shall report annually to the Director of OMB and the Committees on Government Reform and Science of the House of Representatives on the adequacy and effectiveness of information security policies, procedures, and practices, and compliance with the requirements of this title.

Section 1003.

Amends the National Institute of Standards and Technology Act to state that the Institute shall:

- have the mission of developing standards, guidelines, and associated methods and techniques for information systems;
- develop standards and guidelines, including minimum requirements, for information systems used or operated by an agency or by a contractor of an agency, other than national security systems; and
- develop standards and guidelines, including minimum requirements, for providing adequate information security for all agency operations and assets, other than national security systems.

Section 1004.

Renames the Computer System Security and Privacy Advisory Board the Information Security and Privacy Advisory Board and adding to its responsibilities the responsibility to advise the Institute and the Director of the Office of Management and Budget on information security and privacy issues pertaining to Federal Government information systems.

Section 1006.

Clarifies that nothing in this Act affects the authority of the National Institute of Standards and Technology or the Department of Commerce relating to the development and promulgation of standards and guidelines.

TITLE XVII—Conforming and Technical Amendments

Section 1712.

Authorizes the Director of the Office of Science and Technology Policy to advise the President on scientific and technical considerations pertaining to homeland security and to work in close cooperation and consultation with the Office of Homeland Security.

Section 1713.

Amends the National Oceanographic Partnership Program to include the Under Secretary for Science and Technology of the Department of Homeland Security.

Legislative History

Representative Dick Armey, Chairman of the House Select Committee on Homeland Security introduced H.R. 5005 on June 24, 2002. On July 12, 2002 the recommendations of the House Committee on Science were transmitted to the Select Committee on Homeland Security and the Committee on Science was discharged from further consideration of the legislation. On July 24, 2002 the bill was reported (as amended) by the Select Committee on Homeland Security and on July 26, 2002 the bill passed the House of Representatives by a vote of Y–295, N–132 (Roll Call No. 367). The Senate approved the legislation with an amendment on November 19, 2002. H.R. 5005 was signed by the President on November 25, 2002 and became P.L. 207–296.

1.10—P.L. 107–299, National Sea Grant College Program Act Amendments of 2002 (H.R. 3389)

Background and Summary of Legislation

The National Sea Grant College Program (Sea Grant) was established by the National Sea Grant College Act (33 U.S.C. 1121–1131), which Congress passed in 1966. Sea Grant was designed as the marine counterpart of the agriculture research and extension activities based at the country's land grant universities. Sea Grant's objective is to increase the understanding, assessment, development, utilization and conservation of the Nation's ocean, coastal and Great Lakes resources. Sea Grant was originally housed at the National Science Foundation (NSF), but was transferred to the newly created National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce in 1970. Sea Grant is made up of 30 sea Grant College programs located in coastal and Great Lakes states and Puerto Rico that use the resources of more than 300 U.S. universities and scientific institutions to conduct marine research, education and outreach activities.

Each Sea Grant state program works with the National Sea Grant office and the user community of the state to develop a list of priority research areas to promote the sustainable use and overall well-being of marine resources. Each program designs its own education programs to train future marine scientists and technicians at the graduate level as well as elementary and secondary students and teachers. Each program also develops its own Sea Grant extension service, tailored to provide information and technical assistance to meet the needs of the user community of the state.

For FY 2001, $62 million in federal funds was appropriated for Sea Grant. According to the National Sea Grant Office, about 80 percent went directly to the state programs, and 15 percent went to national strategic initiatives through nationwide, competitive grants. By law no more than five percent can go for national administration of the program. The state programs contributed about

another $35 million in matching and in-kind contributions. Sea Grant also managed an additional $16 million that was transferred from other NOAA programs, bringing the total amount to about $113 million.

Of the $113 million, about $63 million or 56 percent was spent on research activities. The remaining 44 percent was used for extension, communication, education and management functions.

Congress last passed a Sea Grant authorization in 1998, which runs through fiscal year 2003. The legislation focused on implementing the recommendations of a 1994 National Research Council (NRC) review of the program, including those to better define the roles of the National Sea Grant Office, Sea Grant College programs and the Sea Grant Review Panel. The NRC panel also recommended streamlining the process for reviewing proposals and evaluating the program, which was accomplished through the legislation and administrative reforms.

The authorization for the Sea Grant program expires at the end of fiscal year 2003. In addition, the Administration's fiscal year 2003 Budget Request proposes to transfer the Sea Grant program from NOAA to the National Science Foundation (NSF) to promote more rigorous, merit-based competition among researchers.

H.R. 3389 reauthorizes Sea Grant within the NOAA for five years, increases authorization levels, and promotes competition between the state programs for additional resources through a strengthened merit-reviewed process.

Section 2—Amendments to Findings

Inserts language to encourage strong collaborations between Administration scientists and academic institutions.

Section 3—Requirements Applicable to National Sea Grant Program

Requires the Secretary of Commerce to develop, at least every four years, a strategic plan that establishes priorities for the National Sea Grant College Program.

Inserts language to: (1) evaluate the performance of sea grant colleges to determine which are the best managed and carry out the highest quality research, education, extension, and training activities; and (2) rate the programs according to their relative performance into no less than five categories, with each of the two best-performing categories containing no more than 25 percent of the programs.

Requires the Secretary of Commerce, three years after the date of enactment, to contract with the National Academy of Sciences to: (1) review the effectiveness of the evaluation and rating system; (2) determine whether the state programs have improved as a result of the evaluation process; and (3) make appropriate recommendations to improve the overall effectiveness of the evaluation process. The Academy shall submit a report to Congress on its finding no later than four years after the date of enactment of the Act.

Inserts language that the Director of the National Sea Grant College Program shall encourage and promote coordination and cooperation between the research, education, and outreach programs of the Administration and those academic institutions.

Section 5—Fellowships

Inserts language that the Secretary shall strive to ensure equal access for minority and economically disadvantaged students to the program carried out under this subsection. In addition, not later than one year after the date of enactment and every two years thereafter, the Secretary of Commerce shall submit a report to Congress describing the efforts by the Secretary to ensure equal access for minority and economically disadvantaged students.

Repeals reference to postdoctoral fellows.

Section 6—Terms of Membership for Sea Grant Review Panel

Inserts language that the term of office for a voting member of the panel shall be three years for a member appointed before the date of enactment of this legislation, and four years for a member appointed after the date of enactment of this legislation.

Section 7—Authorization of Appropriations

Inserts language for authorization of: $60 million for FY 2003; $75 million for FY 2004; $77.5 million for FY 2005; $80 million for FY 2006; $82.5 million for FY 2007; and $85 million for FY 2008. In addition to the amount authorized above, there is authorized for each fiscal years 2003 through 2008, $5 million each for research into zebra mussels, oysters, and harmful algal blooms. Also, it provides $3 million each year for competitive grants for fishery extension activities.

The National Sea Grant College Program Office may use no more than five percent of the total funds authorized for administration of the program. In addition, none of the money appropriated for the zebra mussels, oysters, harmful algal blooms, or fisheries extension may be used by the National Office for administration expenses.

Adds a section that in any fiscal year in which appropriations exceed the amounts appropriated for fiscal year 2003, the Secretary shall distribute any excess amounts (except amounts used for administration of programs) to any combination of the following: state sea grant programs according to their ratings; national strategic initiatives; colleges or universities in the process of being designated a sea grant college program; or a new sea grant program designated after the date of enactment of the bill.

Section 8—Annual Report on Progress in Becoming Designated as Sea Grant Colleges and Sea Grant Institutes

Requires the Secretary of Commerce to report on efforts and progress made by college and universities to become sea grant colleges, and specifically those of territories and freely associated states. It shall also include the assistance provided by the Secretary for these activities and the additional actions and activities necessary for those entities to become designated a sea grant college program.

Section 9—Coordination

Requires the Under Secretary of Commerce for Oceans and Atmosphere and the Director of the National Science Foundation to jointly submit a report to the House Committees on Resources and Science and the Senate Commerce, Science, and Transportation

Committee on how the oceans and coastal research activities of NOAA, including the Coastal Ocean Program and the National Sea Grant College Program, and the National Science Foundation will be coordinated. The report shall describe in detail any overlapping ocean and coastal research interests between the agencies and specify how the programs will pursue such research interests in a complementary manner.

Legislative History

Representative Wayne T. Gilchrest introduced H.R. 3389 on November 30, 2001. On February 28, 2002, the Environment, Technology, and Standards Subcommittee held a hearing on the bill.

On March 7, 2002, the bill was referred to the Committee on Science after being reported by the Committee on Resources. The Subcommittee on Environment, Technology, and Standards met on March 14, 2002 to consider the bill. Subcommittee Chairman Vernon Ehlers offered an en bloc amendment, which was adopted by voice vote. The amendment: (1) required that Sea Grant coordinate with the National Science Foundation; (2) struck any provision relating to moving the Coastal Ocean Program from NOAA's National Ocean Service to Sea Grant; (3) struck the provision granting direct financial assistance to the Pacific Islands Regional Consortium; and (4) required that any funding above the FY02 levels be allocated to state programs by a merit-reviewed, competitive process or to individual projects competed nationally. The Subcommittee favorably reported the bill, H.R. 3389, as amended, by a voice vote.

On March 20, 2002, the Committee on Science considered H.R. 3389. Representative Ehlers offered an en bloc amendment that included two provisions: 1) an amendment by Representative Sheila Jackson Lee requiring the Secretary to 'strive to ensure equal access for minority and economically disadvantaged students;' and 2) an amendment to clarify that education, extension, and training programs would be part of the merit review process. The Committee adopted the amendment by voice vote. The Committee then favorably reported the bill as amended, by voice vote, and authorized staff to make technical and conforming changes as necessary.

The Committee on Science filed H.Rept. 369, Pt. 2 on April 15, 2002.

On June 19, 2002, the House considered the measure. Representative Gilcrest offered a manager's amendment in the nature of a substitute. This amendment included an agreement negotiated between the Resources and Science Committees. The amendment included provisions outlined above passed by the House Science Committee and included provisions for a study on institutions that want to become sea grant programs, especially the Pacific Islands Regional Consortium, and for the National Sea Grant Office to provide Congress with a strategic plan every four years. H.R. 3389 passed the House, as amended, by a vote of 407–2 (Roll Call No. 237).

S. 2428, the Senate companion to H.R. 3389 as passed by the House Science Committee on March 20, 2002, was introduced by Sentor John Kerry on April 30, 2002. On June 27, 2002, the Senate Commerce, Science, and Transportation passed S. 2428 without

amendment. Negotiations between the Senate and the House Resources and Science Committees produced an amendment in the nature of a substitute to H.R. 3389.

The final amendment was very similar to the version passed by the House on June 19, 2002. The minor changes includes language specifying that Sea Grant programs should be evaluated to determine which are the best, and rate them into no less than five categories, with each of the two best-performing categories containing no more than 25 percent of the programs. The amendment instructs NOAA to contract with the National Academy of Sciences to review the effectiveness of the evaluation process.

The amendment in the nature of a substitute to H.R. 3389 passed the Senate on October 11, 2002 by unanimous consent. In the House, the motion to reconsider H.R. 3389, as amended by the Senate, was agreed to by a voice vote on November 12, 2002 and sent to the President. The President signed H.R. 3389 on November 26, 2002, which became P.L. 107–299.

1.11—P.L. 107–303, Great Lakes Legacy Act of 2002 (H.R. 1070)

Background and Summary of Legislation

Over the past 200 years, the Great Lakes region has undergone significant industrialization. Some of the heavy industries include mining, steel, machine tools, and automobile manufacturing. Agriculture also is a significant component of the regional economy.

This development has had a significant impact on the Great Lakes ecosystem as contaminants discharged from various sources have made their way into the waters, then into the sediments, and ultimately into the food chain. The Great Lakes are particularly vulnerable to contamination because the average outflow rates from most of the Lakes are very slow. Lake Superior retains water for 173 years. Lake Michigan for 62 years, Lake Huron for 31 years. Lake Ontario has a water retention period of 6 years and Lake Erie, the shallowest of the Lakes, has the shortest water retention period, at 2.7 years. Lakes with low outflow rates do not flush contaminants quickly. As a result, many pollutants discharged into the Great Lakes settle into the sediments at the bottom of the Lakes.

According to the Environmental Protection Agency's (EPA) National Water Quality Inventory 1998 Report to Congress (based on state surveys of 90 percent of Great Lakes shoreline miles) most of the Great Lakes are safe for swimming and other recreational activities and can be used as a source of drinking water. However, only four percent of the near-shore waters fully support all of their designated uses. Water quality impairments in the Great Lakes generally involve fish consumption advisories and aquatic life impacts. According to EPA's 2001 National Listing of Fish and Wildlife Advisories, 100 percent of the Great Lakes and their connecting waters are under fish consumption advisories for persistent toxic substances. Exposure to these toxic substances, which include polychlorinated biphenyls (PCBs), dioxins, and mercury, may pose a significant risk to human health, mainly through the consumption of contaminated fish. States report that the primary sources of pollutants causing these impairments are atmospheric deposition and

contaminated sediment. Other sources include land disposal of wastes, agricultural sources, industrial and municipal point sources, and storm water and other urban runoff.

In 1972, the United States and Canada signed the Great Lakes Water Quality Agreement to address mutual interests and improve water quality in Great Lakes. In 1987, the two nations revised the agreement and committed to ecosystem cleanup plans for 'Areas of Concern.'

In May 2002, the General Accounting Office (GAO) released a report on the status of implementation of Remedial Action Plans for the Great Lakes' Areas of Concern. This report concluded that the EPA is not effectively fulfilling the Nation's responsibility for developing and implementing the Remedial Action Plans required under the Great Lakes Water Quality Agreement. The report criticized the Agency for transferring oversight responsibility for Remedial Action Plans from the Great Lakes National Program Office to EPA's regional offices in 1992, noting that the regional offices provided initial support and oversight for the Remedial Action Plan process, but then significantly reduced the number of staff and the amount of federally allocated funds devoted to Remedial Action Plan development and implementation. The GAO report recommends that the EPA Administrator clarify which office within EPA is directly responsible for ensuring implementation of the Remedial Action Plans and identify the actions, time periods, and resources needed to help EPA to fulfill its responsibilities.

According to a 1997 document from the IJC 'Overcoming Obstacles to Sediment Remediation,' the primary obstacles to sediment remediation at Great Lakes Areas of Concern fall into six categories: (1) limited funding and resources, (2) regulatory complexity, (3) lack of a decision-making framework, (4) limited corporate involvement, (5) insufficient research and technology development, and (6) limited public and local support.

To help address these barriers, H.R. 1070, the Great Lakes Legacy Act of 2002 authorizes $50 million a year for five years for EPA to conduct, with local cost-sharing partners, monitoring, source control and remediation of sediment contamination in Great Lakes Areas of Concern.

Providing federal support for remediation of Areas of Concern may result in greater cooperation and can leverage contributions by local communities and the private sector. For example, at the Ashtabula River Area of Concern the participation of the Army Corps of Engineers helped to leverage participation by other public and private entities in remediation efforts at that site.

H.R. 1070 supports research on managing contaminated sediments by authorizing $2 million for each of the fiscal years 2003 through 2007 to conduct research and development on the use of innovative approaches, technologies, and techniques for the remediation of sediment contamination in Areas of Concerns.

Finally, H.R. 1070 addresses several of the concerns raised by the General Accounting Office by reemphasizing the role of the Great Lakes National Program Office in implementing the Remedial Action Plans in Areas of Concern, and by authorizing additional federal resources for the Great Lakes National Program Office to address sediment contamination in the Areas of Concern.

Legislative History

Representatives Vernon Ehlers, Mark Kirk, and James Barcia introduced H.R. 1070 on March 15, 2001. The bill was referred to the Committee on Transportation and Infrastructure with subsequent referral to the Committee on Science.

Senator Carl Levin and Senator Mike DeWine introduced S. 2544, the Senate version of the Great Lakes Legacy Act of 2002, on May 22, 2002. It was referred to the Committee on Environment and Public Works.

The Subcommittee on Water Resources and Environment held a hearing on H.R. 1070 on July 11, 2001. On June 25, 2002, the Subcommittee on Water Resources and Environment marked up H.R. 1070, and reported the bill favorably to the Committee by voice vote, with an amendment.

The amendment adopted by the Subcommittee changed the authorization from a grant program to a program that places responsibility to carry out qualified projects with the Administrator of the Environmental Protection Agency, with cost-sharing support from a non-federal sponsor. The amendment also made technical changes to the definition of a qualified project.

The Transportation and Infrastructure Committee met in open session on June 26, 2002, and ordered the bill, as amended, reported to the House by voice vote.

The Science Committee referred the bill to the Subcommittee on Environment, Technology and Standards on March 21, 2001. The Committee discharged the measure on July 18, 2002. On September 4, 2002, the House agreed to suspend the rules and pass H.R. 1070, as amended, by a voice vote.

On September 5, H.R. 1070 was received in the Senate, where it was referred to the Committee on Environment and Public Works.

Senators James Jeffords, Patrick Leahy, Hillary Clinton, and Charles Schumer introduced S. 2928, the Daniel Patrick Moynihan Lake Champlain Basin Program Act of 2002 on September 12, 2002. It was referred to the Committee on Environment and Public Works. The Committee met to consider S. 2928 on September 26, 2002. A manager's amendment offered by Senator Jeffords was agreed to by voice vote. The amended text of S. 2928 was included as title II of the manager's amendment to H.R. 1070. The measure was order reported by voice vote at the Committee markup on September 26, 2002.

H.R. 1070 passed the Senate, as amended, by unanimous consent on October 17, 2002. On November 12, 2002, the House agreed to suspend the rules and agree to the Senate amendment to H.R. 1070 by a voice vote, clearing the measure for the President. The President signed H.R. 1070 on November 27, 2002 which became P.L. 107–303.

1.12—P.L. 107–305, Cyber Security Research and Development Act (H.R. 3394)

Background and Summary of Legislation

The United States has become extraordinarily vulnerable to cyber attacks by terrorists because an increasing number of critical

aspects of daily life rely on computer systems and networks (e.g., water systems and electricity grids). Currently available technologies provide inadequate protection, yet relatively little R&D is being conducted to develop new approaches to protecting computer systems and networks.

This directly follows from the fact that the private sector has had little incentive to invest in cyber security because the market emphasizes only speed and convenience. Yet the Federal Government has not filled the gap and has chronically under-invested in cyber security, due, in part, to the fact that no federal agency has the responsibility of ensuring that the Nation has a robust cyber security research enterprise.

As a result, what little research has been done on cyber security has been incremental, leaving the basic approaches to cyber security unchanged for decades. Moreover, as a field with relatively little money, few researchers and minimal attention, cyber security fails to attract the interest of students, perpetuating the problems in the field.

H.R. 3394 addresses these problems by authorizing appropriations to the National Science Foundation (NSF) and to the Secretary of Commerce for the National Institute of Standards and Technology (NIST) to establish new programs, and to increase funding for certain current programs, for Computer and Network Security (CNS) research and development and CNS research fellowships.

Section 4—National Science Foundation Research

Requires the NSF Director to award grants for CNS through: (1) basic research in innovative approaches to the structure of hardware and software; and (2) multidisciplinary research centers of institutions of higher education (IHEs) or consortia thereof which may partner with government laboratories or for-profit institutions.

Section 5—National Science Foundation Computer and Network Security Programs

Requires the NSF Director to establish programs of grants to IHEs for: (1) capacity-building of undergraduate and Master's degree programs in CNS; (2) graduate traineeships in CNS research; and (3) CNS faculty development traineeship programs to enable graduate students to pursue academic careers in cyber security upon completion of doctoral degrees. Requires the Secretary to provide certain education-related grants under the Scientific and Advanced Technology Act of 1992, but authorizes funds only to support activities to improve education in CNS-related fields. Requires that CNS be included among the fields of specialization supported by NSF's Graduate Research Fellowships program under the National Science Foundation Act of 1950.

Section 7—Consulation

Amends the National Science Foundation Act of 1950 to require the NSF to take a leading role in supporting research and education activities to improve networked information systems' security.

Section 8—National Institute of Standards and Technology Programs

Amends the National Institute of Standards and Technology Act (NISTA) to require the NIST Director, through the Director of the Office for Information Security Programs, to establish a program of assistance to IHEs that enter into partnerships with for-profit entities to support research to improve CNS. Authorizes the NIST Director to establish a program to award post-doctoral research fellowships, including senior fellowships, to individuals seeking research positions at institutions engaged in research activities related to CNS. Provides for periodic program review, as well as a comprehensive review after five program years.

Requires the NIST Director to develop CNS checklists for Federal Government computer hardware or software systems.

Section 9—Computer Security Review, Public Meetings, and Information

Amends NISTA to authorize appropriations to enable the Computer System Security and Privacy Advisory Board to: (1) identify emerging issues related to computer security, privacy, and cryptography; (2) convene public meetings, and (3) publish and disseminate information.

Section 10—Intramural Security Research

Requires NIST to carry out specified types of intramural computer security research.

Section 11—Authorization of Appropriations

Authorizes appropriations to the Secretary of Commerce for NIST for: (1) the CNS research program; and (2) intramural computer security research.

Section 12—National Academy of Sciences Study on Computer and Network Security in Critical Infrastructures

Requires the NIST Director to arrange with the National Research Council of the National Academy of Sciences to study and report to specified congressional committees on vulnerabilities of the Nation's network infrastructure and recommendations for improvements.

Section 13—Coordination of Federal Cyber Security Research and Development

Requires the NSF and NIST Directors to: (1) coordinate the research programs under this Act; and (2) work with the Director of the Office of Science and Technology Policy to ensure that programs under this Act are taken into account in any government-wide cyber security research effort.

Section 16—Grant Eligibility Requirements and Compliance with Immigration Law

Prohibits the award of grants or fellowships under this Act to: (1) individuals who are in violation of their status as non-immigrants under the Immigration and Nationality Act (INA); (2) individuals who are aliens from a country that is a state sponsor of terrorism,

under the Enhanced Border Security and VISA Entry Reform Act (EBSVERA); or (3) institutions that have materially failed to comply with recordkeeping and reporting requirements to receive nonimmigrant students or exchange visitor program participants under INA or the Illegal Immigration Reform and Responsibility Act of 1996, or have been suspended or terminated under EBSVERA.

Section 17—Report on Grant and Fellowship Programs

Requires a report to Congress reviewing this Act to ensure that grants and fellowships are being awarded to individuals and institutions in compliance with INA in order to protect our national security.

Legislative History

Science Committee Chairman Sherwood Boehlert introduced H.R. 3394 on December 4, 2001 and it was referred to the Committee on Science and the Committee on Education and the Workforce. The Committee reported H.R. 3394, as amended, on December 6, 2002 and filed H.Rept. 107–355, Pt. 1 on February 4, 2002. By recorded vote, the bill passed the House on February 7, 2002: Y–400, N–12 (Roll Call No. 13).

The bill was received in the Senate on February 7, 2002. On October 16, 2002, the Senate struck all after the enacting clause and substituted the language of S. 2182. The amended measure then passed by unanimous consent.

On November 12, 2002, the House agreed to suspend the rules and agree to the Senate amendment by a voice vote. The bill was signed by the President on November 27, 2002 and became P.L. 107–305.

1.13—P.L. 107–314, National Defense Authorization Act of 2003 (H.R. 4546)

Background and Summary of Legislation

On July 25, 2002, the Speaker appointed Science Committee Chairman Sherwood Boehlert, Subcommittee on Research Chairman Nick Smith, and Science Committee Ranking Minority Member Ralph Hall as additional conferees to H.R. 4546, Bob Stump National Defense Authorization Act for Fiscal Year 2003, for consideration of Sections 244, 246, 1216, 3155, and 3163.

These conference committee deliberations, contained in H.Rept. 107–772 (Conference Report to accompany H.R. 4546), resulted in the enactment of Sections 245, 247, 1207, and 3155 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (P.L. 107–314), which was signed into law by the President on December 2, 2002. Descriptions of these provisions follow.

Section 245—Vehicle Fuel Cell Program

The Senate amendment contained a provision (Section 244) that would require the Secretary of Defense to carry out a cost-shared program to develop fuel cell technology for use in Department of Defense vehicles. The House bill contained no similar provision. The House receded with a clarifying amendment that would re-

quire the Secretary to carry out the program in coordination with the Department of Energy and other appropriate federal agencies.

Section 247—Activities and Assessment of the Defense Experimental Program to Stimulate Competitive Research

The Senate amendment contained a provision (Section 246) that would modify the Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) and to require a National Research Council assessment of the program. The House bill contained no similar provision. The House receded with an amendment. The conferees directed the Secretary of Defense to continue to support the DEPSCoR effort to develop new defense research capabilities across the Nation. The conferees encouraged the Secretary to continue to support activities that will develop world-class researchers in DEPSCoR states and to work closely with the individual states' planning committees to ensure that the program supports the development of defense research infrastructure.

Section 1207—Monitoring of Implementation of 1979 Agreement Between the United States and China on Cooperation in Science and Technology

The Senate amendment included a provision (Section 1216) that would require the Office of Science and Technology, in cooperation with the Department of State, to monitor the implementation of the 1979 United States-China Agreement on Cooperation in Science and Technology (S&T) and its protocols. The amendment would require the Office of S&T Cooperation to submit a biennial report on the activities conducted under this agreement and the benefits of this agreement to the Chinese economy, military, and defense industrial base. The House bill contained no similar provision. The House recedes with an amendment that would authorize the President to establish a working group to monitor the Agreement and directs the Director of Central Intelligence, the Secretary of Defense, and the Inspector General of the Commerce Department to conduct various assessments that would be components of the biennial report. The conferees continue to support the numerous mutually beneficial exchanges that occur under the auspices of the Agreement.

Section 3155—Program on Research and Technology for Protection from Nuclear or Radiological Terrorism

The Senate amendment contained a provision (Section 3155) that would direct the Administrator of Nuclear Security to carry out a program of research and technology for protection from nuclear or radiological terrorism in support of homeland security and counterterrorism. As part of the program, the Administrator would coordinate this program with the Office of Homeland Security, the Nuclear Regulatory Commission, the Departments of Defense, State, and Commerce, and the International Atomic Energy Agency. In addition, the Administrator would cooperate with the Russian Federation on research and demonstration of these technologies and, where feasible, provide assistance to other countries on matters relating to nuclear or radiological terrorism. The amendment would also authorize the Office of Defense Nuclear Nonproliferation in the

National Nuclear Security Administration to use up to $15.0 million for the development of a new generation of radiation detectors for homeland defense under this program. The House bill contained no similar provision. The House receded with an amendment that would direct the Administrator to establish a cooperative program with the Russian Federation on the research, development, and demonstration of technologies for protection from and response to nuclear or radiological terrorism. The program would conduct research on technologies that could be used for the detection, identification, assessment, control, and disposition of radiological materials that could be used for nuclear terrorism. The program would also provide for the demonstration of the technologies developed by this program to other countries, in cooperation with the Russian Federation. The Administrator would be required to coordinate these research, development, and demonstration efforts with the Department of Energy's Office of Environment, Safety, and Health; the Nuclear Regulatory Commission; the Departments of State, Defense, and Commerce; and the International Atomic Energy Agency. The Administrator would be authorized to use up to $15.0 million to carry out the activities under this program.

Section 3163—Utilization of Department of Energy National Laboratories and Sites in Support of Counter-terrorism and Homeland Security Activities

Senate amendment contained a provision (Section 3163) that would authorize the Department of Energy (DOE) to enter into joint sponsorship agreements at DOE laboratories with state, local, or other federal agencies and establish the parameters under which the joint partnership agreements would operate. The House bill contained no similar provision. The Senate receded, and the provision was not adopted.

1.14—P.L. 107–355, Pipeline Infrastructure Protection to Enhance Security and Safety Act (H.R. 3609)

Background and Summary of Legislation

The purpose of the bill is to strengthen Federal pipeline safety programs to ensure greater protection of the public from the risk of pipeline accidents and spills and to improve the functioning of Federal, state and local pipeline safety programs. Provisions of the bill include a requirement for safety inspections of all U.S. oil and natural gas pipelines within 10 years, improved coordination of state one-call notification programs for reporting pipeline accidents, enhanced enforcement of pipeline safety regulations, greater worker and whistleblower protection measures, and expanded pipeline safety research, development and demonstration programs. Section 9 of the bill enacted into law incorporated provisions related to pipeline safety research, development and demonstration drawn from H.R. 3929, the Energy Pipeline Research, Development and Demonstration Act, introduced by Rep. Ralph Hall and referred to the Committee on Science, and in addition to the Committees on Transportation and Infrastructure and Energy and Commerce.

Section 9—Pipeline Safety Information Grants to Communities

Establishes a Federal research, development, demonstration, and standardization program to be formed by the heads of the Department of Energy, the Department of Transportation, and the National Institute of Standards and Technology (the "participating agencies") to ensure the integrity of "energy pipelines" and "next-generation pipelines." Defines "energy pipeline" as a pipeline system used in the transmission or local distribution of natural gas, crude oil, or refined petroleum products. Defines "next-generation pipelines" as a transmission or local distribution pipeline system for transmitting energy or energy-related products, in liquid or gaseous form, other than energy pipelines. Authorizes appropriations.

Legislative History

On February 1, 2001, comprehensive pipeline safety legislation (S. 235) was introduced in the Senate by Senator John McCain. On February 8, 2001, the measure was considered in Senate and passed by a vote of 98–0. Although numerous bills were introduced in the House, there was no further legislative action on the Senate bill. During Senate floor consideration of comprehensive energy legislation, the Senate added a subtitle incorporating pipeline safety legislation as part of the Senate amendment to H.R. 4, the Energy Policy Act of 2002, (Title VII, Subtitle C—Pipeline Safety). The Senate Amendment to H.R. 4 passed the Senate on April 25, 2002. On June 12, 2002, the Speaker appointed conferees from the Committee on Science for the consideration of *inter alia,* section 770–772 of the Senate Amendment, relating to pipeline safety RD&D.

A companion House bill (H.R. 3609), the Pipeline Infrastructure Protection to Enhance Security and Safety Act, was introduced by Representatives Don Young and W.J. (Billy) Tauzin on December 20, 2001 and referred jointly to the Committees on Transportation and Infrastructure and Energy and Commerce. On March 12, 2002, Science Committee Ranking Minority Member Ralph Hall introduced H.R. 3929, the Pipeline Safety Research, Development and Demonstration Act, which was referred to the Committee on Science, and in addition to the Committees on Transportation and Infrastructure and Energy and Commerce. During committee consideration of H.R. 3609 by both committees of primary jurisdiction over the pipeline safety program, the provisions of H.R. 3929, were incorporated by amendments offered in the Transportation and Infrastructure Committee by Representative Jerry Costello and in the Energy and Commerce Committee by Representative Hall.

On July 23, 2002, the House Committee on Transportation and Infrastructure and the Committee on Energy and Commerce both reported H.R. 3609 (H.Rept. 107–605, Part I for the Committee on Transportation, H.Rept. 107–605, Part II for the Committee on Energy and Commerce). H.R. 3609 passed the House under suspension of the rules on the same day, July 23, 2002, by a vote of 423–4 (Roll Call No. 334).

Since the H.R. 4 conference was already underway, the House-passed Pipeline Safety Bill (H.R. 3609) formed the House position in negotiations with the Senate during the conference and a compromise was negotiated between the House and the Senate with the participation of Science Committee conferees. On September

12, 2002, the Energy bill conferees approved the text of the negotiated pipeline safety portion of the bill, including provisions on RD&D, taken from the text of H.R. 3929. However, negotiations on the rest of the H.R. 4 Conference failed to reach a final agreement on the bill.

On November 13, 2002, when it become clear that final action on an Energy bill was not possible, the Senate took up the House-passed free-standing pipeline safety bill (H.R. 3609), amended it to read as approved by the House and Senate Conferees on H.R. 4, and passed the bill by unanimous consent. Two days later, on November 15, 2002, the House approved the bill without objection and without further amendment. On December 9, 2002, H.R. 3609, Pipeline Infrastructure Protection to Enhance Security and Safety Act was presented to the President for signature.

The President signed the bill on December 17, 2002 and it became P.L. 107–355.

1.15—P.L. 107–368, National Science Foundation Authorization Act of 2002—Investing in America's Future Act of 2002 (H.R. 4664)

Background and Summary of Legislation

The National Science Foundation (NSF) is an independent federal agency created by the National Science Foundation Act of 1950 (P.L. 81–507). NSF's mission is unique among the Federal Government's scientific research agencies in that it is to support science and engineering across all disciplines. NSF currently funds research and education activities at more than 2,000 universities, colleges, K–12 schools, businesses, and other research institutions throughout the United States. Virtually all of this support is provided through competitive, merit-reviewed grants and cooperative agreements. Although NSF's research and development budget accounts for only about four percent of all federally funded research, the role of NSF in promoting fundamental research is vital to the Nation's scientific enterprise, as NSF provides approximately 25 percent of the federal support for basic research conducted at academic institutions.

Basic research pays enormous dividends to society. Economic growth, public health, national defense, and social advancement have all been tied to technological developments resulting from research and development. In fact, economists estimate that innovation and the application of new technology have generated at least half of the phenomenal growth in America's gross domestic product since World War II. As Allan Bromley, science advisor to former President George H.W. Bush, put it, "No science, no surplus. It's that simple."

Though NSF-funded research has had a tremendous impact on society, funding for NSF has not been sufficient to maximize the agency's potential contribution to the Nation's research enterprise. NSF is currently able to fund only about one third of the grant proposals submitted because of limited funds; 13 percent of top rated grant applications are not funded. More funding for basic science is needed to feed the innovation pipeline and to ensure future eco-

nomic growth, as well as to strengthen homeland defense and national security.

NSF was most recently authorized by the National Science Foundation Act of 1998, which authorized appropriations for NSF for FY 1998, FY 1999, and FY 2000. In addition to the lapse in authorizations of appropriations for the agency, several policy issues—including ones related to the Foundation's responsibilities for large-scale research facilities—have arisen since the 1998 Act expired.

The *National Science Authorization Act of 2002* sets the government's premier research agency—the National Science Foundation (NSF)—on the path to doubling its budget over the next five years. The bill authorizes 15 percent increases in each of fiscal years 2003 through 2007. Authorizations for FY 2006 and FY 2007 are contingent upon a Congressional determination that NSF has made progress toward meeting the President's five management goals. The bill also contains key provisions from four bills that passed the House by voice vote: H.R. 1858, H.R. 100, H.R. 3130, and H.R. 2051.

Funding

- Research and Related Activities. The bill authorizes annual increases of approximately 15 percent for each of fiscal years 2003 through 2007. Within this amount, specific increases are provided in FY 2003 and FY 2004 for networking and information technology research and nanoscale science and engineering.
- Education and Human Resources. The bill authorizes annual increases of approximately 15 percent for each of fiscal years 2003 through 2007. These increases fund a variety of activities and initiatives including the following key programs:
  - Mathematics and Science Partnerships program (H.R. 1858), which is authorized at $200 million in FY 2003, $300 million in FY 2004, and $400 million in FY 2004;
  - Robert Noyce Scholarship Program (H.R. 1858), which is authorized at $20 million for each of fiscal years 2003 through 2005; and
  - Science, Mathematics, Engineering and Technology Talent Expansion Program (H.R. 3130), which is authorized at $25 million in FY 2003, $30 million in FY 2004, and $35 million in FY 2005.
- Major Research Equipment and Facilities Construction. The bill authorizes an increase of approximately 23 percent for each of fiscal years 2003 through FY 2005. These increases will enable the Foundation to complete projects that have already been initiated and reduce the backlog of large facilities projects that are awaiting funding.

National Research Facilities

The bill will provide greater transparency in the process through which Major Research Equipment and Facilities Construction projects are evaluated, prioritized, and selected for funding. The bill requires the Director to develop a numerically prioritized list

of proposed projects indicating the relative priority of each for funding. Upon approval of the list by the National Science Board (NSB), a panel of 24 eminent scientists who are appointed by the President to advise NSF, the Director will be required to submit the list to Congress along with a report describing how the projects were prioritized. In addition, the Director is required to enter into an arrangement with the National Academy of Sciences to perform a study on setting priorities for a diverse array of disciplinary and interdisciplinary large research facility projects.

National Science Board

The National Science Board may not be complying with the spirit of the *Government in the Sunshine Act* (now contained in section 552b of Title 5 USC), which was intended to make meetings regarding a federal agencies' activities open to the public (with narrow statutory exemptions). The Board holds most of its meetings, including committee meetings where much of the Board's work gets done, behind closed doors, with a single session open to the public at the meeting's end. The bill affirms that all committees, subcommittees and task forces are subject to the *Government in the Sunshine Act* and requires the NSF Inspector General to conduct an annual compliance audit to ensure that these laws are complied with. The bill also ensures the independence of the Board by providing a separate budget line for its official activities and allowing it to hire its own staff.

Astronomy and Astrophysics

NSF and the National Aeronautics and Space Administration (NASA) sponsor the majority of federally funded astronomy research in the United States. NSF has traditionally supported ground-based observatories and small research groups while NASA's strength has been the support of major space-based missions. The *National Science Foundation Authorization Act of 2002,* in response to concerns raised by a blue ribbon panel established last year by the National Research Council, establishes an interagency advisory board to provide systematic, comprehensive, and coordinated planning of astronomy and astrophysics research and investments. In addition, the bill emphasizes the importance of NSF's astronomical research and instrumentation program and authorizes NSF to continue supporting research that will advance our understanding of the origins and characteristics of planets and the universe.

Provisions from H.R. 1858, the Mathematics and Science Partnerships Act

Mathematics and Science Partnerships Program. The bill authorizes the NSF to carry out the President's Mathematics and Science Partnership program by making competitive, merit-reviewed awards to institutions of higher education working in partnership with school districts or state education agencies to develop programs that will better prepare future math and science teachers, provide professional development opportunities to current mathematics and science teachers, train a cadre of mathematics and science master teachers, and develop exemplary materials and op-

portunities for students. The bill also requires the Director to perform an assessment of the program utilizing a common set of benchmarks and tools so that projects funded under this program can be compared to determine best practices and materials. The Director is also required to work with the Secretary of Education to coordinate the work of this program with the related program at the Department of Education.

Robert Noyce Scholarship Program. The bill authorizes NSF to award grants to colleges and universities to make scholarships to talented math and science majors or minors in return for a commitment to teach at the elementary or secondary school level. Grants may also be used to award stipends to math or science professionals seeking to become teachers. A credentialed teacher who majored in his or her subject, not class size, is the greatest predictor of student achievement. Authorizes $20 million per year for each of FY 2003–2005. Authorizes funds for program administration in the out years.

Centers for Research on Mathematics and Science Learning and Education Improvement. Research findings from cognitive science, neuroscience and education are rarely translated into practical solutions for teachers. Based on the recommendations of the National Academy of Sciences, this bill requires the Director to establish problem-oriented, multidisciplinary research centers focused on figuring out how the latest scientific findings about learning can be put to use by elementary and secondary school math and science teachers. At least one center will focus on developing ways in which research results can be applied, duplicated and scaled up for use in low-performing schools and each center will assess and improve the ways that information technology can be used to enhance science and mathematics teaching and learning.

Provisions from H.R. 100, the National Science Education Act

Master Teachers. The bill authorizes, as part of the Mathematics and Science Partnerships Program, NSF to award grants to support the training of master K–12 mathematics and science teachers.

Provisions from H.R. 3130, the Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act

The Technology Talent Program. The bill authorizes NSF to provide grants to institutions of higher education to increase the number and quality of graduates from physical science, mathematics, engineering, and technology degree and transfer programs (authorized at $25 million in FY 2002, and $30 million in each of Fiscal Years 2004 and 2005).

Undergraduate Education Reform. The bill authorizes NSF to provide grants to institutions of higher education to expand successful reform efforts and to stimulate changes in institutional policies and practices that place higher value on faculty participation in undergraduate science, mathematics, engineering, and technology education.

Provisions from H.R. 2051, to provide for the establishment of regional plant genome and gene expression research and development centers

Plant Genome and Gene Expression Research Centers. The bill authorizes a merit-based, competitive program at NSF to provide grants to consortia of institutions of higher education and/or non-profit organizations to develop regional plant genome and gene expression research centers. These centers would conduct plant genomics and plant gene expression research.

Partnerships for Plant Biotechnology in the Developing World. The bill establishes a merit-based, competitive program at NSF to provide grants to institutions of higher education, non-profit organizations, or consortia thereof, to develop research partnerships supporting plant biotechnology targeted to the needs of the developing world. It also encourages NSF to include minority-serving institutions in consortia and requires that all partnerships include one or more research institutions from a developing nation.

Legislative History

On May 7, 2002, Research Subcommittee Chairman Nick Smith, Full Committee Chairman Sherwood Boehlert, Committee Ranking Minority Member Ralph Hall, and Research Subcommittee Ranking Minority Member Eddie Bernice Johnson introduced H.R. 4664, the National Science Foundation Authorization Act of 2002, a bill to authorize appropriations for Fiscal Years 2003, 2004, and 2005 for NSF. On May 8, 2002 it was referred to the Subcommittee on Research and a hearing was held.

The Subcommittee on Research met on Thursday, May 9, 2002, to consider the bill. An amendment was offered by Chairman Boehlert that changed the title of the bill to the Investing in America's Future Act of 2002. The amendment was adopted by a voice vote. The measure was ordered reported, as amended.

On May 22, 2002, the Committee on Science considered H.R. 4664. An Amendment was offered by Chairman Boehlert, which made technical changes to the bill and added provisions providing specific authorizations for the Advanced Technical Education Program and the Minority Serving Institutions Undergraduate Program. The amendment was adopted by a voice vote.

On June 4, 2002 the Committee on Science filed H.Rept. 107–488. H.R. 4664 passed the House, as amended, on June 5, 2002: Y–397, N–25 (Roll Call No. 212). On June 6, 2002 it was received in the Senate and referred to the Senate Committee on Health, Education, Labor, and Pensions and the measure was discharged on November 14, 2002.

H.R. 4664 passed the Senate, with an amendment and an amendment to the title by a voice vote on November 14, 2002. On November 15, 2002, the House agreed to the Senate amendment by a voice vote clearing the measure for the President. The President signed H.R. 4664 on December 19, 2002, which became P.L. 107–368.

Chapter II—Other Legislative Activities of the Committee on Science

2.1—H.R. 4, Securing America's Future Energy Act of 2001

Background and Summary of Legislation

H.R. 4 is omnibus energy legislation, the purpose of which is, "To enhance energy conservation, research and development and to provide for security and diversity in the energy supply for the American people, and for other purposes." The Science Committee developed the legislative provisions in Division B, relating to energy research, development, and demonstration (RD&D) and, working with the Committee on Energy and Commerce, Division E, relating to clean coal technology. Division B was taken from the text of H.R. 2460, the Comprehensive Energy Research and Technology Act of 2001, introduced by Science Committee Chairman, Sherwood Boehlert on July 11, 2001. The bill was the result of a series of hearings by the Committee on Science on energy R&D and the recommendations of the Administration's National Energy Policy Development Group, published in May, 2001. The bill was referred solely to the Committee on Science, which marked up the bill on July 18, 2001 and reported the bill to the full House on July 31, 2001 (H.Rept. 107–177). Division E, relating to Federal clean coal technology program authorizations, was also based on language in H.R. 2460, which was modified in negotiations with the Committee on Energy and Commerce. Ultimately, the House and Senate passed H.R. 4 as described below. A summary of Division B and E as passed by the House follows:

I. Summary of Major Provisions of H.R. 4, Securing America's Future Energy (SAFE) Act of 2001

Division B: "Comprehensive Energy Research and Technology Act of 2001"

Section 2001. Short Title

Subsection 2001 cites the division as the "Comprehensive Energy Research and Technology Act of 2001."

Section 2002. Findings.

Section 2003 contains the eight findings.

Section 2003. Purposes.

Section 2003 contains the eight purposes of the Act.

Section 2004. Goals.

Subsection 2004(a) states that, subject to subsection 2004(b), the Secretary should conduct a balanced energy RD&D and commercial application portfolio of programs guided by the specific goals listed for each of (1) Energy Conservation and Energy Efficiency, (2) Renewable Energy, (3) Nuclear Energy, (4) Fossil Energy and (5) Science.

Subsection 2004(b) requires the Secretary of Energy, in consultation with others, to perform an assessment that establishes meas-

urable cost and performance-based goals, or that modifies the goals under subsection (a), for 2005, 2010, 2015, and 2020, for each of the programs authorized by this Act, that would enable each such program to meet the purposes under section 2003. The assessment is to be based on the latest scientific and technical knowledge, and shall also take into consideration, as appropriate, the comparative environmental impacts (including emissions of greenhouse gases) of the energy saved or produced by specific programs.

In establishing the measurable cost and performance-based goals under subsection 2004(b), subsection 2004(c) requires the Secretary to consult with the private sector, institutions of higher learning, national laboratories, environmental organizations, professional and technical societies, and any other persons the Secretary considers appropriate.

Subsection 2004(d) requires the Secretary, within 120 days of the date of enactment of this Act, to issue and publish in the *Federal Register* a set of draft measurable cost and performance-based goals for public comment for those programs established before the date of enactment of this Act. (In the case of a program not established before the date of the enactment of this Act, then not later than 120 days after the date of establishment of the program). Not later than 60 days after the date of publication, after taking into consideration any public comments received, the Secretary is to transmit to the Congress and publish in the *Federal Register* the final measurable cost and performance-based goals. Such goals must be updated on a biennial basis.

Section 2005. Definitions.

Section 2005 defines the terms: (1) "Administrator" to mean the Administrator of the Environmental Protection Agency (EPA); (2) "appropriate congressional committees" to mean (A) the Committee on Science and the Committee on Appropriations of the House of Representatives; and (B) the Committee on Energy and Natural Resources and the Committee on Appropriations of the Senate; (3) the "Department" to mean the Department of Energy; and (4) the "Secretary" to mean the Secretary of Energy.

Section 2006. Authorizations.

Section 2006 states that authorizations of appropriations under this Act are for environmental R&D, scientific and energy RD&D and commercial application of energy technology programs, projects, and activities. This is consistent with the Science Committee's jurisdiction under rule X, clause 1(n) of the Rules of the House.

Section 2007. Balance of Funding Priorities.

Subsection 2007(a) expresses the sense of the Congress that the funding of the various programs authorized by titles I through IV of this Act should remain in the same proportion to each other as provided in this Act, regardless of the total amount of funding made available for those programs.

If the amounts appropriated in general appropriations Acts for FY 2002, FY 2003, or FY 2004 for the programs authorized in titles I through IV of this Act are not in the same proportion to one an-

other as are the authorizations for such programs in this Act, subsection 2207(b) requires the Secretary and the Administrator, within 60 days after the date of the enactment of the last general appropriations Act appropriating amounts for such programs, to transmit to the appropriate congressional committees a report describing the programs, projects, and activities that would have been funded if the proportions provided for in this Act had been maintained in the appropriations. The amount appropriated for the program receiving the highest percentage of its authorized funding for a fiscal year shall be used as the baseline for calculating the proportional deficiencies of appropriations for other programs in that fiscal year.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle A—Alternative Fuel Vehicles

Section 2101. Short Title.

Subsection 2101 cites the subtitle as the "Alternative Fuel Vehicle Acceleration Act of 2001."

Section 2102. Definitions.

Section 2102 defines the terms "alternative fuel vehicle," "pilot program," and "ultra-low sulfur diesel vehicle."

Section 2103. Pilot Program.

Subsection 2103(a) directs the Secretary to establish an alternative fuel and ultra-low sulfur diesel vehicle energy demonstration and commercial application competitive grant pilot program to provide not more than 15 grants to State governments, local governments, or metropolitan transportation authorities to carry out a project or projects for the purposes described in subsection (b).

Subsection 2103(b) defines the purposes for which the grants may be used.

Subsections 2103(c), (d), and (e) set out the grant application requirements, selection criteria, and pilot project requirements, respectively.

Subsection 2103(e) limits: (1) the amount of an award to any one applicant to not more than $20.0 million; (2) the Federal cost share to not more than 50 percent; and (3) the length of the funding period to not more than five years. It also directs the Secretary to assure nationwide deployment of alternative fuel vehicles through broad geographic distribution of project sites; and to establish mechanisms that ensure the dissemination of information gained by the pilot program participants to all interested parties including all other applicants.

Subsection 2103(f) directs the Secretary to publish in the *Federal Register, Commerce Business Daily,* and elsewhere requests for project grant applications under the pilot program, which shall be due within six months after the notice publication. The Secretary shall select from among the project grant applications by a competitive, peer review process to award grants under the pilot program.

Section 2103(g) mandates that the Secretary shall provide not less than 20 percent and not more than 25 percent of the grant funding for the acquisition of ultra-low sulfur diesel vehicles.

Section 2104. Reports to Congress.

Section 2104 requires the Secretary to transmit an initial report to the appropriate congressional committees within two months after the grants are awarded detailing the successful applicants' projects, a listing of the applicants and a description of the information dissemination mechanism under 2103(e)(5). Not later than three years after the date of enactment, and annually thereafter until the program ends, the Secretary is required to transmit a report containing an evaluation of the pilot program's effectiveness to the same committees. This evaluation report is to include an assessment of the benefits to the environment derived from the projects included in the pilot program as well as an estimate of the potential benefits to the environment to be derived from widespread application of alternative fuel vehicles and ultra-low sulfur diesel vehicles.

Section 2105. Authorization of Appropriations.

Section 2105 authorizes $200.0 million for FY 2002 for the pilot program, to remain available until expended.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle B—Distributed Power Hybrid Energy Systems

Section 2121. Findings.

Section 2121 lists 4 findings.

Section 2122. Definitions.

Section 2122 defines the terms "distributed power hybrid system" and "distributed power source."

Section 2123. Strategy.

Under subsection 2123(a), not later than one year after the date of the enactment of this Act, the Secretary shall develop and transmit to the Congress a distributed power hybrid systems strategy showing: (1) needs best met with distributed power hybrid systems configurations, especially systems including one or more solar or renewable power sources; and (2) technology gaps and barriers (including barriers to efficient connection with the power grid) that impede the use of distributed power hybrid systems.

Subsection 2123(b) specifies five elements the strategy should address, including a comprehensive RD&D and commercial application program to ensure the reliability, efficiency, and environmental integrity of distributed energy resources.

Subsection 2123(c) requires the Secretary to implement the strategy transmitted under subsection 2123(a) and the research program under subsection 2123(b). Activities pursuant to the strategy are to be integrated with other activities of the DOE's Office of Power Technologies.

Section 2124. High Power Density Industry Program.

Subsection 2124(a) requires the Secretary to develop and implement a comprehensive RD&D and commercial application program to improve energy efficiency, reliability, and environmental responsibility in high power density industries, such as data centers, server farms, telecommunications facilities, and heavy industry.

Subsection 2124(b) provides that in carrying out this section, the Secretary shall consider technologies that provide: (1) significant improvement in efficiency of high power density facilities, and in data and telecommunications centers, using advanced thermal control technologies; (2) significant improvements in air conditioning efficiency in facilities such as data centers and telecommunications facilities; (3) significant advances in peak load reduction; and (4) advanced real time metering and load management and control devices.

Subsection 2124(c) requires that activities pursuant to this program be integrated with other activities of the DOE's Office of Power Technologies.

Section 2125. Micro-Cogeneration Energy Technology.

Section 2125 requires the Secretary to make competitive, merit-based grants to consortia of private sector entities for the development of micro-cogeneration energy technology. The consortia shall explore the creation of small-scale combined heat and power through the use of residential heating appliances. The section also authorizes $20.0 million, to remain available until expended.

Section 2126. Program Plan.

Section 2126 directs the Secretary to consult with appropriate representatives of the distributed energy resources, power transmission, and high power density industries, other appropriate entities, and Federal, State and local agencies, within four months of enactment, to present to Congress a five-year program plan to guide activities under this subtitle.

Section 2127. Report.

Section 2127 instructs the Secretary, jointly with other appropriate Federal agencies, to report to Congress within two years of enactment and every two years thereafter for the duration of the program on the program's progress made to achieve the purposes of this subtitle.

Section 2128. Voluntary Consensus Standards.

Under this section, not later than two years after the date of enactment of this Act, the Secretary, in consultation with the NIST, shall work with the Institute of Electrical and Electronic Engineers and other standards development organizations toward the development of voluntary consensus standards for distributed energy systems for use in manufacturing and using equipment and systems for connection with electric distribution systems, for obtaining electricity from, or providing electricity to, such systems.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle C—Secondary Electric Vehicle Battery Use

Section 2131. Definitions.

Section 2131 defines the terms "battery" and "associated equipment."

Section 2132. Establishment of Secondary Electric Vehicle Battery Use Program.

Subsection 2132(a) directs the Secretary to establish and carry out a RD&D program for the secondary use of batteries originally used in transportation applications. The program should demonstrate the use of batteries in secondary application, including utility and commercial power storage and power quality and should be structured to evaluate the performance, including longevity of useful service life and costs, of such batteries in field operations, and evaluate the necessary supporting infrastructure, including disposal and reuse of batteries. The Secretary is directed to coordinate with ongoing secondary battery use programs underway at the national laboratories and in industry.

Subsection 2132(b) directs the Secretary, no later than six months after the date of the enactment of this Act, to solicit proposals to demonstrate the secondary use of batteries and associated equipment and supporting infrastructure in geographic locations throughout the United States. The Secretary may make additional solicitations for proposals if the Secretary determines that such solicitations are necessary to carry out this section. Proposals submitted in response to a solicitation under this section shall include: (1) a description of the project, including the batteries to be used in the project; the proposed locations and applications for the batteries; the number of batteries to be demonstrated; and the type, characteristics, and estimated life-cycle costs of the batteries compared to other energy storage devices currently in use; (2) the contribution, if any, of State or local governments and other persons to the demonstration project; (3) the type of associated equipment to be demonstrated and the type of supporting infrastructure to be demonstrated; and (4) any other information the Secretary considers appropriate. If the proposal includes a lease arrangement, the proposal shall indicate the terms of such lease arrangement for the batteries and associated equipment.

Subsection 2132(c) directs the Secretary, no later than three months after the closing date established by the Secretary for receipt of proposals under subsection 2132(b), to select at least five proposals to receive financial assistance under this subsection. No one project selected is permitted to receive more than 25 percent of the funds authorized under this section, and no more than three projects selected under this section shall demonstrate the same battery type.

In selecting a proposal under subsection 2132(c), the Secretary must consider:

(1) the ability of the proposer to acquire the batteries and associated equipment and to successfully manage and con-

duct the demonstration project, including the reporting requirements;

(2) the geographic and climatic diversity of the projects selected;

(3) the long-term technical and competitive viability of the batteries to be used in the project and of the original manufacturer of such batteries;

(4) the suitability of the batteries for their intended uses;

(5) the technical performance of the battery, including the expected additional useful life and the battery's ability to retain energy;

(6) the environmental effects of the use of and disposal of the batteries proposed to be used in the project selected;

(7) the extent of involvement of State or local government and other persons in the demonstration project and whether such involvement will permit a reduction of the Federal cost share per project or otherwise be used to allow the Federal contribution to be provided to demonstrate a greater number of batteries; and

(8) such other criteria as the Secretary considers appropriate.

The Secretary must require that as a part of a demonstration project, the users of the batteries provide to the proposer information regarding the operation, maintenance, performance, and use of the batteries, and the proposer provide such information to the battery manufacturer, for three years after the beginning of the demonstration project.

The Secretary must also require the proposer to provide to the Secretary information regarding the operation, maintenance, performance, and use of the batteries that the Secretary may request during the period of the demonstration project. The proposer must provide at least 50 percent of the costs associated with the proposal.

Section 2133. Authorization of Appropriations.

Section 2133 authorizes (from amounts authorized under section 2161(a)) for purposes of this subtitle $1.0 million for FY 2002, $7.0 million for FY 2003 and $7.0 million for FY 2004, to remain available until expended.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle D—Green School Buses

Section 2141. Short Title.

Section 2141 cites the subtitle as the "Clean Green School Bus Act of 2001."

Section 2142. Establishment of Pilot.

Subsection 2142(a) directs the Secretary to establish a pilot program for awarding grants on a competitive basis to eligible entities for the demonstration and commercial application of alternative fuel school buses and ultra-low sulfur diesel school buses.

Subsection 2142(b) requires the Secretary, no later than three months after the date of enactment of this Act, to establish and publish in the *Federal Register* grant requirements on eligibility for assistance, and on implementation of the program established under subsection (a), including certification requirements to ensure compliance with this subtitle.

Subsection 2142(c) requires the Secretary, no later than six months after the date of enactment of this Act, to solicit proposals for grants under this section.

Subsection 2142(d) requires that a grant be awarded, under this section only, to a local governmental entity responsible for providing school bus service for one or more public school systems or, jointly with a contracting entity that provides school bus service to the public school system or systems.

Subsection 2142(e) requires that grants under this section shall be for the demonstration and commercial application of technologies to facilitate the use of alternative fuel school buses and ultra-low sulfur diesel school buses in lieu of buses manufactured before model year 1977 and diesel-powered buses manufactured before model year 1991. Other than the receipt of the grant, a recipient of a grant under this section may not receive any economic benefit in connection with the receipt of the grant. When awarding grants, the Secretary shall give priority to applicants who can demonstrate the use of alternative fuel buses and ultra-low sulfur diesel school buses in lieu of buses manufactured before model year 1977.

Subsection 2142(f) requires that a grant provided under this section shall include the following conditions:

(1) all buses acquired with funds provided under the grant shall be operated as part of the school bus fleet for which the grant was made for a minimum of five years;

(2) funds provided under the grant may only be used to pay the cost, except as provided in the following paragraph (3), of new alternative fuel school buses or ultra-low sulfur diesel school buses, including State taxes and contract fees to provide—

(i) up to 10 percent of the price of the alternative fuel school buses acquired, for necessary alternative fuel infrastructure if the infrastructure will only be available to the grant recipient; and

(ii) up to 15 percent of the price of the alternative fuel school buses acquired, for necessary alternative fuel infrastructure if the infrastructure will be available to the grant recipient and to other bus fleets;

(3) the grant recipient shall be required to provide at least the lesser of 15 percent of the total cost of each bus received or $15,000 per bus;

(4) in the case of a grant recipient receiving a grant to demonstrate ultra-low sulfur diesel school buses, the grant recipient shall be required to provide documentation to the satisfaction of the Secretary that diesel fuel containing sulfur at not more than 15 parts per million (PPM) is avail-

able for carrying out the purposes of the grant, and a commitment by the applicant to use such fuel in carrying out the purposes of the grant.

Subsection 2142(g) requires that funding under a grant made under this section may be used to demonstrate the use only of new alternative fuel school buses or ultra-low sulfur diesel school buses:

(1) with a gross vehicle weight of greater than 14,000 pounds;

(2) that are powered by a heavy duty engine;

(3) that, in the case of alternative fuel school buses, emit not more than—

(A) 2.5 grams per brake horsepower-hour of non-methane hydrocarbons and oxides of nitrogen and 0.01 grams per brake horsepower-hour of particulate matter for buses manufactured in model years 2001 and 2002; and

(B) 1.8 grams per brake horsepower-hour of non-methane hydrocarbons and oxides of nitrogen and 0.01 grams per brake horsepower-hour of particulate matter for buses manufactured in model years 2003 through 2006; and

(4) that, in the case of ultra-low sulfur diesel school buses, emit not more than—

(A) 3.0 grams per brake horsepower-hour of non-methane hydrocarbons and oxides of nitrogen and 0.01 grams per brake horsepower-hour of particulate matter for buses manufactured in model years 2001 through 2003; and

(B) 2.5 grams per brake horsepower-hour of non-methane hydrocarbons and oxides of nitrogen and 0.01 grams per brake horsepower-hour of particulate matter for buses manufactured in model years 2004 through 2006, except that under no circumstances shall buses be acquired under this section that emit non-methane hydrocarbons, oxides of nitrogen, or particulate matter at a rate greater than the best performing technology of ultra-low sulfur diesel school buses commercially available at the time the grant is made.

Subsection 2142(h) requires the Secretary, to the maximum extent practicable, to achieve nationwide deployment of alternative fuel school buses through the program under this section, and to ensure a broad geographic distribution of grant awards, with a goal of no State receiving more than 10 percent of the grant funding made available under this section for a fiscal year.

Subsection 2142(i) requires the Secretary to provide not less than 20 percent and not more than 25 percent of the grant funding made available under this section for any fiscal year for the acquisition of ultra-low sulfur diesel school buses.

Subsection 2142(j) defines the term "alternative fuel school bus" to mean a bus powered substantially by electricity (including electricity supplied by a fuel cell), or by liquefied natural gas, compressed natural gas, liquefied petroleum gas, hydrogen, propane, or

methanol or ethanol at no less than 85 percent by volume. It also defines the term "ultra-low sulfur diesel school bus" to mean a school bus powered by diesel fuel which contains not more than 15 PPM sulfur.

Section 2143. Fuel Cell Development and Demonstration Program.

Subsection 2143(a) requires the Secretary to establish a program for entering into cooperative agreements with private-sector fuel cell bus developers for the development of fuel-cell-powered school buses, and subsequently with not less than two units of local government using natural-gas-powered school buses and such private sector fuel cell bus developers to demonstrate the use of fuel-cell-powered school buses.

Subsection 2143(b) requires the non-Federal contribution for activities funded under this section to be no less than 20 percent for fuel infrastructure development activities and no less than 50 percent for demonstration activities and for non-fuel infrastructure development activities.

Subsection 2143(c) limits the amount authorized under section 2144 that may be used for carrying out this section for the period encompassing FY 2002 through FY 2006 to no more than $25.0 million.

Subsection 2143(d) requires the Secretary, no later than three years after the date of enactment of this Act, and, again, no later than October 1, 2006, to transmit to Congress a report that evaluates the process of converting natural gas infrastructure to accommodate fuel-cell-powered school buses and assesses the results of the development and demonstration program under this section.

Section 2144. Authorization of Appropriations.

Section 2144 authorizes $40.0 million for FY 2002, $50.0 million for FY 2003, $60.0 million for FY 2004, $70.0 million for FY 2005, and $80.0 million for FY 2006, to remain available until expended, to carry out this subtitle.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle E—Next Generation Lighting

Section 2151. Short Title.

Section 2151 cites the subtitle as "Next Generation Lighting Initiative Act."

Section 2152. Definition.

Section 2152 defines the term "Lighting Initiative" to mean the "Next Generation Lighting Initiative" established under subsection 2153(a).

Section 2153. Next Generation Lighting Initiative.

Subsection 2153(a) authorizes the Secretary to establish a Lighting Initiative to be known as the "Next Generation Lighting Initiative" to research, develop, and conduct demonstration activities on advanced lighting technologies, including white light emitting diodes.

Subsection 2153(b) states the research objectives of the Lighting Initiative to develop, by 2011, advanced lighting technologies that, compared to incandescent and fluorescent lighting technologies as of the date of the enactment of this Act, are longer lasting, more energy-efficient and cost-competitive.

Section 2154. Study.

Subsection 2154(a) requires the Secretary, in consultation with other Federal agencies, as appropriate, no later than six months after the date of enactment of this Act, to complete a study on strategies for the development and commercial application of advanced lighting technologies. The Secretary shall request a review by the National Academies of Sciences and Engineering of the study under this subsection, and shall transmit the results of the study to the appropriate congressional committees.

Subsection 2154(b) requires that the study include the development of a comprehensive strategy to implement the Lighting Initiative and identifying the research and development, manufacturing, deployment, and marketing barriers that must be overcome to achieve a goal of a 25 percent market penetration by advanced lighting technologies into the incandescent and fluorescent lighting market by the year 2012.

Subsection 2154(c) requires the Secretary to modify the implementation of the Lighting Initiative, if necessary, to take into consideration the recommendations of the National Academies of Sciences and Engineering, as soon as practicable after the review of the study under subsection 2154(a) is transmitted to the Secretary by the National Academies of Sciences and Engineering.

Section 2155. Grant Program.

Subsection 2155(a) permits the Secretary to make merit-based competitive grants to firms and research organizations that conduct RD&D projects related to advanced lighting technologies, subject to section 2603 of this Act.

Subsection 2155(b) requires an annual independent review of the grant-related activities of firms and research organizations receiving a grant under this section to be conducted by a committee appointed by the Secretary under the Federal Advisory Committee Act (5 U.S.C. App.), or, at the request of the Secretary, a committee appointed by the National Academies of Sciences and Engineering. Using clearly defined standards established by the Secretary, the review shall assess technology advances and progress toward commercialization of the grant-related activities of firms or research organizations during each fiscal year of the grant program.

Subsection 2155(c) requires the national laboratories and other Federal agencies, as appropriate, to cooperate with and provide technical and financial assistance to firms and research organizations.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle F—Department of Energy Authorization of Appropriations

Section 2161. Authorization of Appropriations.

Subsection 2161(a) authorizes $625.0 million for FY 2002, $700.0 million for FY 2003; and (3) $800 million for FY 2004 for Energy Conservation operation and maintenance (including Building Technology, State and Community Sector, Industry Sector, Transportation Sector, Power Technologies, and Policy and Management), to remain available until expended. These amount are in addition to: (1) $200.0 million authorized for FY 2002 under section 2105 for alternative fuel and ultra-low sulfur diesel vehicles; (2) $20.0 million for FY 2002 authorized under section 2125 for micro-cogeneration energy technology; and (3) $40.0 million for FY 2002, $50.0 million for FY 2003, and $60.0 million for FY 2004 authorized under section 2144 for green school buses.

Subsection 2161(b) provides that none of the funds authorized to be appropriated in subsection 2131(a) may be used for: "(1) Building Technology, State and Community Sector—(A) Residential Building Energy Codes; (B) Commercial Building Energy Codes; (C) Lighting and Appliance Standards; (D) Weatherization Assistance Program; (E) State Energy Program; or (2) Federal Energy Management Program." These limitations are included to preserve the Science Committee's sole jurisdiction over the bill since the jurisdiction of programs under this subsection 2131(b) either resides with the Committee on Energy and Commerce or is shared with that Committee.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle G—Environmental Protection Agency Office of Air and Radiation Authorization of Appropriations

Section 2171. Short Title.

Section 2171 cites the subtitle as the "Environmental Protection Agency Office of Air and Radiation Authorization Act of 2001."

Section 2172. Authorization of Appropriations.

Section 2172 authorizes to be appropriated to the Administrator for the Office of Air and Radiation Climate Change Protection Programs $121.942 million for FY 2002, $126.8 million for FY 2003, and $131.8 million for FY 2004, to remain available until expended, of which:

(1) $52.731 million for FY 2002, $54.8 million for FY 2003, and $57.0 million for FY 2004 shall be for Buildings;

(2) $32.441 million for FY 2002, $33.7 million for FY 2003, and $35.0 million for FY 2004 shall be for Transportation;

(3) $27.295 million FY 2002, $28.4 million for FY 2003, and $29.5 million for FY 2004 shall be for Industry;

(4) $1.7 million for FY 2002, $1.8 million FY 2003, and $1.9 million for FY 2004 shall be for Carbon Removal;

(5) $2.5 million for FY 2002, $2.6 million for FY 2003, and $2.7 million for FY 2004 shall be for State and Local Climate; and

(6) $5.275 million for FY 2002, $5.5 million for FY 2003, and $5.7 million for FY 2004 shall be for International Capacity Building.

Section 2173. Limits on Use of Funds.

Subsection 2173(a) prohibits EPA from using funds to produce or provide articles or services for the purpose of selling the articles or services to a person outside the Federal Government, unless the Administrator determines that comparable articles or services are not available from a commercial source in the United States.

Subsection 2173(b) prohibits EPA from using funds to prepare or initiate Requests for Proposals for a program if Congress has not authorized the program.

Section 2174. Cost Sharing.

Except as otherwise provided in this subtitle, subsection 2174(a) mandates that for R&D programs carried out under this subtitle, the Administrator shall require a commitment from non-Federal sources of at least 20 percent of the cost of the project. The Administrator may reduce or eliminate the non-Federal requirement under this subsection if the Administrator determines that the R&D is of a basic or fundamental nature.

Similarly, under subsection 2174(b) the Administrator shall require at least 50 percent of the costs directly and specifically related to any demonstration or commercial application project under this subtitle to be provided from non-Federal sources. The Administrator may reduce the non-Federal requirement under this subsection if the Administrator determines that the reduction is necessary and appropriate considering the technological risks involved in the project and is necessary to meet the objectives of this subtitle.

In calculating the amount of the non-Federal commitment under subsection (a) or (b), subsection 2174(c) permits the Administrator to include personnel, services, equipment, and other resources.

Section 2175. Limitations on Demonstrations and Commercial Application of Energy Technology.

Section 2175 requires the Administrator to provide funding only for scientific or energy demonstration or commercial application programs, projects or activities for technologies or processes that can reasonably be expected to yield new, measurable benefits to the cost, efficiency, or performance of the technology or process.

Section 2176. Reprogramming.

Section 2176 prohibits the reprogramming of funds in excess of 105 percent of the amount authorized for a program, project, or activity, or in excess of $0.25 million above the amount authorized for the program, program, project, or activity until the Administrator submits a report to the appropriate congressional committees and

a period of 30 days has elapsed after the date on which the report is received. Such reprogramming of funds is limited to no more than the total amount authorized to be appropriated by this subtitle and such funds may not be reprogrammed or used for a program, project, or activity for which Congress has not authorized appropriation.

Section 2177. Budget Request Format.

Section 2177 requires the Administrator to provide to the appropriate congressional committees, to be transmitted at the same time as the EPA's annual budget request submission, a detailed justification for budget authorization for the programs, projects, and activities for which funds are authorized by this subtitle.

Each such document shall include, for the fiscal year for which funding is being requested and for the two previous fiscal years: (1) a description of, and funding requested or allocated for, each such program, project, or activity; (2) an identification of all recipients of funds to conduct such programs, projects, and activities; and (3) an estimate of the amounts to be expended by each recipient of funds under (2).

Section 2178. Other Provisions.

Subsection 2178(a) requires the Administrator to provide simultaneously to the Committee on Science: (1) any annual operating plan or other operational funding document, including any additions or amendments thereto; and (2) any report relating to the environmental research or development, scientific or energy research, development, or demonstration, or commercial application of energy technology programs, projects, or activities of the EPA, provided to any committee of Congress.

Subsection 2178(b) requires the Administrator to provide notice to the appropriate congressional committees not later than 15 days before any reorganization of any environmental research or development, scientific or energy research, development, or demonstration, or commercial application of energy technology program, project, or activity of the Office of Air and Radiation.

TITLE I—ENERGY CONSERVATION AND ENERGY EFFICIENCY

Subtitle H—National Building Performance Initiative

Not later than three months after the date of the enactment of this Act, subsection 2181(a) requires the Director of the OSTP to establish an Interagency Group responsible for the development and implementation of a National Building Performance Initiative to address energy conservation and R&D and related issues. The NIST shall provide necessary administrative support for the Interagency Group.

Under subsection 2181(b), not later than nine months after the date of the enactment of this Act, the Interagency Group shall transmit to the Congress a multiyear implementation plan describing the Federal role in reducing the costs, including energy costs, of using, owning, and operating commercial, institutional, residential, and industrial buildings by 30 percent by 2020. The plan shall

include: (1) RD&D of systems and materials for new construction and retrofit, on the building envelope and components; and (2) the collection and dissemination, in a usable form, of research results and other pertinent information to the design and construction industry, government officials, and the general public.

Subsection 2181(c) requires the establishment of a National Building Performance Advisory Committee to advise on creation of the plan, review progress made under the plan, advise on any improvements that should be made to the plan, and report to the Congress on actions that have been taken to advance the Nation's capability in furtherance of the plan. The members shall include representatives of a broad cross-section of interests such as the research, technology transfer, architectural, engineering, and financial communities; materials and systems suppliers; State, county, and local governments; the residential, multi-family, and commercial sectors of the construction industry; and the insurance industry.

Subsection 2181(d) requires the Interagency Group, within 90 days after the end of each fiscal year, to transmit a report to the Congress describing progress achieved during the preceding fiscal year by government at all levels and by the private sector, toward implementing the plan developed under subsection (b), and including any amendments to the plan.

TITLE II—RENEWABLE ENERGY

Subtitle A—Hydrogen

Section 2201. Short Title.

Section 2201 cites the subtitle as the "Robert S. Walker and George E. Brown, Jr. Hydrogen Energy Act of 2001."

Section 2202. Purposes.

Section 2202 amends section 102(b) the Spark M. Matsunaga Hydrogen RD&D Act of 1990 (1990 Act) to include RD&D activities leading to the use of hydrogen for commercial applications, information dissemination and education, and development of a hydrogen production methodology that minimizes adverse environmental impacts, including efficient and cost-effective production from renewable and nonrenewable resources.

Section 2203. Definitions.

Section 2203 amends section 102(c) of the 1990 Act to include the definition of "advisory committee."

Section 2204. Reports to Congress.

Section 2204 amends section 103 of the 1990 Act by requiring the Secretary to submit to Congress a detailed report on the status and progress of the programs and activities authorized under the Act within one year of its enactment, and biennially thereafter.

Section 2205. Hydrogen Research and Development.

Section 2205 amends section 104 of the 1990 Act by streamlining the text. Also, for R&D programs carried out under this section, the Secretary shall require a commitment from non-Federal sources of

at least 20 percent of the cost of the project. The Secretary may reduce or eliminate the non-Federal requirement under this subsection if the Secretary determines that the R&D is of a basic or fundamental nature.

Section 2206. Demonstrations.

Section 2206 amends section 105 of the 1990 Act by eliminating the requirement that demonstration of critical technologies and small-scale demonstrations be conducted in or at "self-contained locations." In addition, the small-scale demonstrations are to include a fuel cell bus demonstration program to address hydrogen production, storage, and use in transit bus applications.

Section 2207. Technology Transfer.

Section 2207 amends section 106 of the 1990 Act by requiring the Secretary to conduct a hydrogen technology transfer program designed to accelerate wider application of hydrogen production, storage, transportation and use technologies, including application in foreign countries to increase the global market for hydrogen technologies and foster global economic development without harmful environmental effects.

Section 2208. Coordination and Consultation.

Section 2208 amends section 107 of the 1990 Act by requiring the Secretary to establish a central point for coordination of all DOE hydrogen RD&D activities. It also requires the Secretary to consult with other Federal agencies, as appropriate, and the advisory committee established under section 2209.

Section 2209. Advisory Committee.

Section 2209 amends section 108 of the 1990 Act by requiring the Secretary to enter into arrangements with the National Academies of Sciences and Engineering to establish an advisory committee to replace the current Hydrogen Technical Advisory Panel.

Section 2210. Authorization of Appropriations.

Subsection 2210 amends section 109 of the 1990 Act to provide authorization of appropriations for the five-year period, FY 2002 through FY 2006.

Subsection 2210(a) authorizes $40.0 million for FY 2002, $45.0 million for FY 2003, $50.0 million for FY 2004, $55.0 million for FY 2005, and $60.0 million for FY 2006 for hydrogen R&D activities and the advisory committee.

Subsection 2210(b) authorizes $20.0 million for FY 2002, $25.0 million for FY 2003, $30.0 million for FY 2004, $35.0 million for FY 2005, and $40.0 million for FY 2006 for hydrogen demonstration activities.

Section 2211. Repeal.

Section 2211 amends the Hydrogen Future Act of 1996 to repeal title II containing the program relating to the integration of fuel cells with hydrogen production systems.

TITLE II—RENEWABLE ENERGY

Subtitle B—Bioenergy

Section 2221. Short Title.

Section 2221 cites the subtitle as the "Bioenergy Act of 2001."

Section 2222. Findings.

Section 2222 lists five findings.

Section 2223. Definitions.

Section 2223 defines the terms "bioenergy," "biofuels," "biopower," and "integrated bioenergy research and development."

Section 2224. Authorizations.

Section 2224 authorizes the Secretary to conduct bioenergy-related RD&D and commercial application programs, projects, and activities, including: (1) biopower energy systems, (2) biofuels energy systems, and (3) integrated bioenergy R&D.

Section 2225. Authorization of Appropriations.

As shown in the following table, subsections 2225(a), 2225(b), and 2225(c) authorize a total of $912.2 million for Biopower Energy Systems, Biofuels Energy Systems, and Integrated Bioenergy R&D for the five-year period, FY 2002 through FY 2006.

Table. Bioenergy Act of 2001 Authorizations: FY 2002-FY 2006
(In Thousands of Dollars)

Program (Subsection)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	Total (FY 2002-FY 2006)
Biopower (2225(a))	45,700	52,500	60,300	69,300	79,600	307,400
Biofuels (2225(b))	53,500	61,400	70,600	81,100	93,200	359,800
Integrated Bioenergy R&D (2225(c))	49,000	49,000	49,000	49,000	49,000	245,000
Total	148,200	162,900	179,900	199,400	221,800	912,200

Also, Integrated Bioenergy R&D activities funded under subsection 2225(c) are to be coordinated with ongoing related programs of other Federal agencies, including the NSF Plant Genome Program.

Subsection 2225(d) authorizes amounts under this subtitle to be used to assist in the planning, design, and implementation of projects to convert rice straw and barley grain into biopower or biofuels.

TITLE II—RENEWABLE ENERGY

Subtitle C—Transmission Infrastructure Systems

Section 2241. Transmission Infrastructure Systems RD&D and commercial Application.

Subsection 2241(a) requires the Secretary to develop and implement a comprehensive RD&D and commercial application program to ensure the reliability, efficiency, and environmental integrity of electrical transmission systems. Such program shall include advanced energy technologies and systems, high capacity superconducting transmission lines and generators, advanced grid reliability and efficiency technologies development, technologies contributing to significant load reductions, advanced metering, load management and control technologies, and technology transfer and education.

In carrying out this subtitle, subsection 2241(b) allows the Secretary to include RD&D on and commercial application of improved transmission technologies including the integration of the following technologies into improved transmission systems: (1) high temperature superconductivity; (2) advanced transmission materials; (3) self-adjusting equipment, processes, or software for survivability, security, and failure containment; (4) enhancements of energy transfer over existing lines; and (5) any other infrastructure technologies, as appropriate.

Section 2242. Program Plan.

Section 2242 requires the Secretary, within four months after the date of the enactment of this Act and in consultation with other appropriate Federal agencies, to prepare and transmit to Congress a five-year program plan to guide activities under this subtitle. In preparing the program plan, the Secretary shall consult with appropriate representatives of the transmission infrastructure systems industry to select and prioritize appropriate program areas. The Secretary shall also seek the advice of utilities, energy services providers, manufacturers, institutions of higher learning, other appropriate State and local agencies, environmental organizations, professional and technical societies, and any other persons as the Secretary considers appropriate.

Section 2243. Report.

Under section 2243, two years after the date of the enactment of this Act, and at two year intervals thereafter, the Secretary, in consultation with other appropriate Federal agencies, shall transmit a report to Congress describing the progress made to achieve the purposes of this subtitle and identifying any additional resources needed to continue the development and commercial application of transmission infrastructure technologies.

TITLE II—RENEWABLE ENERGY

Subtitle D—Authorization of Appropriations

Section 2261. Authorization of Appropriations.

Including the amounts authorized for hydrogen R&D under section 2210 and for bioenergy R&D under section 2225, subsection 261(a) authorizes $535.0 million for FY 2002, $639.0 million for FY 2003, and $683.0 million for FY 2004 for Renewable Energy operation and maintenance, including subtitle C (Transmission Infrastructure Systems), Geothermal Technology Development, Hydropower, Concentrating Solar Power, Photovoltaic Energy Systems, Solar Building Technology Research, Wind Energy Systems, High Temperature Superconducting Research and Development, Energy Storage Systems, Transmission Reliability, International Renewable Energy Program, Renewable Energy Production Incentive Program, Renewable Program Support, National Renewable Energy Laboratory, and Program Direction, to remain available until expended.

Subsection 2281(b) requires the Secretary to carry out a research program, in conjunction with other appropriate Federal agencies, on wave powered electric generation within the amounts authorized under subsection 2281(a).

Using funds authorized in subsection 2281(a), subsection 2281(c) requires the Secretary to transmit to the Congress, within one year after the date of the enactment of this Act, an assessment of all renewable energy resources available within the United States. The report shall include a detailed inventory describing the available amount and characteristics of solar, wind, biomass, geothermal, hydroelectric, and other renewable energy sources, and an estimate of the costs needed to develop each resource. The report shall also include such other information as the Secretary believes would be useful in sitting renewable energy generation, such as appropriate terrain, population and load centers, nearby energy infrastructure, and location of energy resources. The information and cost estimates in this report shall be updated annually and made available to the public, along with the data used to create the report. This subsection shall expire at the end of FY 2004.

Subsection 2261(d) provides that none of the funds authorized to be appropriated in subsection 2241(a) may be used for: "(1) Departmental Energy Management Program; or (2) Renewable Indian Energy Resources." These limitations are included to preserve the Science Committee's sole jurisdiction over the bill, since the jurisdiction of these programs either resides with the Committee on Energy and Commerce, or is shared with that Committee.

TITLE III—NUCLEAR ENERGY

Subtitle A—University Nuclear Science and Engineering

Section 2301. Short Title.

Section 2301 cites the subtitle as the "Department of Energy University Nuclear Science and Engineering Act."

Section 2302. Findings.

Section 2302 lists three findings.

Section 2303. Department of Energy Program.

Subsection 2303(a) directs the Secretary, through the Office of Nuclear Energy, Science and Technology (Office) to maintain the Nation's human resource investment and infrastructure related to civilian nuclear R&D.

Subsection 2303(b) requires the Director of the Office to: (1) develop a robust graduate and undergraduate program to attract new students; (2) develop a Junior Faculty Research Initiation Grant to recruit and maintain new faculty; (3) maintain investment in the Nuclear Engineering Education Research Program; (4) encourage collaborative nuclear research between industry, national labs and universities through Nuclear Energy Research Initiative (NERI); (5) support public outreach regarding nuclear science and engineering; and (6) support communication and outreach related to nuclear science and engineering.

Subsection 2303(c) directs the Office to provide for: (1) university research reactor refueling with low enriched fuels, operational instrumentation upgrading, and reactor sharing among universities; (2) assistance in relicensing and upgrading university training reactors as part of a student training program in collaboration with the U.S. nuclear industry; and (3) awards for reactor improvements for research, training and education.

Subsection 2303(d) directs the Secretary to develop a program in the Office for: nuclear science and technology sabbatical fellowships for university professors at the Department labs and for student fellowships at Department labs; and a visiting scientist program for Department lab staff to visit universities' nuclear science programs to work with faculty and staff.

Subsection 2303(e) requires the host institution to provide at least 50 percent of the cost of a university research reactor's operation when funds authorized under this subtitle are used to supplement operation of such research reactor.

Subsection 2303(f) requires that all grants, contracts, cooperative agreements or other financial assistance awards under this Act be made based on independent merit review.

Subsection 2303(g) requires the Secretary to prepare a report within six months of enactment of this Act, laying out a five-year plan on the programs authorized in this section. This report is to be delivered to the appropriate congressional committees.

Section 2304. Authorization of Appropriations.

Subsection 2304(a) authorizes total appropriation of funds to carry out the purposes of this subtitle and for all funds to remain available until expended: $30.2 million for FY 2002; $41.0 million for FY 2003; $47.9 million for FY 2004; $55.6 million for FY 2005; and $64.1 million for FY 2006.

For the Graduate and Undergraduate Fellowships to carry out subsection 2303(b)(1) from the funds authorized in subsection 2304(a), subsection 2304(b) authorizes $3.0 million for FY 2002, $3.1 million for FY 2003, $3.2 million for FY 2004, $3.2 million for FY 2005, and $3.2 million for FY 2006.

For the Junior Faculty Research Initiation Grant Program to carry out subsection 2303(b)(2) from the funds authorized in subsection 2304(a), subsection 2304(c) authorizes $5.0 million for FY 2002, $7.0 million for FY 2003, $8.0 million for FY 2004, $9.0 million for FY 2005, and $10.0 million for FY 2006.

For the Nuclear Engineering and Education Research Program to carry out subsection 2303(b)(3) from the funds authorized in subsection 2304(a), subsection 2304(d) authorizes $8.0 million for FY 2002, $12.0 million for FY 2003, $13.0 million for FY 2004, $15.0 million for FY 2005, and $20.0 million for FY 2006.

For Communication and Outreach Related to Nuclear Science and Engineering to carry out subsection 2303(b)(5) from the funds authorized in subsection 2304(a), subsection 2304(e) authorizes $0.2 million for each of FY 2002 and FY 2003, and $0.3 million for each of FY 2004 through FY 2006.

For Refueling of Research Reactors and Instrumentation Upgrades to carry out subsection 2303(c)(1) from the funds authorized in subsection 2304(a), subsection 2304(f) authorizes $6.0 million for FY 2002, $6.5 million for FY 2003, $7.0 million for FY 2004, $7.5 million for FY 2005, and $8.0 million for FY 2006.

For Relicensing Assistance to carry out subsection 2303(c)(2) from the funds authorized in subsection 2304(a), subsection 2304(g) authorizes $1.0 million for FY 2002, $1.1 million for FY 2003, $1.2 million for FY 2004, and $1.3 million for each of FY 2005 and FY 2006.

For the Reactor Research and Training Award Program to carry out subsection 2303(c)(3) from the funds authorized in subsection 2304(a), subsection 2304(h) authorizes $6.0 million for FY 2002, $10.0 million for FY 2003, $14.0 million for FY 2004, $18.0 million for FY 2005, and $20.0 million for FY 2006.

For University-Department Laboratory Interactions to carry out subsection 2303(d) from the funds authorized in subsection 2304(a), subsection 2304(i) authorizes $1.0 million for FY 2002, $1.1 million for FY 2003, $1.2 million for FY 2004, and $1.3 million for each of FY 2005 and FY 2006.

TITLE III—NUCLEAR ENERGY

Subtitle B—Advanced Fuel Recycling Technology Research and Development Program

Section 2321. Program.

Section 2321(a) requires the Secretary, through the Director of the Office, to conduct an advanced fuel recycling technology R&D program to further the availability of proliferation-resistant fuel recycling technologies as an alternative to aqueous reprocessing in support of evaluation of alternative national strategies for spent nuclear fuel and the Generation IV advanced reactor concepts, subject to annual review by the Secretary's Nuclear Energy Research Advisory Committee or other independent entity, as appropriate.

Section 2321(b) requires the Secretary to report on the activities of the advanced fuel recycling technology R&D program as part of the Department's annual budget submission.

Section 2321(c) authorizes: (1) $10.0 million for FY 2002, and (2) such sums as are necessary for FY 2003 and FY 2004.

TITLE III—NUCLEAR ENERGY

Subtitle C—Department of Energy Authorization of Appropriations

Section 2341. Nuclear Energy Research Initiative.

Subsection 2341(a) requires the Secretary, through the Office, to conduct a Nuclear Energy Research Initiative for grants to be competitively awarded and subject to peer review for research relating to nuclear energy.

Subsection 2341(b) mandates that the program be directed toward accomplishing the objectives of: (1) developing advanced concepts and scientific breakthroughs in nuclear fission and reactor technology to address and overcome the principal technical and scientific obstacles to the expanded use of nuclear energy in the United States; (2) advancing the state of nuclear technology to maintain a competitive position in foreign markets and a future domestic market; (3) promoting and maintaining a United States nuclear science and engineering infrastructure to meet future technical challenges; (4) providing an effective means to collaborate on a cost-shared basis with international agencies and research organizations to address and influence nuclear technology development worldwide; and (5) promoting United States leadership and partnerships in bilateral and multilateral nuclear energy research.

Subsection 2341(c) authorizes to be appropriated to the Secretary to carry out this section: (1) $60.0 million for FY 2002; and (2) such sums as are necessary for FY 2003 and FY 2004.

Section 2342. Nuclear Energy Plant Optimization Program.

Subsection 2342(a) requires the Secretary to conduct a Nuclear Energy Plant Optimization R&D program jointly with industry and cost-shared by industry by at least 50 percent and subject to annual review by the Secretary's Nuclear Energy Research Advisory Committee or other independent entity, as appropriate.

Subsection 2342(b) states the program shall be directed toward accomplishing the following technical objectives: (1) managing long-term effects of component aging; and (2) improving efficiency and productivity of existing nuclear power stations.

Subsection 2342(c) authorizes to be appropriated to the Secretary to carry out this section: (1) $15.0 million for FY 2002; and (2) such sums as are necessary for FY 2003 and FY 2004.

Section 2343. Nuclear Energy Technologies.

Subsection 2343(a) requires the Secretary to conduct a study of Generation IV nuclear energy systems, including development of a technology roadmap and performance of R&D necessary to make an informed technical decision regarding the most promising candidates for commercial application.

Under subsection 2343(b), to the extent practicable, in conducting the study under subsection 2343(a), the Secretary shall study nuclear energy systems that offer the highest probability of achieving the goals for Generation IV nuclear energy systems, including: (1) economics competitive with any other generators; (2) enhanced safety features, including passive safety features; (3) sub-

stantially reduced production of high-level waste, as compared with the quantity of waste produced by reactors in operation on the date of enactment of this Act; (4) highly proliferation-resistant fuel and waste; (5) sustainable energy generation including optimized fuel utilization; and (6) substantially improved thermal efficiency, as compared with the thermal efficiency of reactors in operation on the date of enactment of this Act.

In preparing the study under subsection 2343(b), subsection 2343(c) requires the Secretary to consult with appropriate representatives of industry, institutions of higher education, Federal agencies, and international, professional and technical organizations.

Subsection 2343(d) requires that, not later than December 31, 2002, the Secretary shall transmit to the appropriate congressional committees a report describing the activities of the Secretary under this section, and plans for R&D leading to a public/private cooperative demonstration of one or more Generation IV nuclear energy systems. The report shall contain: (A) an assessment of all available technologies; (B) a summary of actions needed for the most promising candidates to be considered as viable commercial options within the five to ten years after the date of the report, with consideration of regulatory, economic, and technical issues; (C) a recommendation of not more than three promising Generation IV nuclear energy system concepts for further development; (D) an evaluation of opportunities for public/private partnerships; (E) a recommendation for the structure of a public/private partnership to share in development and construction costs; (F) a plan leading to the selection and conceptual design, by September 30, 2004, of at least one Generation IV nuclear energy system concept recommended under subparagraph (C) for demonstration through a public/private partnership; (G) an evaluation of opportunities for siting demonstration facilities on DOE land; and (H) a recommendation for appropriate involvement of other Federal agencies.

Subsection 2343(e) authorizes to be appropriated to the Secretary to carry out this section: (1) $20.0 million for FY 2002; and (2) such sums as are necessary for FY 2003 and FY 2004.

Section 2344. Authorization of Appropriations.

Subsection 2344(a) authorizes activities under this title for nuclear energy operation and maintenance, including amounts authorized under sections 2304(a) (University Nuclear Science and Engineering), 2321(c) (Advanced Fuel Recycling Technology R&D Program), 2341(c) (Nuclear Energy Research Initiative), 2342(c) (Nuclear Energy Plant Optimization Program), and 2343(e) (Nuclear Energy Technologies), and including Advanced Radioisotope Power Systems, Test Reactor Landlord, and Program Direction, $191.2 million for FY 2002, $199.0 million for FY 2003, and $207.0 million for FY 2004, to remain available until expended.

Subsection 2344(b) authorizes:

(1) $0.95 million for FY 2002, $2.2 million for FY 2003, $1.246 million for FY 2004, and $1.699 million for FY 2005 for completion of construction of Project 99–E–200, Test Reac-

tor Area (TRA) Electric Utility Upgrade, Idaho National Engineering and Environmental Laboratory (INEEL); and

(2) $0.5 million for each of FY 2002 through FY 2005 for completion of construction of Project 95–E–201, TRA Fire and Life Safety Improvements, INEEL.

Subsection 2344(c) provides that none of the funds authorized to be appropriated in subsection 2481(a) may be used for: "(1) Nuclear Energy Isotope Support and Production; (2) Argonne National Laboratory-West Operations; (3) Fast Flux Test Facility; or (4) Nuclear Facilities Management." These limitations are included to preserve the Science Committee's sole jurisdiction over the bill since the jurisdiction of programs under this subsection either resides with the Committee on Energy and Commerce or is shared with that Committee.

TITLE IV—FOSSIL ENERGY

Subtitle A—Coal

Section 2401. Coal and Related Technologies Programs.

Subsection 2401(a) authorizes to be appropriated to the Secretary $172.0 million for FY 2002, $179.0 million for FY 2003, and $186.0 million for FY 2004, to remain available until expended, for other coal and related technologies programs, which shall include: (1) Innovations for Existing Plants; (2) Integrated Gasification Combined Cycle; (3) advanced combustion systems; (4) Turbines; (5) Sequestration Research and Development; (6) innovative technologies for demonstration; (7) Transportation Fuels and Chemicals; (8) Solid Fuels and Feedstocks; (9) Advanced Fuels Research; and (10) Advanced Research.

Notwithstanding subsection 2401(a), subsection 2405(b) prohibits the use of funds to carry out the activities authorized by this subtitle after September 30, 2002, unless the Secretary has transmitted to the appropriate congressional committees the report required by this subsection and one month have elapsed since that transmission. The report must include a plan containing: (1) a detailed description of how proposals will be solicited and evaluated, including a list of all activities expected to be undertaken; (2) a detailed list of technical milestones for each coal and related technology that will be pursued; and (3) a description of how the programs authorized in this section will be carried out so as to complement and not duplicate activities authorized under division E (Clean Coal Power Initiative).

TITLE IV—FOSSIL ENERGY

Subtitle B—Oil and Gas

Section 2421. Petroleum-Oil Technology.

Section 2421 directs the Secretary to conduct a RD&D and commercial application program on petroleum-oil technology. The programs shall address: (1) Exploration and Production Supporting Research; (2) Oil Technology Reservoir Management/Extension; and (3) Effective Environmental Protection.

Section 2422. Gas.

Section 2422 directs the Secretary to conduct a program of RD&D and commercial application on natural gas technologies. The program shall address: (1) Exploration and Production; (2) Infrastructure; and (3) Effective Environmental Protection.

TITLE IV—FOSSIL ENERGY

Subtitle C—Ultra-Deepwater and Unconventional Drilling

Section 2441. Short Title.

Section 2441 cites the subtitle as the "Natural Gas and Other Petroleum Research, Development, and Demonstration Act of 2001."

Section 2442. Definitions.

Section 2442 defines six terms, including the terms "deepwater" to mean water depths greater than 200 meters but less than 1,500 meters, "ultra-deepwater" to mean water depths greater than 1,500 meters, and "unconventional" to mean located in heretofore inaccessible or uneconomic formations on land.

Section 2443. Ultra-Deepwater Program.

Section 2443 requires the Secretary to establish a program of RD&D of ultra-deepwater natural gas and other petroleum exploration and production technologies, in areas currently available for Outer Continental Shelf leasing. The program shall be carried out by the Research Organization as provided in this subtitle.

Section 2444. National Energy Technology Laboratory.

The National Energy Technology Laboratory (NETL) and the U.S. Geological Survey (USGS), when appropriate, shall carry out programs of long-term research into new natural gas and other petroleum exploration and production technologies and environmental mitigation technologies for production from unconventional and ultra-deepwater resources, including methane hydrates. NETL shall conduct a program of RD&D of new technologies for the reduction of greenhouse gas emissions from unconventional and ultra-deepwater natural gas or other petroleum exploration and production activities, including sub-sea floor carbon sequestration technologies.

Section 2445. Advisory Committee.

Within six months after the date of the enactment of this Act, subsection 2445(a) requires the Secretary to establish an Advisory Committee consisting of seven members, each having extensive operational knowledge of and experience in the natural gas and other petroleum exploration and production industry who are not Federal Government employees or contractors. A minimum of four members shall have extensive knowledge of ultra-deepwater natural gas or other petroleum exploration and production technologies, a minimum of two members shall have extensive knowledge of unconventional natural gas or other petroleum exploration and production technologies, and at least one member shall have

extensive knowledge of greenhouse gas emission reduction technologies, including carbon sequestration.

Subsection 2445(b) defines the function of the Advisory Committee to be to advise the Secretary on the selection of an organization to create the Research Organization and on the implementation of this subtitle.

Under subsection 2445(c), members of the Advisory Committee shall serve without compensation but shall receive travel expenses, including per diem in lieu of subsistence, in accordance with applicable provisions under subchapter I of chapter 57 of title 5, United States Code.

Subsection 2445(d) provides that the costs of activities carried out by the Secretary and the Advisory Committee under this subtitle shall be paid or reimbursed from the Fund established in section 2450.

Under subsection 2455(e), Section 14 of the Federal Advisory Committee Act shall not apply to the Advisory Committee.

Section 2446. Research Organization.

Subsection 2446(a) requires the Secretary, within six months after the date of the enactment of this Act, to solicit proposals from eligible entities for the creation of the Research Organization, and within three months after such solicitation, to select an entity to create the Research Organization.

Under subsection 2446(b), entities eligible to create the Research Organization shall: (1) have been in existence as of the date of the enactment of this Act; (2) be entities exempt from tax under section 501(c)(3) of the Internal Revenue Code of 1986; and (3) be experienced in planning and managing programs in natural gas or other petroleum exploration and production RD&D.

Subsection 24246(c) requires that a proposal from an entity seeking to create the Research Organization shall include a detailed description of the proposed membership and structure of the Research Organization.

The functions of the Research Organization, as defined in subsection 2446(c) are to: (1) award grants on a competitive basis to qualified research institutions, institutions of higher education, companies, and consortia of same for the purpose of conducting RD&D of unconventional and ultra-deepwater natural gas or other petroleum exploration and production technologies; and (2) review activities under those grants to ensure that they comply with the requirements of this subtitle and serve the purposes for which the grants were made.

Section 2447. Grants.

Subsection 2447(a) provides for three types of grants: (1) unconventional, for RD&D of technologies aimed at unconventional reservoirs; (2) ultra-deepwater, for R&D of technologies aimed at ultra-deepwater areas; and (3) ultra-deepwater architecture. In the case of ultra-deepwater architecture, the Research Organization shall award a grant to one or more consortia for the purpose of developing and demonstrating the next generation architecture for ultra-deepwater production of natural gas and other petroleum.

Subsection 2447(b) provides that grants under this section shall contain seven specific conditions:

1. If the grant recipient consists of more than one entity, the recipient shall provide a signed contract agreed to by all participating members clearly defining all rights to intellectual property for existing technology and for future inventions conceived and developed using funds provided under the grant, in a manner that is consistent with applicable laws.
2. There shall be a repayment schedule for Federal dollars provided for demonstration projects under the grant in the event of a successful commercialization of the demonstrated technology. Such repayment schedule shall provide that the payments are made to the Secretary with the express intent that these payments not impede the adoption of the demonstrated technology in the marketplace. In the event that such impedance occurs due to market forces or other factors, the Research Organization shall renegotiate the grant agreement so that the acceptance of the technology in the marketplace is enabled.
3. Applications for grants for demonstration projects shall clearly state the intended commercial applications of the technology demonstrated.
4. The total amount of funds made available under a grant provided under subsection 2447(a)(3) for ultra-deepwater architecture shall not exceed 50 percent of the total cost of the activities for which the grant is provided.
5. The total amount of funds made available under a grant provided either under subsection 2447(a)(1) for unconventional reservoirs or under subsection 2447(a)(2) for ultra-deepwater areas shall not exceed 50 percent of the total cost of the activities covered by the grant, except that the Research Organization may elect to provide grants covering a higher percentage, not to exceed 90 percent, of total project costs in the case of grants made solely to independent producers.
6. An appropriate amount of funds provided under a grant shall be used for the broad dissemination of technologies developed under the grant to interested institutions of higher education, industry, and appropriate Federal and State technology entities to ensure the greatest possible benefits for the public and use of government resources.
7. Demonstrations of ultra-deepwater technologies for which funds are provided under a grant may be conducted in ultra-deepwater or deepwater locations.

Subsection 2447(c) requires that funds available for grants under this subtitle be allocated as follows: (1) 15 percent shall be for grants under subsection 2447(a)(1) for unconventional reservoirs; (2) 15 percent shall be for grants under subsection 2447(a)(2) for ultra-deepwater areas; (3) 60 percent shall be for grants under subsection 2447(a)(3) for ultra-deepwater architecture; and (4) 10 per-

cent shall be for the NETL and the USGS, when appropriate, for carrying out section 2444.

Section 2448. Plan and Funding.

Subsection 2448(a) requires the Research Organization to transmit to the Secretary an annual plan proposing projects and funding of activities under each paragraph of section 2447(a).

Under subsection 2448(b), the Secretary shall have one month to review the annual plan, and shall approve the plan, if it is consistent with this subtitle. If the Secretary approves the plan, the Secretary shall provide funding as proposed in the plan. If the Secretary does not approve the plan, subsection 2448(c) provides that the Secretary shall notify the Research Organization of the reasons for disapproval and shall withhold funding until a new plan is submitted which the Secretary approves. Within one month after notifying the Research Organization of a disapproval, the Secretary shall notify the appropriate congressional committees of the disapproval.

Section 2449. Audit.

Section 2449 requires the Secretary to retain an independent, commercial auditor to determine the extent to which the funds authorized by this subtitle have been expended in a manner consistent with the purposes of this subtitle. The auditor must transmit a report annually to the Secretary, who shall transmit the report to the appropriate congressional committees, along with a plan to remedy any deficiencies cited in the report.

Section 2450. Fund.

Subsection 2450(a) establishes a fund to be known as the "Ultra-Deepwater and Unconventional Gas Research Fund" (Fund) in the United States Treasury (Treasury), which shall be available for obligation to the extent provided in advance in appropriations Acts for allocation under section 2447(c) above.

Subsection 2450(b) specifies the Fund's three funding sources:

1. Loans from the Treasury—Subsection 2450(b)(1) authorizes to be appropriated to the Secretary $900.0 million for the period encompassing FY 2002 through FY 2009. Such amounts shall be deposited by the Secretary in the Fund, and shall be considered loans from the Treasury. Income received by the United States in connection with any ultra-deepwater oil and gas leases shall be deposited in the Treasury and considered as repayment for the loans under this paragraph.
2. Additional Appropriations—Subsection 2450(b)(2) authorizes to be appropriated to the Secretary such sums as may be necessary for FY 2002 through FY 2009, to be deposited in the Fund.
3. Oil and Gas Lease Income—To the extent provided in advance in appropriations Acts, not more than 7.5 percent of the income of the United States from Federal oil and gas leases may be deposited in the Fund for FY 2002 through

FY 2009. The Congressional Budget Office estimates these amounts to total $3.616 billion.

Section 2451. Sunset.

Under section 2451, no funds are authorized to be appropriated for carrying out this subtitle after FY 2009, and the Research Organization is terminated when it has expended all funds made available pursuant to this subtitle.

TITLE IV—FOSSIL ENERGY

Subtitle D—Fuel Cells

Section 2461. Fuel Cells.

Section 2461(a) requires the Secretary to conduct a program of research, development, RD&D and commercial application on fuel cells. The program shall address: (1) Advanced Research; (2) Systems Development; (3) Vision 21–Hybrids; and (4) Innovative Concepts.

In addition to the program under subsection 2461(a), subsection 2461(b) requires the Secretary, in consultation other Federal agencies, as appropriate, to establish a program for the demonstration of fuel cell technologies, including fuel cell proton exchange membrane technology, for commercial, residential, and transportation applications. The program shall specifically focus on promoting the application of and improved manufacturing production and processes for fuel cell technologies.

Under subsection 2461(c), within the amounts authorized to be appropriated under subsection 2481(a), there are authorized to be appropriated to the Secretary for the purpose of carrying out subsection 2461(b) $28.0 million for each of FY 2002, 2003, and 2004.

TITLE IV—FOSSIL ENERGY

Subtitle E—DOE Authorization of Appropriations

Section 2481. Authorization of Appropriations.

Subsection 2481(a) authorizes appropriations for subtitle B (Oil and Gas) and subtitle D (Fuel Cells), and for Fossil Energy Research and Development Headquarters Program Direction, Field Program Direction, Plant and Capital Equipment, Cooperative Research and Development, Import/Export Authorization, and Advanced Metallurgical Processes $282.0 million for FY 2002, $293.0 million for FY 2003, and $305.0 million for FY 2004.

Subsection 2481(b) provides that none of the funds authorized to be appropriated in subsection 2481(a) may be used for: "(1) Gas Hydrates; (2) Fossil Energy Environmental Restoration; or (3) RD&D and commercial application on coal and related technologies, including activities under subtitle A." The first limitation is imposed because the Methane Hydrate Act of 2000 has been recently enacted and has its own separate authorization. The second limitation is included to preserve the Science Committee's sole jurisdiction over the bill, since the jurisdiction of Fossil Energy Environmental Restoration is shared with the Committee on Energy and Commerce. The third limitation is imposed to limit the amount of coal funding to that contained in subtitle A.

TITLE V—SCIENCE

Subtitle A—Fusion Energy Sciences

Section 2501. Short Title.

Section 2501 cites the subtitle as the "Fusion Energy Sciences Act of 2001."

Section 2502. Findings.

Section 2502 lists nine findings.

Section 2503. Plan for Fusion Experiment.

Subsection 2503(a) requires the Secretary, in full consultation with the Fusion Energy Sciences Advisory Committee and the Secretary of Energy Advisory Board as appropriate, to develop a plan for construction in the United States of a magnetic fusion burning plasma experiment for the purpose of accelerating scientific understanding of fusion plasmas. The Secretary shall request a review of the plan by the National Academy of Sciences (NAS), and shall transmit the Department plan and the NAS review to the Congress by July 1, 2004.

Subsection 2503(b) requires the plan to: (1) address key burning plasma physics issues; and (2) include specific information on the scientific capabilities of the proposed experiment, the relevance of these capabilities to the goal of practical fusion energy, and the overall design of the experiment including its estimated cost and identifying potential construction sites.

Subsection 2503(c) authorizes the Secretary, in full consultation with the Fusion Energy Sciences Advisory Committee and the Secretary of Energy Advisory Board as appropriate, to develop a plan for the United States participation in an international burning plasma experiment for the purpose of accelerating scientific understanding of fusion plasmas, whose construction is found by the Secretary to be highly likely and where the United States participation is cost effective relative to the cost and scientific benefits of a domestic experiment described in subsection 2503(a). If the Secretary elects to develop a plan under this subsection, the Secretary shall include the information described in subsection 2503(b), and an estimate of the cost of United States participation in such an international experiment. The Secretary shall request a review by the NAS of any such plan, shall transmit the plan and the review to the Congress by July 1, 2004.

Subsection 2503(d) authorizes the Secretary, through the Department's Fusion Energy Sciences Program, to conduct any R&D necessary to fully develop the plans described in this section.

Section 2504. Plan for Fusion Energy Sciences Program.

Section 2504 requires that within six months after the enactment of this Act, the Secretary, in full consultation with the Fusion Energy Sciences Advisory Committee, to develop and transmit to the Congress a plan for the purpose of ensuring a strong scientific base for the Fusion Energy Sciences Program and to enable the burning plasma experiment described in section 2503. Such plan shall ensure: (1) that existing fusion research facilities and equipment are

more fully utilized with appropriate measurements and control tools; (2) a strengthened fusion science theory and computational base; (3) that the selection of and funding for new magnetic and inertial fusion research facilities is based on scientific innovation and cost effectiveness; (4) improvement in the communication of scientific results and methods between the fusion science community and the wider scientific community; (5) that adequate support is provided to optimize the design of the magnetic fusion burning plasma experiment referred to in section 2503; (6) that inertial confinement fusion facilities are utilized to the extent practicable for the purpose of inertial fusion energy R&D; (7) the development of a roadmap for a fusion-based energy source that shows the important scientific questions, the evolution of confinement configurations, the relation between these two features, and their relation to the fusion energy goal; (8) the establishment of several new centers of excellence, selected through a competitive peer-review process and devoted to exploring the frontiers of fusion science; (9) that the NSF, and other agencies, as appropriate, play a role in extending the reach of fusion science and in sponsoring general plasma science; and (10) that there be continuing broad assessments of the outlook for fusion energy and periodic external reviews of fusion energy sciences.

Section 2505. Authorization of Appropriations.

Section 2505 authorizes—for ongoing activities in Department's Fusion Energy Sciences Program and for the purpose of planning activities under section 2503, but not for implementation of such plans—$320.0 million for FY 2002 and $335.0 million for FY 2003 of which up to $15 million for each of FY 2002 and FY 2003 may be used to establish several new centers of excellence under section 2504(8).

TITLE V—SCIENCE

Subtitle B—Spallation Neutron Source

Section 2521. Definition.

Section 2521 defines the term "Spallation Neutron Source" to mean Department Project 99–E–334, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Section 2522. Authorization of Appropriations.

Subsection 2522(a) authorizes to be appropriated to the Secretary for construction of the Spallation Neutron Source (SNS): (1) $276.3 million for FY 2002, (2) $210.571 million for FY 2003, (3) $124.6 million for FY 2004, (4) $79.8 million for FY 2005, and (5) $41.1 million for FY 2006 for completion of construction.

Subsection 2522(b) authorizes appropriation for other SNS project costs (including R&D necessary to complete the project, preoperations costs, and capital equipment not related to construction) $15.353 million for FY 2002 and $103.279 million for FY 2003 through 2006, to remain available until expended through September 30, 2006.

Section 2523. Report.

Section 2523 requires the Secretary to report on the SNS as part of Department's annual budget submission, including a description of the achievement of milestones, a comparison of actual costs to estimated costs, and any changes in estimated project costs or schedule.

Section 2524. Limitations.

Section 2524 limits the total amount obligated for the SNS by the Department, including prior year appropriations, to not more than: (1) $1,192.7 million for costs of construction; (2) $219.0 million for other project costs; and (3) $1,411.7 million for total project cost.

TITLE V—SCIENCE

Subtitle C—Facilities, Infrastructure, and User Facilities

Section 2541. Definition.

Subsection 2541(1) defines the term "nonmilitary energy laboratory" to mean: (A) Ames Laboratory; (B) Argonne National Laboratory; (C) Brookhaven National Laboratory; (D) Fermi National Accelerator Laboratory; (E) Lawrence Berkeley National Laboratory; (F) Oak Ridge National Laboratory; (G) Pacific Northwest National Laboratory; (H) Princeton Plasma Physics Laboratory; (I) Stanford Linear Accelerator Center; (J) Thomas Jefferson National Accelerator Facility; or (K) any other facility of the Department that the Secretary, in consultation with the Director, Office of Science and the appropriate congressional committees, determines to be consistent with the mission of the Office of Science.

Subsection 2541(2) defines the term "user facility" to mean: (A) an Office of Science facility at a nonmilitary energy laboratory that provides special scientific and research capabilities, including technical expertise and support as appropriate, to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others, including research institutions or individuals from other nations where reciprocal accommodations are provided to United States research institutions and individuals or where the Secretary considers such accommodation to be in the national interest; and (B) any other Office of Science funded facility designated by the Secretary as a user facility.

Section 2542. Facility and Infrastructure Support for Nonmilitary Energy Laboratories.

Subsection 2542(a) requires the Secretary to develop and implement a least-cost nonmilitary energy laboratory facility and infrastructure strategy for: (1) maintaining existing facilities and infrastructure, as needed; (2) closing unneeded facilities; (3) making facility modifications; and (4) building new facilities.

Subsection 2542(b) requires the Secretary to prepare a comprehensive ten-year plan for conducting future facility maintenance, making repairs, modifications, and new additions, and constructing new facilities at each nonmilitary energy laboratory. Such plan is to provide for facilities work in accordance with the fol-

lowing priorities: (1) providing for the safety and health of employees, visitors, and the general public with regard to correcting existing structural, mechanical, electrical, and environmental deficiencies; (2) providing for the repair and rehabilitation of existing facilities to keep them in use and prevent deterioration, if feasible; and (3) providing engineering design and construction services for those facilities that require modification or additions in order to meet the needs of new or expanded programs.

Subsection 2542(c) requires the Secretary to prepare and transmit to the appropriate congressional committees a report containing the plan prepared under subsection 2542(b) within one year after the date of the enactment of this Act. For each nonmilitary energy laboratory, the report is to contain: (1) the current priority list of proposed facilities and infrastructure projects, including cost and schedule requirements; (2) a current ten-year plan that demonstrates the reconfiguration of its facilities and infrastructure to meet its missions and to address its long-term operational costs and return on investment; (3) the total current budget for all facilities and infrastructure funding; and (4) the current status of each facilities and infrastructure project compared to the original baseline cost, schedule, and scope.

The report shall also: (1) include a plan for new facilities and facility modifications at each nonmilitary energy laboratory that will be required to meet the Department's changing missions for the twenty-first century, including schedules and estimates for implementation, and including a section outlining long-term funding requirements consistent with anticipated budgets and annual authorization of appropriations; (2) address the coordination of modernization and consolidation of facilities among the nonmilitary energy laboratories in order to meet changing mission requirements; and (3) provide for annual reports to the appropriate congressional committees on accomplishments, conformance to schedules, commitments, and expenditures.

Section 2543. User Facilities.

Under subsection 2543(a), when the Department makes a user facility available to universities and other potential users, or seeks input from universities and other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users.

Subsection 2543(b) requires the Department to employ full and open competition in selecting participants when the Department considers the participation of a university or other potential user in the establishment or operation of a user facility.

Section 2543(c) prohibits the Department from redesignating a user facility, as defined by section 2541(b) as something other than a user facility to avoid the requirements of subsections (a) and (b).

TITLE V—SCIENCE

Subtitle D—Advisory Panel on Office of Science

Section 2561. Establishment.

Section 2561 requires the Director of the Office of Science and Technology Policy, in consultation with the Secretary, to establish an Advisory Panel on the Office of Science comprised of knowledgeable individuals to: (1) address concerns about the current status and the future of scientific research supported by the Office; (2) examine alternatives to the current organizational structure of the Office within the Department, taking into consideration existing structures for the support of scientific research in other Federal agencies and the private sector; and (3) suggest actions to strengthen the scientific research supported by the Office that might be taken jointly by the Department and Congress.

Section 2562. Report.

Under section 2562, within six months after the date of the enactment of this Act, the Advisory Panel shall transmit its findings and recommendations in a report to the Director of the Office of Science and Technology Policy and the Secretary. The Director and the Secretary shall jointly: (1) consider each of the Panel's findings and recommendations, and comment on each as they consider appropriate; and (2) transmit the Panel's report and the comments of the Director and the Secretary on the report to the appropriate congressional committees within nine months after the date of the enactment of this Act.

TITLE V—SCIENCE

Subtitle E—Department of Energy Authorization of Appropriations

Section 2581. Authorization of Appropriations.

Including the amounts authorized to be appropriated for FY 2002 under section 2505 for Fusion Energy Sciences and under subsection 2522(b) for the SNS, subsection 2581(a) authorizes to be appropriated to the Secretary for the Office of Science (also including subtitle C–Facilities, Infrastructure, and User Facilities, High Energy Physics, Nuclear Physics, Biological and Environmental Research, Basic Energy Sciences (except for the SNS authorization under subsection 2522(b)), Advanced Scientific Computing Research, Energy Research Analysis, Multiprogram Energy Laboratories-Facilities Support, Facilities and Infrastructure, Safeguards and Security, and Program Direction) operation and maintenance $3,299.558 million for FY year 2002, to remain available until expended.

Subsection 2581(b) provides that within the amounts authorized under subsection (a), $5.0 million for FY 2002 may be used to carry out research in the use of precious metals (excluding platinum, palladium, and rhodium) in catalysis, either directly though national laboratories, or through the award of grants, cooperative agreements, or contracts with public or nonprofit entities.

Subsection 2581(c) provides that in addition to the amounts authorized under subsection 2522(a) for SNS construction, subsection 2581(b) authorizes:

(1) $11.4 million for FY 2002 for completion of construction of Project 98–G–304, Neutrinos at the Main Injector, Fermi National Accelerator Laboratory;

(2) $11.405 million for FY 2002 for completion of construction of Project 01–E–300, Laboratory for Comparative and Functional Genomics, Oak Ridge National Laboratory;

(3) $4.0 million for FY 2002, $8.0 million for FY 2003, and $2.0 million for FY 2004 for completion of construction of Project 02–SC–002, Project Engineering Design (PED), Various Locations;

(4) $3.183 million for FY 2002 for completion of construction of Project 02–SC–002, Multiprogram Energy Laboratories Infrastructure Project Engineering Design (PED), Various Locations; and

(5) $18.633 million for FY 2002 and $13.029 million for FY 2003 for completion of construction of Project MEL–001, Multiprogram Energy Laboratories, Infrastructure, Various Locations.

Subsection 2581(d) provides that none of the funds authorized to be appropriated in subsection 2581(b) may be used for construction at any national security laboratory as defined in section 3281(1) of the National Defense Authorization Act for Fiscal Year 2000 (50 U.S.C. 2471(1)) or at any nuclear weapons production facility as defined in section 3281(2) of the National Defense Authorization Act for 2000 (50 U.S.C. 2471(2)). This limitation is included to preserve the Science Committee's sole jurisdiction over the bill, since the jurisdiction of these laboratories and facilities reside with the Committee on Armed Services.

TITLE VI—MISCELLANEOUS

Subtitle A—General Provisions for the Department of Energy

Section 2601. Research, Development, Demonstration and Commercial Application of Energy Technology Programs, Projects, and Activities.

Subsection 2601(a) requires that RD&D and commercial application programs, projects, and activities authorized under this Act be carried out under the procedures of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5901 et seq.), the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.), or any other Act under which the Secretary is authorized to carry out such programs, projects, and activities, only to the extent the Secretary is authorized to carry out such activities under each Act and except as otherwise provided in this Act.

Subsection 2601(b) authorizes the Secretary to use grants, joint ventures, and any other form of agreement available to the Secretary to the extent authorized under applicable provisions of law, contracts, cooperative agreements, cooperative R&D agreements under the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.), except as otherwise provided in this Act, to carry out RD&D and commercial application programs, projects, and activities.

Subsection 2601(c) defines the term "joint venture" for the purpose of this section to have the meaning given that term under section 2 of the National Cooperative Research and Production Act of 1993 (15 U.S.C. 4301), except that such term applies to RD&D and commercial application of energy technology joint ventures.

Subsection 2601(d) requires that section 12(c)(7) of the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3710a(c)(7)), relating to the protection of information, will apply to RD&D and commercial application of energy technology programs, projects, and activities under this Act.

Under subsection 2601(e), an invention conceived and developed by any person using funds provided through a grant under this Act shall be considered a subject invention for the purposes of chapter 18 of title 35, United States Code (commonly referred to as the Bayh-Dole Act).

Subsection 2601(f) requires the Secretary to ensure that each program authorized by this Act includes an outreach component to provide information, as appropriate, to manufacturers, consumers, engineers, architects, builders, energy service companies, universities, facility planners and managers, State and local governments, and other entities.

Subsection 2601(g) requires the Secretary to provide guidelines and procedures for the transition of energy technologies from research through development and demonstration to commercial application of energy technology where appropriate. Nothing in this section precludes the Secretary from: (1) entering into a contract, cooperative agreement, cooperative R&D agreement under the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.), grant, joint venture, or any other form of agreement available to the Secretary under this section that relates to RD&D and commercial application of energy technology; or (2) extending a contract, cooperative agreement, cooperative R&D agreement under the Stevenson-Wydler Technology Innovation Act of 1980, grant, joint venture, or any other form of agreement available to the Secretary that relates to RD&D to cover commercial application of energy technology.

Subsection 2601(h) states that this section shall not apply to any contract, cooperative agreement, cooperative R&D agreement under the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.), grant, joint venture, or any other form of agreement available to the Secretary that is in effect as of the date of enactment of this Act.

Section 2602. Limits on Use of Funds.

Subsection 2602(a) prohibits the use of funds authorized by this Act to award a management and operating contract for a federally owned or operated nonmilitary energy laboratory of the Department unless such contract is awarded using competitive procedures or the Secretary grants, on a case-by-case basis, a waiver to allow for such a deviation. The Secretary may not delegate the authority to grant such a waiver. At least 60 days before a contract award, amendment, or modification for which the Secretary intends to grant such a waiver, the Secretary shall submit to the appropriate

congressional committees a report notifying the committees of the waiver and setting forth the reasons for the waiver.

Subsection 2602(b) prohibits the Secretary from using funds to produce or provide articles or services for the purpose of selling the articles or services to a person outside the Federal Government, unless the Secretary determines that comparable articles or services are not available from a commercial source in the United States.

Subsection 2602(c) prohibits the Secretary from using funds to prepare or initiate Requests for Proposals for a program if Congress has not authorized the program.

Section 2603. Cost Sharing.

Except as otherwise provided in this subtitle, subsection 2603(a) mandates that for R&D programs carried out under this subtitle, the Secretary shall require a commitment from non-Federal sources of at least 20 percent of the cost of the project. The Secretary may reduce or eliminate the non-Federal requirement under this subsection if the Secretary determines that the R&D is of a basic or fundamental nature.

Similarly, under subsection 2603(b) the Secretary shall require at least 50 percent of the costs directly and specifically related to any demonstration or commercial application project under this subtitle to be provided from non-Federal sources. The Secretary may reduce the non-Federal requirement under this subsection if the Secretary determines that the reduction is necessary and appropriate considering the technological risks involved in the project and is necessary to meet the objectives of this subtitle.

In calculating the amount of the non-Federal commitment under subsection (a) or (b), the Secretary may include personnel, services, equipment, and other resources.

Section 2604. Limitations on Demonstrations and Commercial Application of Energy Technology.

Section 2604 requires the Secretary to provide funding only for scientific or energy demonstration and commercial application of energy technology programs, projects or activities for technologies or processes that can reasonably be expected to yield new, measurable benefits to the cost, efficiency, or performance of the technology or process.

Section 2605. Reprogramming.

Section 2605 prohibits the reprogramming of funds in excess of 105 percent of the amount authorized for a program, project, or activity, or in excess of $0.25 million above the amount authorized for the program, program, project, or activity until the Secretary submits a report to the appropriate congressional committees and a period of 30 days has elapsed after the date on which the report is received. The report shall be a full and complete statement of the proposed reprogramming and the facts and circumstances in support of the proposed reprogramming. This section prohibits the Secretary from obligating funds in excess of the total amount authorized to be appropriated to the Secretary by this Act and prohibits

the Secretary from using funds for any use for which Congress has declined to authorize funds.

TITLE VI—MISCELLANEOUS

Subtitle B—Other Miscellaneous Provisions

Section 2611. Notice of Reorganization.

Section 2611 requires the Secretary to provide notice to the appropriate congressional committees not later than 15 days before any reorganization of environmental research or development, scientific or energy research, development, or demonstration, or commercial application of energy technology program, project, or activity of the Department.

Section 2612. Limits on General Plant Projects.

Section 2612 requires the Secretary to halt the construction of a civilian environmental research, development, or demonstration, or commercial application of energy technology "general plant project" if the estimated cost of the project (including any revisions) exceeds $5.0 million unless the Secretary has furnished a complete report to the appropriate congressional committees explaining the project and the reasons for the estimate or revision.

Section 2613. Limits on Construction Projects.

Section 2613 prohibits construction on a civilian environmental R&D, scientific or energy RD&D, or commercial application of energy technology project for which funding has been specifically authorized by law to be initiated and continued if the estimated cost for the project exceeds 110 percent of the higher of: (1) the amount authorized for the project; or (2) the most recent total estimated cost presented to Congress as budget justification for such project. To exceed such limits, the Secretary must report in detail to the appropriate congressional committees on the related circumstances and the report must be before the appropriate congressional committees for 30 legislative days (excluding any day on which either House of Congress is not in session because of an adjournment of more than three days to a day certain). This section shall not apply to any construction project that has a current estimated cost of less than $5.0 million.

Section 2614. Authority for Conceptual and Construction Design.

Section 2614 limits the Secretary's authority to request construction funding in excess of $5.0 million for a civilian environmental R&D, scientific or energy research, development, or demonstration, or commercial application of energy technology program, project, or activity until the Secretary has completed a conceptual design for that project. Furthermore, if the estimated cost of completing a conceptual design for the construction project exceeds $0.75 million, the Secretary must submit a request to Congress for funds for the conceptual design before submitting a request for the construction project. In addition, the subsection allows the Secretary to carry out construction design (including architectural and engineering services) in connection with any proposed construction project that is in support of a civilian environmental R&D, scientific or energy

research, development, and demonstration, or commercial application of energy technology program, project, or activity of the Department if the total estimated cost for such design does not exceed $0.25 million; if the total estimated cost for construction design exceeds $0.25 million, funds for such design must be specifically authorized by law.

Section 2615. National Energy Policy Group Mandated Reports.

Subsection 2615(a) requires that upon completion of the Secretary's review of current funding and historic performance of the Department's energy efficiency, renewable energy, and alternative energy R&D programs in response to the recommendations of the May 16, 2001, Report of the National Energy Policy Development Group, the Secretary shall transmit a report containing the results of such review to the appropriate congressional committees.

Subsection 2615(b) requires that upon completion of the Office of Science and Technology Policy and the President's Council of Advisors on Science and Technology reviewing and making recommendations on using the Nation's energy resources more efficiently, in response to the recommendations of the May 16, 2001, Report of the National Energy Policy Development Group, the Director of the Office of Science and Technology Policy shall transmit a report containing the results of such review and recommendations to the appropriate congressional committees.

Section 2616. Independent Reviews and Assessments.

Section 2616 requires the Secretary to enter into appropriate arrangements with the National Academies of Sciences and Engineering to ensure that there be periodic reviews and assessments of the programs authorized by this Act, as well as the goals for such programs as established under section 2004. Such reviews and assessments shall be conducted at least every five years, and the Secretary shall transmit to the appropriate congressional committees reports containing the results of these reviews and assessments.

Division E: "Clean Coal Power Initiative Act of 2001"

Section 5000. Short Title

Subsection 5000 cites the division as the "Clean Coal Power Initiative Act of 2001."

Section 5001. Findings.

Section 5001 contains eight findings.

Section 5002. Definitions.

Section 5003 defines the term "cost and performance-based goals" to mean the cost and performance-based goals established under section 5004, and the term "Secretary" to mean the Secretary of Energy.

Section 5003. Clean Coal Power Initiative.

Subsection 5003(a) requires the Secretary to carry out the Clean Coal Power Initiative under: (1) this division; (2) the Federal Nonnuclear Energy Research and Development Act of 1974 (42

U.S.C.5901 et seq.); (3) the Energy Reorganization Act of 1974 (42 U.S.C.5801 et seq.); and (4) title XIII of the Energy Policy Act of 1992 (42 U.S.C.13331 et seq.), to achieve cost and performance goals established by the Secretary under section 5004.

Section 5004. Cost and Performance Goals.

Subsection 5004(a) requires the Secretary to perform an assessment that establishes measurable cost and performance goals for 2005, 2010, 2015, and 2020 for the programs authorized by this division. Such assessment must be based on the latest scientific, economic, and technical knowledge.

In establishing the cost and performance goals, subsection 5004(b) requires the Secretary to consult with representatives of: (1) the United States coal industry; (2) State coal development agencies; (3) the electric utility industry; (4) railroads and other transportation industries; (5) manufacturers of advanced coal-based equipment; (6) institutions of higher learning, national laboratories, and professional and technical societies; (7) organizations representing workers; (8) organizations formed to—(A) promote the use of coal; (B) further the goals of environmental protection; and (C) promote the production and generation of coal-based power from advanced facilities; and (9) other appropriate Federal and State agencies.

Under subsection 5004(c), the Secretary shall: (1) not later than 120 days after the date of enactment of this division, issue a set of draft cost and performance goals for public comment; and (2) not later than 180 days after the date of enactment, after taking into consideration any public comments received, submit to the Committee on Energy and Commerce and the Committee on Science of the House of Representatives, and to the Senate, the final cost and performance goals.

Section 5005. Authorization of Appropriations.

Except as provided in subsection 5005(c), subsection 5005(a) authorizes to be appropriated to the Secretary to carry out the Clean Coal Power Initiative under section 5003 $200.0 million for each of the fiscal years 2002 through 2011, to remain available until expended.

Notwithstanding subsection 5005(a), subsection 5005(b) prohibits the use of funds to carry out the activities authorized by this division after September 30, 2002, unless the Secretary has transmitted to the to the Committee on Energy and Commerce and the Committee on Science of the House of Representatives, and to the Senate, the report required by this subsection and one month has elapsed since that transmission. The report shall include, with respect to subsection 5005(a), a 10-year plan containing: (1) a detailed assessment of whether the aggregate funding levels provided under subsection 5005(a) are the appropriate funding levels for that program; (2) a detailed description of how proposals will be solicited and evaluated, including a list of all activities expected to be undertaken; (3) a detailed list of technical milestones for each coal and related technology that will be pursued; (4) recommendations for a mechanism for recoupment of Federal funding for successful commercial projects; and (5) a detailed description of how

the program will avoid problems enumerated in General Accounting Office reports on the Clean Coal Technology Program, including problems that have resulted in unspent funds and projects that failed either financially or scientifically.

Subsection 5005(c) provides that subsection 5005(b) shall not apply to any project begun before September 30, 2002.

Section 5006. Project Criteria.

Subsection 5006(a) prohibits the Secretary from providing funding for project that does not advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies that are in operation or have been demonstrated as of the date of the enactment of this division.

Subsection 5006(b) contains the technical criteria for the Clean Coal Power Initiative.

Under subsection 5006(b)(1)(A), in allocating the funds authorized under section 5005(a), the Secretary shall ensure that at least 80 percent of the funds are used only for projects on coal-based gasification technologies, including gasification combined cycle, gasification fuel cells, gasification coproduction and hybrid gasification/combustion.

Subsection 5006(b)(1)(B) requires the Secretary to set technical milestones specifying emissions levels that coal gasification projects must be designed to and reasonably expected to achieve. The milestones shall get more restrictive through the life of the program, and such milestones shall be designed to achieve by 2020 coal gasification projects able to: (1) remove 99 percent of sulfur dioxide; (2) emit no more than 0.05 pounds (lbs) of nitrous oxides (NO_X) per million British Thermal Unit (BTU); (3) achieve substantial reductions in mercury emissions; and (4) achieve a thermal efficiency of 60 percent (higher heating value).

For projects not described in subsection 5006(b)(1)(A) or subsection 5006(b)(1)(B), subsection 5006(b)(2) requires the Secretary to set technical milestones specifying emissions levels that the projects must be designed to and reasonably expected to achieve. The milestones shall get more restrictive through the life of the program, and such milestones shall be designed to achieve by 2010 projects able to: (1) remove 97 percent of sulfur dioxide; (2) emit no more than 0.08 lbs of NOx per million BTU; (3) achieve substantial reductions in mercury emissions; and (4) achieve a thermal efficiency of 45 percent (higher heating value).

Subsection 5006(c) prohibits the Secretary from providing a funding award under this division unless the recipient of the award has documented to the satisfaction of the Secretary that: (1) the award recipient is financially viable without the receipt of additional Federal funding; (2) the recipient will provide sufficient information to the Secretary for the Secretary to ensure that the award funds are spent efficiently and effectively; and (3) a market exists for the technology being demonstrated or applied, as evidenced by statements of interest in writing from potential purchasers of the technology.

Subsection 5006(d) requires the Secretary to provide financial assistance to projects that meet the requirements of subsections 5006 (a), (b), and (c) and are likely to: (1) achieve overall cost reductions

in the utilization of coal to generate useful forms of energy; (2) improve the competitiveness of coal among various forms of energy in order to maintain a diversity of fuel choices in the United States to meet electricity generation requirements; and (3) demonstrate methods and equipment that are applicable to 25 percent of the electricity generating facilities that use coal as the primary feedstock as of the date of enactment of this division.

Subsection 5006(e) limits the Federal share of the cost of a coal or related technology project funded by the Secretary to not more than 50 percent.

Subsection 5006(f) provides that neither the use of any particular technology, nor the achievement of any emission reduction, by any facility receiving assistance under this division shall be taken into account for purposes of making any determination under the Clean Air Act in applying the provisions of that Act to a facility not receiving assistance under this division, including any determination concerning new source performance standards, lowest achievable emission rate, best available control technology, or any other standard, requirement, or limitation.

Section 5007. Study.

Under subsection 5007(a), not later than one year after the date of enactment of this division, and once every two years thereafter through 2016, the Secretary, in cooperation with other appropriate Federal agencies, must transmit to the Committee on Energy and Commerce and the Committee on Science of the House of Representatives, and to the Senate, a report containing the results of a study to: (1) identify efforts (and the costs and periods of time associated with those efforts) that, by themselves or in combination with other efforts, may be capable of achieving the cost and performance goals; (2) develop recommendations for the Department of Energy to promote the efforts identified under (1); and (3) develop recommendations for additional authorities required to achieve the cost and performance goals.

In carrying out this section, subsection 5007(b) requires the Secretary shall give due weight to the expert advice of representatives of the entities described in subsection 5004(b).

Section 5008. Clean Coal Centers of Excellence.

As part of the Clean Coal Power Initiative authorized in section 5003, section 5008, which is included in the manager's amendment, requires the Secretary to award competitive, merit-based grants to universities for the establishment of Centers of Excellence for Energy Systems of the Future. Such centers shall be located at universities with a proven record of conducting research on, developing, or demonstrating clean coal technologies. The Secretary shall provide grants to universities that can show the greatest potential for demonstrating new clean coal technologies.

Legislative History

Representative W.J. (Billy) Tauzin, Chairman of the Committee on Energy and Commerce, introduced H.R. 4 on July 27, 2001. It was referred to the Committee on Energy and Commerce and, in addition, to the Committees on Science, Ways and Means, Re-

sources, Education and the Workforce, Transportation and Infrastructure, the Budget, and Financial Services. The Committee on Science held a markup of H.R. 4 on July 30, 2001 and discharged the bill on July 31, 2001, at which time the Committee on Rules filed H.Rept. 107–178 on H.Res. 216, providing for consideration of H.R. 4.

On August 2, 2001, the House agreed to H.Res. 216 by: Y–220, N–206 (Roll Call No. 307). On August 2, 2001, the House passed H.R. 4, as amended, by: Y–240, N–189 (Roll Call No. 320).

The Senate passed H.R. 4 by: Y–88, N–11 (Roll Call No. 94) after striking all after the enacting clause and inserting the text of S. 517, the Senate companion measure, as amended. The Senate Amendment contained several titles and provisions falling within the jurisdiction of the Committee on Science, including provisions related to energy research, development and demonstration (Sections 513–516, 770–772, 807–809, 814, 816, 824, 832, Titles XII, Title XIV, Sections 1502, 1504–1505, Title XVII and Sections 1801–1805), indemnification of nuclear energy programs (Sections 501–507, and 509) and global climate change policy and science and technology (Sections 1001–1022 and Titles XI and XIII).

On May 1, 2002, the Senate requested a conference and appointed conferees.

The House disagreed with the Senate amendment to H.R. 4 and agreed to a conference. From the Committee on Science, the Speaker appointed Science Committee Chairman Sherwood Boehlert, Energy Subcommittee Chairman Roscoe Bartlett, and Committee Ranking Minority Member Ralph Hall, provided that Representative Woolsey be appointed in lieu of Rep. Hall for consideration of sections 2001–2178 and 2201–2261 of Division B of the House bill and modifications committed to conference.

The Conferees met on June 27, July 25, September 12, 19, 25 and 26, and October 2 and 3, of 2002 and reached agreement on a number of key provisions in the Conference. However, the Conferees were unable to resolve differences on the remainder of the bill and the legislation died with the adjournment of 107th Congress.

2.2—H.R. 64, To provide for the establishment of the position of Deputy Administrator for Science and Technology of the Environmental Protection Agency, and for other purposes

Background and Summary of Legislation

The Environmental Protection Agency (EPA) is responsible for protecting the environment and public health through environmental regulation, enforcement, remediation, and voluntary programs. To carry out its mission, EPA is organized into thirteen 13 offices in Washington, D.C. and ten regional offices. Assistant Administrators (AA) head nine of the thirteen regulatory, science, and information offices. The AAs are of equal rank and report to the Deputy Administrator and the Administrator of the Agency.

Although EPA's mission is largely regulatory, it carries out a broad scientific research agenda to support regulatory decisions. The Office of Research and Development (ORD) is the scientific

arm of the Agency primarily responsible for carrying out this agenda. ORD conducts intramural research and administers extramural research to support the Agency's decisions. However, the Agency's regulatory offices also conduct various research efforts on issues specific to their mission.

Expert panels commissioned by the EPA and Congress have reviewed the EPA's science programs and have recommended structural and management changes to strengthen the role science plays in the decision-making process. In 1992, an expert panel commissioned by EPA recommended that EPA should appoint a "science advisor" because the process of ensuring that policy decisions are informed by a clear understanding of the relevant science—is not well defined or coherently organized within the EPA.

In the 1995 Departments of Veterans Affairs and Housing and Urban Development Appropriations Act, Congress directed EPA to obtain an independent review of the overall structure and management of EPA's research program and the Agency's scientific peer-review procedures. The National Academy of Sciences released four reports in response to this charge. The final report, "Strengthening Science at the U.S. Environmental Protection Agency: Research-Management and Peer-Review Practices," was released in June 2000 and serves as the basis for this legislation.

According to the Academy report, a new Deputy for Science and Technology is needed to serve as an advocate for science within upper management at the Agency and is needed to coordinate research among the regulatory and scientific arms of the Agency. The authors argued that the new Deputy Administrator is needed because this person would (1) rank higher than the existing AAs, thereby fostering better research relationships between ORD and the Agency's regulatory offices; (2) provide central science-policy authority to administer the Agency's science work; (3) have the appropriate authority to ensure that the best possible peer-review and research-planning practices, and (4) elevate the role of science in the decision-making process. The Academy concluded, "The importance of science in EPA decision-making process should be no less than that afforded to legal considerations."

The report also recommended that the AA for ORD be turned into a six-year appointed position to help ensure greater continuity in long-term research programs. The tenure of an AA at ORD averages two to three years and is typically a lower priority appointment in new administrations, thereby undermining the stability needed to sustain a quality research program. According to the report, a longer tenure for the AA would help insulate the office during changes in the Administration, thereby providing more continuity for research conducted at the Agency.

The purpose of H.R. 64 is to establish a Deputy Administrator for Science and Technology at EPA, who would be given the title of Chief Scientist and appointed for a fixed term at EPA. It is intended to increase the political clout of science at the Agency while it decreases the political pressures on the AA for ORD.

Legislative History

Representative Vernon J. Ehlers, Chairman of the Subcommittee on Environment, Technology, and Standards, introduced H.R. 64 on

January 3, 2001. The bill was referred to the Science Committee on February 14, 2001. On March 29, 2001, the Environment, Technology, and Standards Subcommittee held a hearing on this bill.

The Subcommittee met on May 17, 2001, to consider the bill. Representative Ehlers and Subcommittee Ranking Minority Member James Barcia offered a manager's amendment, which was adopted by a voice vote. The manager's amendment clarified the role and duties of the new Deputy Administrator, reduced the Assistant Administrator's term from six years to five, and dropped a paragraph outlining "the sense of Congress" on how the Office of Research and Development should operate. The Subcommittee reported the bill, H.R. 64, as a single amendment in the nature of a substitute, by a voice vote.

On October 3, 2001, the Science Committee considered H.R. 64. Representative Sheila Jackson Lee offered an amendment to clarify the guidelines for the dissemination of research results. Representative Jackson Lee's amendment called for the guidelines to recognize historically black colleges and universities, Hispanic serving institutions, and other minority and rural communities. Chairman Boehlert offered a second-degree amendment to the amendment further clarifying the intent of Representative Jackson Lee's amendment, and it was adopted. The Committee then adopted Representative Jackson Lee's amendment, as amended. The Committee reported the bill as amended, by voice a vote.

On November 30, 2001, the Committee filed H.Rept. 107–311. On April 30, 2002, the House agreed to suspend the rules and pass H.R. 64, as amended, by a voice vote. The bill was received in the Senate and was referred to the Committee on Environment and Public Works on May 1, 2002. No further action was taken in the Senate.

2.3—H.R. 100, National Science Education Act

Background and Summary of Legislation

In 1945 when Dr. Vannevar Bush transmitted his landmark report, 'Science—the Endless Frontier,' he paraphrased Harvard President John Conant in making the case for the importance of a targeted investment in mathematics and science education as part of a national research policy:

> In every section of the entire area where the word science may properly be applied, the limiting factor is a human one. We shall have rapid or slow advance in this direction or in that depending on the number of really first-class scientists who are engaged in the work in question. So in the last analysis, the future of science in this country will be determined by our basic educational policy.

This analysis is as true today as it was fifty years ago. Recent studies have shown that the most important factor in successful educational improvement efforts, especially those in science, math, engineering and technology, is the skill of enthusiastic and well-prepared teachers. When integrating the needs of learners into the context of the emerging needs of the American workplace and society, the truth of the observation 'teaching is the essential profes-

sion, the one that makes all other professions possible' is obvious. Teachers provide the essential connection between students and the content they are learning. A gifted and well-trained teacher can instill the excitement of scientific inquiry while anchoring the material in the context of everyday life.

Thus, high quality teachers must be identified, recruited, and retained in every school district throughout the Nation. K–12 science, mathematics, engineering, or technology teachers should be respected by their peers, rewarded financially and intellectually, and have sufficient opportunities for advancement. In exchange, we must expect that all teachers have mastered their content area, curricula, up-to-date research in teaching and learning, and techniques that can be used to connect information to the students in their classrooms.

The National Commission on Mathematics and Science Teaching for the 21st Century concluded that the most efficient way to disseminate information about best practices and to improve the quality of professional development was to train a cadre of master teachers. These teachers, who must be well versed in the most effective teaching methods, have demonstrated the ability to obtain high student achievement, and be able to effectively use technology for teaching and learning, can assume responsibility for reviewing and modifying curriculum and developing and implementing professional development and mentoring programs for their peers. H.R. 100, the National Science Education Act (NSEA) responds to these recommendations and authorizes the Director of the National Science Foundation to establish a program to provide grants to universities to train master teachers and for other purposes designed to improve the instruction of elementary and secondary mathematics and science education.

Legislative History

Representative Vernon J. Ehlers, Chairman of the Subcommittee on Environment, Technology, and Standards, introduced H.R. 100 on January 3, 2001. It was referred to the Committee on Science. On February 14, 2001 it was referred to the Subcommittee on Research. The Subcommittee on Research held a markup on June 7, 2001. Science Committee Chairman Sherwood Boehlert offered an amendment in the nature of a substitute; to revise Section 4, the master teacher program, by authorizing grants to institutions of higher education for the purpose of training master teachers; to revise section 9, the distance learning grant program, by providing grants to higher education institutions for the implementation of K–12 distance learning programs; and to strike Section 3—Assurance of Continued Local Control, Section 7—Teacher Technology Professional Development, Section 10—Scholarships to Participate in Certain Research Activities, and Section 11—Interagency Coordination of Science Education Programs. The amendment was adopted by a voice vote. On June 13, 2001 the Committee on Science held a markup and ordered the measure reported, as amended, by a voice vote. The Committee filed H.Rept. 107–133, Pt. 1 on July 11, 2001. On July 30, 2001 the House agreed to suspend the rules and pass H.R. 100, as amended, by a voice vote. On July 31, 2001, H.R. 100 was received in the Senate and referred

to the Senate Committee on Health, Education, Labor, and Pensions. Provisions of H.R. 100 were incorporated into H.R. 4664, the National Science Foundation Authorization Act of 2002 which became P.L. 107–368.

2.4—H.R. 524, Electronic Commerce Enhancement Act of 2001

Background and Summary of Legislation

H.R. 524 requires the Director of the National Institute of Standards and Technology (NIST) to establish an Advisory Panel to report to Congress on the challenges facing small and medium-sized manufacturers and other such businesses in integrating and utilizing electronic commerce technologies and business practices. The bill requires the final report to include: (1) a three-year planning document for NIST's Manufacturing Extension Partnership (MEP) program in the field of electronic commerce; and (2) recommendations for NIST to address interoperability issues in electronic commerce.

The bill requires the MEP program to establish a pilot program to assist small and medium-sized manufacturers and businesses in integrating and utilizing electronic commerce technologies and business practices through a competitive grants program, and to design the program based on recommendations in the Panel's reports.

H.R. 524 also requires the Director of NIST to: (1) identify critical enterprise integration standards and implementation activities for major manufacturing industries; (2) report to Congress on such matters and anticipated related NIST activities for that fiscal year; and (3) submit to Congress a plan for enterprise integration for each major manufacturing industry. Requires annual plan updates for an industry until enterprise integration has been achieved.

Legislative History

H.R. 524 was introduced in the House by Representative James Barcia, Ranking Minority Member of the Subcommittee on Environment, Technology, and Standards, on February 8, 2001 and was referred to the Committee on Science. Under suspension of the rules, the bill passed on February 14, 2001 by: Y–409, N–6 (Roll Call No. 14). The measure was received in the Senate on the same day and was referred to the Committee on Commerce, Science, and Transportation. No further legislative action was taken in the Senate.

2.5—H.R. 1259, Computer Security Enhancement Act of 2001

Background and Summary of Legislation

Computer Security Enhancement Act of 2001—Amends the National Institute of Standards and Technology Act to require the Institute to provide assistance to Federal agencies in the protection of computer networks, promote Federal compliance with computer information security and privacy guidelines, and assist Federal response efforts to unauthorized access to Federal systems.

Section 4—Computer Security Implementation

Requires the Institute to develop uniform standards for the cost-effective security and privacy of sensitive information in certain Federal systems, provide a list of certified commercial computer system security products, and report annually on Federal computer system evaluations.

Section 5—Computer Security Review, Public Meetings, and Information

Directs the Institute to solicit Computer System Security and Privacy Advisory Board recommendations regarding standards. Authorizes appropriations for FY 2002 and 2003 to enable the Board to identify emerging computer security, privacy, and cryptography issues.

Section 6—Limitation on Participation in Requiring Encryption and Electronic Authentication Standards

Prohibits the Institute from adopting encryption and electronic authentication standards for other than Federal computer systems.

Section 7—Miscellaneous Amendments

Authorizes (current law requires) the Institute to draw upon National Security Agency computer security guidelines.

Section 8—Federal Computer System Security Training

Amends the Computer Security Act of 1987 to require Federal computer security training to emphasize protecting information accessible through public networks.

Section 9—Computer Security Fellowship Program

Authorizes appropriations for FY 2002 and 2003 for fellowships to students in computer security.

Section 10—Study of Electronic Authentication Technologies by the National Research Council

Requires a National Research Council of the National Academy of Sciences to: (1) conduct a study of electronic authentication technologies; and (2) report to specified congressional committees on its findings, conclusions, and recommendations for public policy related to such technologies. Authorizes appropriations for FY 2002.

Section 11—Promotion of National Information Security

Directs the Under Secretary of Commerce for Technology to promote an increased use of security technologies for the Nation's information infrastructure, establish a central repository of information on security vulnerability and risks, and promote the development of national infrastructures for encryption technologies.

Section 12—Electronic Authentication Infrastructures

Directs the Institute's Director to develop technology-neutral electronic authentication infrastructure standards for Federal agencies, provide a list of commercially available authentication products, establish core specifications for Federal electronic certification

and management technologies, provide a list of conforming systems, and report annually on infrastructure implementation.

Section 13—Authorizes appropriations for FY 2002 and 2003.

Legislative History

H.R. 1259 was introduced in the House by Representative Constance Morella on March 28, 2001 and was referred to the Committee on Science. It was discharged from the Committee on November 27, 2001 and passed the House, as amended, under suspension of the rules by: Y–391, N–4 (Roll Call No. 449). The bill was received in the Senate on November 28, 2001 and was referred to the Committee on Commerce, Science, and Transportation. No further legislative action was taken in the Senate.

2.6—H.R. 1858, National Mathematics and Science Partnership Act

Background and Summary of Legislation

President George W. Bush has called on the Nation to develop partnerships involving parents, teachers, school administrators, chief state school officers, leaders of the business community, and institutions of higher education. Individually, none of these groups has the capacity to address the problem that is before us. By forming partnerships, however, each group can make meaningful contributions and can accomplish together what none of them can accomplish alone.

The National Mathematics and Science Partnerships Act responds to the President's call. Using the resources of the National Science Foundation, it encourages local communities to participate in model partnerships designed to reform the instruction of elementary and secondary school mathematics and science education. The Partnerships Act recognizes the unique contribution that institutions of higher education and businesses can make to education reform. It draws upon these strengths to develop model programs that, if proven successful, will hold the key to large-scale education reform efforts that can be conducted by state and local educational agencies.

One of the first challenges that the partnerships must face will be the development and implementation of better preparatory training and professional programs for teachers. Under the partnership model, successful efforts will look beyond the colleges of education to involve professional scientists, mathematicians and engineers from institutions of higher education, government and industry. New models for professional development will be developed and elementary and secondary mathematics and science teachers will be given opportunities to expand their own horizons through research opportunities at universities, government or industry laboratories.

The need to recruit well-prepared teachers is an equally critical challenge to mathematics and science education reform. A recent study conducted by the National Council for Accreditation of Teacher Preparation showed that 50,000 new teachers enter the profession each year lacking appropriate preparation. Nearly 25 percent of all secondary teachers do not have a college major or minor in

their main teaching field and, in particular, more than 30 percent of secondary mathematics teachers hold neither a major nor a minor in mathematics. Teachers must possess a command of science and math content at a level sufficient to distill the important concepts and methodology and to present activities and opportunities to students that will allow them to explore and understand basic concepts, logic, and applications of mathematics and science. To encourage mathematics, science, and engineering students to pursue careers in teaching, the Act establishes the Noyce Scholarship Program in which students are offered scholarships in exchange for a commitment to teach. In addition, the Noyce Scholarship Program will facilitate transitions to careers in teaching for the most capable science, engineering, mathematics and technology professionals. These scholarships are named for Robert N. Noyce, an inventor of the integrated circuit and co-founder of Intel.

A more robust body of research about student learning must guide teacher recruitment, preparation and professional development and other education reform efforts. Recent reports of the National Academy of Sciences have shown that a wide and troublesome gap exists between our current understanding of how the brain functions during learning and actual classroom practices. The gap between research and practice is even wider in the use of educational technologies in instruction or assessment. Aggressive technological expansion programs have resulted in the acquisition of computer technology by over 99 percent of schools, yet many schools have not optimized the use of these computers for instruction, assessment, or teacher enhancement. In part, this disparity in the use of technology is the result of a shortage of professional development opportunities for teachers, but also reflects a fundamental lack of understanding of how best to use technology in teaching. The Partnerships Act recognizes that better research must provide the foundation for state and local education reform efforts. Titles III and VI of the Partnerships Act authorize research programs designed to provide educators and policy makers with scientifically based methods and materials upon which to build education reform activities.

In short, this Act calls on individuals, institutions of higher education, state and local educational agencies and corporations to collaboratively develop and implement programs to recruit the Nation's brightest into careers in teaching, support these teachers through meaningful training, engage them in high quality lifelong learning opportunities, and arm them with scientifically-based, empirically validated teaching tools and practices to enable them to be successful in their work.

Legislative History

On May 16, 2001, Science Committee Chairman Sherwood Boehlert introduced H.R. 1858, the National Mathematics and Science Partnerships Act, a bill to authorize appropriations for science, mathematics, engineering and technology education for Fiscal Years 2003 through 2011. On May 24, 2001 it was referred to the Subcommittee on Research.

The Subcommittee on Research met on June 7, 2001, to consider the bill. Subcommittee Chairman Nick Smith and Ranking Minor-

ity Member Eddie Bernice Johnson offered an en bloc amendment. In addition to making technical corrections to the bill, the amendment (1) removed the requirement for matching funds for each authorized program and instead permitted the Director of the National Science Foundation (NSF) to establish matching requirements for any of the programs authorized by the bill with the exception of the Noyce Scholarship program; (2) specified that allowable activities under the Mathematics and Science Education Partnerships include programs that encourage the interest of girls in science, mathematics, engineering, and technology; (3) required applications for Partnership grants that will provide education programs for students to describe how the proposed activities will encourage the interest of women and minorities in science, mathematics, engineering, and technology and prepared them to pursue further education in those fields; (4) enabled funds from Digital Libraries grants to be used to provide assistance to schools using materials made available through the Digital Library; (5) required the NSF Director to consider the capacity of grant applicants for the Strategic Education Research Centers to attract and support graduate students studying education research and related fields; (6) established a fellowship program for K–12 teachers to pursue education research at institutions of higher education; (7) changed the amount that Noyce scholarship recipients must pay back if they fail to complete their full service obligation; (8) removed the requirement that NSF hold a conference on improving K–12 science, mathematics, engineering, and technology education; (9) established a program at NSF to award grants to local educational agencies working in partnership with industry to develop and improve K–12 math, science, and information technology education programs; (10) required the NSF Director to give priority to grant proposals under the Scientific and Advanced-Technology Act of 1992 to proposals that involve secondary schools with a majority of students from groups underrepresented in the science, mathematics, and engineering workforce; (11) required the NSF Director to review NSF's in-service teacher professional development programs; and (12) established a program to award grants for the creation of centers to evaluate and improve the effectiveness of K–12 information technologies. The amendment was adopted by a voice vote.

On June 13, 2001, the Committee met to consider the bill, H.R. 1858, as reported by the Subcommittee on Research. Committee Chairman Sherwood Boehlert and Ranking Minority Member Ralph Hall offered an en bloc amendment. In addition to making technical corrections to the bill, the amendment (1) specified that allowable activities under the Mathematics and Science Education Partnerships includes programs that support research projects performed by high school students; (2) allowed funds for Mathematics and Science Education Partnerships to be used to provide stipends for teachers or students participating in certain training or research activities; (3) required the Digital Library to compile information on national and regional K–12 education conferences; (4) required the Strategic Education Research Centers to conduct research and development activities designed to improve the performance of a broad range of students; (5) required Noyce Scholarship program recipients to supply relevant statistical and demographic

data on scholarship and stipend recipients; (6) required the NSF Director to submit a report to Congress on the impact of the program; (7) allowed the NSF Director to award grants for the development of K–12 educational materials on energy issues; (8) required the NSF Director to conduct a study on the impact of and access to high bandwidth capacity to the Internet for schools and libraries; (9) allowed the NSF Director to award grants to higher education institutions to establish centers to assist K–12 schools in the use of information technology for math, science and technology instruction; and (10) allowed the NSF Director to award a grant to a consortium of community colleges to encourage women, minorities, and persons with disabilities to study mathematics, science, engineering, and technology. The amendment was adopted by a voice vote.

On July 11, 2001 the Committee on Science filed H.Rept. 107–134, Pt. 1. On July 30, 2001 the House agreed to suspend the rules and pass H.R. 1858, as amended, by a voice vote. It was received in the Senate on July 31, 2001 and referred to the Senate Committee on Health, Education, Labor, and Pensions. Provisions of H.R. 1858 were included in H.R. 4664, the National Science Foundation Authorization Act which became P.L. 107–368.

2.7—H.R. 2051, To authorize the National Science Foundation to establish regional centers for the purpose of plant genome and gene expression research and development and international research partnerships for the advancement of plant biotechnology in the developing world

Background and Summary of Legislation

The National Science Foundation (NSF) has been at the forefront of research aimed at better understanding the molecular, genetic, and biochemical nature of plants. Developments based on this research have driven progress in the field of agricultural biotechnology—and thus are of tremendous interest to the agricultural community. NSF-funded research in this area, however, is in keeping with the agency's mission of basic research and therefore has focused primarily on efforts to better understand the fundamental biology of plants.

One area of particular focus for NSF has been study of the plant *Arabidopsis thaliana,* which is a relative of plants such as broccoli and cauliflower. *Arabidopsis* has been used by scientists as a model organism for plant biology studies for many years, and an effort to sequence the entire *Arabidopsis* genome—analogous in many ways to the Human Genome Project—was completed in December 2000. That effort, part of NSF's Plant Genome Research Program, involved the work of a consortium of scientists from six different countries. NSF led the effort for the United States with support from the Department of Agriculture (USDA) and the Department of Energy (DOE).

While having the complete DNA sequence of an organism is an important step in understanding how that organism functions, just knowing the sequence of all of an organism's genes is not enough to gain a full understanding of the organism. Central to scientists'

efforts to better understand plants is a clearer understanding of what individual genes in the organism actually do—information that cannot be derived from DNA sequences alone. NSF recently launched a research program to determine the functions of all 25,000 *Arabidopsis* genes—the '2010 Project,' which began in FY 2001. Better understanding the specific roles of various plant genes and how they contribute to the overall function of the plant provides the foundation for all aspects of plant biotechnology.

The promise of a program such as NSF's 2010 Project is in its ability to harness fundamental knowledge to solve additional research questions and, eventually, to help solve problems related to plant production and utilization. While understanding the biology of *Arabidopsis* will provide insight into the basic genetics and physiology of all plants, additional research is required to better understand the unique features of more complex plants including commercially-valuable crop plants such as corn and wheat. H.R. 2051 would expand NSF's support of genomics research to include new agriculturally important species and applications of the knowledge derived from studies of genomics.

Food for the Developing World.—The 'Green Revolution' of the 1960's is credited with saving a billion lives through the implementation of novel agricultural technologies—selective breeding and hybridization techniques, the introduction of inorganic fertilizers, and utilization of controlled irrigation procedures—in parts of the developing world. The Green Revolution, however, was not a permanent solution to feeding the ever-increasing world population. In his acceptance speech for the 1970 Nobel Peace Prize, Dr. Norman Borlaug cautioned that the Green Revolution had only 'won a temporary success in man's war against hunger,' given the globe's burgeoning population. While the world's population has grown significantly over the past four decades, natural resources and cropland have not. In addition, subsistence farming has led to mineral depletion, erosion, and increased salinity or acidity of much of that land. While technological developments have resulted in improved crop yields, many people in the developing world still go hungry every day.

Biotechnology has already shown promise for producing plants that are more tolerant to drought or high soil salt levels, can resist insect, fungal, and viral infections, and improve the nutritional content of food. Also, since some staple crops of the African diet, such as the cassava tuber, have little or no nutritive value, enhancing the nutritional content of food could be a key weapon in the fight against malnutrition and disease. For example, the 'golden rice' project, which involved the incorporation of genes able to lead to the production of vitamin A in rice, created a nutritionally-enhanced plant that could potentially reduce the effects—such as blindness—of endemic vitamin A deficiency in the developing world. Other nutritionally-enhanced food products, such as those with increased levels of cancer-fighting compounds, for example, could also potentially be produced. Beyond plant-based production of pharmaceuticals, researchers are also using biotechnology to develop foods that are a direct source of edible vaccines. These vaccines are genetically incorporated into food plants, need no refrigeration, and require no sterilization equipment or needles for deliv-

ery. Such a vaccine delivery system could overcome many of the health care and transportation infrastructure limitations in many parts of the developing world.

Federal funding for genomic research on developing world crops, or so called 'orphan crops,' will play an important role in the development of agricultural biotechnology in the developing world. Private companies have contributed a great deal to the advancement of agricultural biotechnology, but their focus has been on commodities that are grown in temperate climates, such as corn and soybeans. Little research has been done on orphan crops because private companies have very little incentive to invest in products that will not bring a financial return. While not a solution in itself in combating many of the problems of the developing world, public funding for genomic and biotechnology research on developing world crops will serve as a catalyst in helping the technology reach its potential in fighting hunger, malnutrition and disease.

Research on risks associated with agricultural biotechnology.—Balancing these promising technological developments, however, are concerns that the introduction of new compounds to a given plant could upset the biochemical balance of the plant in a way that renders the plant harmful for human consumption. Additional research, including that aimed at better understanding the underlying biology of plants and the effects of introducing new biochemical pathways, will continue to develop our ability to assess any risks to the environment or to human health that these new varieties may pose.

Other potential risks to the environment exist as well. Transmission of unwanted genetic traits from modified crop plants to nearby plant relatives, adverse impacts on insect populations that feed on modified plants, more rapid acquisition of resistance to pesticides by insect pests, and other ecological concerns will require additional assessment.

Beyond technological concerns, socioeconomic issues associated with the development and use of these new technologies in developing countries exist as well. For example, these countries typically do not have national regulatory bodies that review genetically altered crops to determine whether their introduction is appropriate.

The programs authorized by H.R. 2051 will enable researchers to build on our current knowledge base and accelerate the development of this promising technology while continuing to address concerns related to its safety.

Legislative History

On June 5, 2001, Research Subcommittee Chairman Nick Smith introduced H.R. 2051, a bill to provide for the establishment of regional plant genome and gene expression research and development centers. On June 15, 2001 it was referred to the Subcommittee on Research and a hearing was held on September 25, 2001.

The Subcommittee on Research met on December 12, 2001, to consider the bill. Representative Smith and the Subcommittee Ranking Minority Member Eddie Bernice Johnson, offered an en bloc amendment. In addition to making technical corrections to the bill, the amendment incorporated the major provisions of H.R.

2912, a bill to establish plant biotechnology partnerships with the developing world, introduced by Representative Johnson. The amendment also (1) dropped the requirement that NSF could not contribute more than 50 percent of the funds needed to establish plant genome and gene expression centers; and (2) combined the authorization amounts of H.R. 2051 and H.R. 2912 into one authorization amount for carrying out the provisions of the bill. The amendment was adopted by a voice vote.

On March 20, 2002, the Committee met to consider the bill, H.R. 2051, as reported by the Subcommittee on Research. With a quorum present, Ms. Johnson moved that the Committee report the bill, H.R. 2051, as amended. The motion was agreed to by a voice vote. On April 30, 2002 the Committee on Science filed H.Rept. 107–422.

On May 14, 2002 the House agreed to suspend the rules and pass H.R. 2051, as amended, by a voice vote and on May 15, 2002 it was received in the Senate and referred to the Senate Committee on Health, Education, Labor, and Pensions. Provisions of H.R. 2051 were included in H.R. 4664, the National Science Foundation Authorization Act of 2002 which became P.L. 107–368.

2.8—H.R. 2275, Voting Technology Standards Act of 2001

Background and Summary of Legislation

Establishes a commission, chaired by the director of the National Institute of Standards and Technology (NIST), to develop voluntary technical standards to ensure the usability, accuracy, security, and integrity of U.S. voting products and systems.

Requires NIST to: (1) accredit independent laboratories to test and certify that voting products and systems conform with the standards established by the commission; (2) disseminate such standards, other relevant technical information, guidelines for usage of the standards, and any other information appropriate to assist States in implementing the standards; and (3) maintain and make available, including through the Internet, a list of U.S. voting products and systems that have been certified by an accredited laboratory to conform with the standards established by the commission.

Directs the Director of NIST to establish a program for research and development in areas to support the development of such standards.

Legislative History

On May 22, 2001, the Science Committee held a hearing to examine the role of standards in voting technology. Subcommittee on Environment, Technology, and Standards Chairman Vernon J. Ehlers introduced H.R. 2275, for himself and Ranking Minority Member James Barcia, on June 21, 2001.

The Subcommittee met on June 27, 2001, to consider the bill. Chairman Ehlers and Ranking Minority Member Barcia offered a manager's amendment, which was adopted by a voice vote. The Subcommittee favorably reported the bill, H.R. 2275, by a voice vote, as amended.

On July 18, 2001, the Committee on Science met to consider H.R. 2275. Representative Sheila Jackson Lee offered an en bloc amendment to restrict Voting Standards Commissioners to serving no more than three terms, ensure the accreditation of at least one minority-owned testing laboratory, and require a report to Congress. The amendment was adopted by a voice vote.

The Committee on Science favorably reported the bill, H.R. 2275, as amended, by a voice vote.

Provisions of H.R. 2275, including those: (1) creating a panel of experts led by the director of NIST to develop voluntary voting standards; (2) directing NIST to evaluate laboratories for accreditation for the testing of voting equipment; and (3) authorizing research to support the development of voting system standards, were incorporated into H.R. 3295, the Help America Vote Act, as introduced in the House on November 14, 2001.

H.R. 3295 was cleared for the President on October 16, 2002 and signed into law on October 29, 2002, becoming P.L. 107–252.

2.9—H.R. 2426, Remote Sensing Applications Act of 2002

Background and Summary of Legislation

The Remote Sensing Applications Act of 2002 directs the Administrator of the National Aeronautics and Space Administration (NASA) to: (1) establish a program of grants for pilot projects to explore the integrated use of sources of remote sensing and other geospatial information to address State, local, regional, and tribal agency needs; (2) establish an advisory committee to monitor the program; (3) transmit to Congress an independent evaluation of program effectiveness; and (4) ensure that project results are retrievable through an Internet-accessible database. It also requires the Administrator to seek opportunities to assist: (1) in the development of commercial applications potentially available from the remote sensing industry; and (2) State, local, regional, and tribal agencies in applying remote sensing and geospatial information technologies for growth management.

The bill also requires the Administrator to establish an educational outreach program to increase awareness at institutions of higher education and such agencies of the potential applications of remote sensing and geospatial information. In addition to this, the bill requires the Administrator to study the effect of remote sensing imagery costs on potential State, local, regional, and tribal agency applications.

Legislative History

On June 28, 2001 Representative Mark Udall introduced H.R. 2426, the Remote Sensing Application Act of 2001. It was referred to the House Science Committee, Subcommittee on Space and Aeronautics on July 9, 2001.

On May 20, 2002, the Subcommittee on Space and Aeronautics held a hearing on state and local community use of NASA's remote sensing applications program.

On September 30, 2002 the House Science Committee discharged H.R. 2460 and on October 1, 2002 the House agreed to suspend the rules and pass H.R. 2460, as amended, by a voice vote. The meas-

ure was received in the Senate on October 2, 2002. No further legislative action was taken.

2.10—H.R. 2460, Comprehensive Energy Research and Technology Act of 2001

Background and Summary of Legislation

H.R. 2460 authorizes R&D funding and enumerates goals for energy RD&D and commercial application programs targeting the following areas: (1) energy conservation and efficiency with respect to the building technology, state, and community sector, the industry sector, power technologies, and the transportation sector; (2) renewable energy targeting hydrogen research, bioenergy, geothermal technology development, hydropower, concentrating solar power, photovoltaic energy systems, solar building technology research, wind energy systems, electric energy systems and storage, international renewable energy and renewable energy production incentive programs, and renewable program support; (3) nuclear energy; (4) fossil energy; and (5) science. The bill also provides cost-sharing and reporting guidelines.

Legislative History

H.R. 2460 was introduced by Science Committee Chairman Sherwood Boehlert on July 11, 2001 and was referred to the Committee on Science and Subcommittee on Energy. On July 17, 2001, the subcommittee discharged the bill. The Committee met on July 18, 2001 and ordered the measure reported, as amended, by a voice vote. On July 31, 2001, the Committee filed H.Rept. 107–177. Provisions of H.R. 2460 were incorporated into H.R. 4, the Securing America's Future Energy Act of 2001, which is described in detail above.

2.11—H.R. 2478, Comprehensive Renewable Energy and Energy Efficiency Act of 2001

Background and Summary of Legislation

The purpose of this bill is to set forth a statutory framework for RD&D and commercial applications programs designed to enable 20 percent of domestic energy to be generated from non-hydropower renewable energy sources by 2020. The bill prescribes requirements for such programs in renewable energy and energy efficiency and sets goals for energy RD&D and commercial application programs. Also includes tax provisions relating to incentives for energy efficiency and renewable energy.

The bill instructs the Secretary of Energy to: (1) provide private sector commercialization assistance for renewable energy and energy efficiency technologies; (2) establish a fuel cell technologies demonstration program; and (3) establish a National Electric System Public Benefits Board to administer a National Electric System Public Benefits Fund.

It sets goals for energy RD&D, and commercial application programs targeting the following areas: (1) energy conservation and efficiency; (2) renewable energy; (3) nuclear energy; (4) fossil energy; and (5) science.

The bill also: establishes the High Performance Schools grant program; amends Federal transportation law to mandate: (1) increased vehicle fuel economy standards; and (2) a national tire fuel efficiency program; establishes the Energy Star program to promote cost-effective energy-efficient products and buildings; prescribes requirements for: (1) Federal electric power purchases; (2) Federal buildings energy efficiency; (3) guaranteed energy savings; and (4) Federal use of Energy Star standards.

Finally, the bill makes a number of changes to the Internal Revenue Code to allow tax credits for: (1) certain energy efficient business property; (2) the manufacture of energy efficient appliances; (3) construction of a new energy-efficient home; (4) energy efficiency improvements to existing homes; (5) residential solar, wind, and fuel cell energy property; and (6) purchase of Energy Star products. It allows a deduction for energy-efficient commercial building property expenditures, and prescribes depreciation requirements for: (1) distributed power property; and (2) property used in electricity transmission. Increases the credit rate for electricity produced from renewable and waste products. Treats facilities using bagasse to produce energy as solid waste disposal facilities eligible for tax-exempt financing. Grants an investment tax credit for additional plant capacity for existing renewable resources facilities producing electricity. In addition, it allows tax credits for: (1) alternative motor vehicles placed in service; (2) retail sales of alternative fuels for motor vehicles; and (3) installation of alternative fueling stations. Extends the deduction for certain refueling property.

Legislative History

On July 11, 2001, Representative Lynn Woolsey, Ranking Minority Member of the Subcommittee on Energy, introduced H.R. 2478. It was referred to the Committees on Science, Ways and Means, and Energy and Commerce. On July 23, 2001 it was referred to the Subcommittee on Energy of the Committee on Science. On July 31, 2001, the bill was referred to the Subcommittee on Energy and Air Quality, of the Committee on Energy and Commerce. Rep. Woolsey incorporated the goals section of H.R. 2478 into H.R. 2460, the Comprehensive Energy Research and Technology Act of 2001, by way of amendment, which was subsequently incorporated into Division B of H.R. 4.

2.12—H.R. 2587, Energy Advancement and Conservation Act of 2001

Background and Summary of Legislation

The purposes of H.R. 2587 are to enhance energy conservation and to provide for security and diversity in the energy supply for the American people.

Title I: Energy Conservation Subtitle A: Reauthorization of Federal Energy Conservation Programs—Amends the Department of Energy Organization Act to reauthorize through FY 2006 specified Federal Energy Conservation Programs including: (1) promotion of export of energy efficient products; (2) energy conservation standards for new buildings; (3) the Federal Energy Management Pro-

gram; (4) energy efficient lighting and building centers; (5) energy efficiency labeling for windows and window systems; (6) energy efficiency for commercial office equipment; (7) energy efficiency information for luminaries; (8) energy efficiency in industrial facilities; and (9) process-oriented industrial energy efficiency.

Legislative History

H.R. 2587 was introduced by Representative W.J. (Billy) Tauzin and jointly referred to the Committee on Science on July 23, 2001. The Committees of jurisdiction discharged the bill on July 25, 2001. Provisions of H.R. 2587 were incorporated into H.R. 4, Securing America's Future Energy Act of 2002.

2.13—H.R. 2983, PRICE-ANDERSON REAUTHORIZATION ACT OF 2001

Background and Summary of Legislation

H.R. 2983 amends the Atomic Energy Act of 1954 to extend from 2002 to 2017 the indemnification authority of the Nuclear Regulatory Commission (NRC) and the Secretary of Energy (Secretary) with respect to certain licensees, Department of Energy (DOE) contractors, and nonprofit educational institution. In addition to the extension of indemnification authority, it also provides for an increased maximum assessment that may be assessed a licensee following a nuclear incident (Section 3); prohibits application in any foreign country whose government has been identified as engaged in State sponsorship of terrorist activities (Section 10); makes additional requirements for transfer of specified nuclear materials (Section 11); instructs the President to study and report to Congress on threats to NRC-licensed facilities and Federal actions taken to address them (Section 12); mandates that the Secretary issue appropriate industrial health and safety regulations applicable to contractors and subcontractors at DOE nuclear facilities (Section 13); requires the NRC, before entering into an indemnification agreement with respect to a utilization facility, to consult with the Assistant to the President for Homeland Security (Section 14); and authorizes the Attorney General prosecute intentional corporate misconduct (Section 15).

Legislative History

On October 2, 2001, Representative Heather Wilson introduced H.R. 2983, and it was referred to the Committee on Energy and Commerce. It was subsequently referred to the Committee on Science on November 19, 2001, and was discharged the next day.

On November 27, 2001, the bill was considered under suspension of the rules, and was agreed to, as amended, by voice vote. The bill was received in the Senate and placed on the Senate Legislative Calendar.

The Senate included Price-Anderson Act Reauthorization provisions in its amendment to H.R. 4 in Title V, Subtitle A, Section 501–509. The Senate Amendment to H.R. 4 passed the Senate on April 25, 2002. The Science Committee Members were appointed by the Speaker to be conferees on all of Subtitle A—except Section 508 (treatment of modular reactors).

Since the Energy Conference failed to complete action on comprehensive energy legislation before adjournment, the provisions related to the Price-Anderson reauthorization failed to be enacted with one exception. That provision, extending the indemnification of Department of Energy contractors through the end of 2004, was included as Section 3171 in the Conference Report on H.R. 4546, the Bob Stump National Defense Authorization Act for Fiscal Year 2003. The Conference Report passed the House on November 12, 2002 and the Senate on November 13, 2002.

The President signed H.R. 4546 on December 2, 2002 and it became P.L. 107–314.

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

Background and Summary of Legislation

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

The limited numbers of students pursuing science, mathematics, and engineering degrees appears to be a result of at least two factors: too few students who enter college wanting to major in one of those fields, and too many students who initially show such interest changing their minds during the first two years of their college education. Evidence of a decline in the percentage of freshmen choosing to enter and remain in mathematics and science-based majors first became apparent in the mid-1980s, as a result of a number of studies. Researchers determined that 40 percent of science, mathematics, and engineering undergraduates left the major, and that most did so within the first 2.5 years of the undergraduate experience. Similarly, a 2002 report by the U.S. Department of Education's National Center for Educational Statistics showed that fewer than 50 percent of students who intend to major in science and engineering fields complete a science or engineering degree within five years.

There is some evidence that poor K–12 preparation in mathematics has a significant impact on a student's decision to enroll in undergraduate science, mathematics and engineering coursework. According to the National Science Foundation's (NSF) Science and Engineering Indicators 2002, more than 40 percent of freshmen at public two-year colleges and 22 percent of freshmen at public four-year colleges required remedial work in reading, writing or mathematics. Among its science and engineering disciplines, approximately 28 percent of first-year students intending to major in the social and behavioral sciences and 25 percent of those intending to

major in biological or agricultural science reported the need for remedial mathematics instruction. Fifteen percent of engineering and physical sciences majors reported a similar need for remedial mathematics instruction. A recent survey also found that students are facing increasing demands on their time, with nearly 75 percent of today's college students engaging in at least part-time work and 25 percent working full time.

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

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

Adding to the complexity of the problem is the diversity of undergraduate institutions in the U.S. Although research-intensive universities produce most of the engineering degrees and a large proportion of the natural and social science degrees at the undergraduate level, student enrollment at those institutions represents less than 30 percent of the total undergraduate enrollment nationwide. Comprehensive universities and colleges account for approximately 23 percent of the total U.S. undergraduate enrollment, and liberal arts institutions for approximately seven percent. Two-year colleges account for nearly 40 percent of the total undergraduate enrollment, and yet their impact on the number of science and engineering baccalaureate degrees conferred remains largely unrecognized since many students transfer to a four-year institution without first earning an associate degree. The diversity of U.S. institutions of higher education should be regarded as a strength, and not a liability, in improving scientific literacy broadly and in increasing the number of science and engineering graduates in particular, but it is clear that reform must not be a one-size-fits-all endeavor.

While current data provide no clear guidelines or best practices regarding undergraduate education reform, both the National Research Council's Committee on Undergraduate Science Education and NSF have made a number of recommendations regarding insti-

tutional and departmental reforms necessary to improve undergraduate science and engineering education. Those recommendations include:

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

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

Legislative History

On October 16, 2001, Science Committee Chairman Sherwood Boehlert and Representative John Larson introduced H.R. 3130, the Technology Talent Act of 2001, a bill to provide for increasing the technically trained workforce in the United States. On October 29, 2001 it was referred to the Subcommittee on Research and a hearing was held on March 7, 2002.

The Subcommittee on Research met on May 9, 2002, to consider the bill. Chairman Boehlert, Representative Larson, Research Subcommittee Chairman Nick Smith and Ranking Minority Member Eddie Bernice Johnson offered an Amendment in the nature of a substitute. In addition to making technical corrections to the bill, the amendment (1) restricted disciplines included in the Technology Talent program to the physical and information sciences, mathematics, engineering and technology; (2) required the National Science Foundation (NSF) Director to award Institutional Reform grants to expand previously implemented undergraduate reform activities that have proven to be successful in increasing the number and quality of students receiving degrees in science, mathematics,

engineering, and technology; (3) required the Director to award grants for professional development of undergraduate faculty in support of improved undergraduate science, mathematics, engineering, and technology education; (4) required the Director to award grants to institutions of higher education to support the acquisition of research grade instrumentation and to support training related to its use; (5) required the Director to award grants to establish sites that provide research experiences for 10 or more undergraduate science, mathematics, engineering, and technology students; (6) required that all science, mathematics, engineering, and technology projects sponsored by NSF disseminate project information and results via the Internet; (7) required the Director to evaluate the effectiveness of all undergraduate science, mathematics, engineering, and technology education activities supported by NSF; and (8) required a study on the factors that influence undergraduates to enter and complete degrees in science, mathematics, engineering, and technology programs. The amendment was adopted by a voice vote.

The Committee met on May 22, 2002, to consider the bill. Chairman Boehlert offered an amendment making technical changes to the bill. An amendment was offered by Representative Lynn Woolsey that would require the Director to strive to increase the number of underrepresented students receiving baccalaureate degrees in science, mathematics, engineering and technology and to require the program evaluation to include disaggregated data reflecting minority enrollment and graduation rates. Representative Joe Baca offered an amendment that would establish a Minority Serving Institutions Undergraduate Program to award grants to enhance the quality of science, mathematics, engineering, and technology education at qualifying minority-serving institutions. Representative Brian Baird offered an amendment that would amend the Scientific and Advanced Technology act of 1992 by: (1) expanding the purpose of NSF's Advanced Technological Education (ATE) program to include improvement of core math and science courses; (2) expanding the activities under the articulation partnerships section to include student research experiences at four year institutions; (3) establishing an ATE program Advisory Committee; and (4) authorizing additional funding for acquisition of state-of-the-art instruments required for science and technology education. These four amendments were merged into one en bloc amendment, which was passed by a voice vote.

On June 12, 2002 the Science Committee filed H.Rept. 107–505, Pt. 1. On July 9, 2002 the House agreed to suspend the rules and pass H.R. 3130, as amended, by a voice vote. On July 11, 2002 it was received in the Senate and referred to the Senate Committee on Health, Education, Labor and Pensions. Provisions of H.R. 3130 were included in H.R. 4664, the National Science Foundation Authorization Act of 2002 which became P.L. 107–368.

2.15—H.R. 3178, Water Infrastructure Security and Research Development Act

Background and Summary of Legislation

H.R. 3178 directs the Administrator of the Environmental Protection Agency to protect water supply systems by establishing a program of research, development, and demonstration activities to achieve improvements to technologies and related processes for the security of water supply systems. It authorizes the program to be carried out through grants to, or cooperative agreements with, research organizations for the research and development of (1) technologies to assess the vulnerabilities of water supply and related information systems, (2) technologies capable of monitoring in real time chemical, biological, and radiological attacks, (3) technologies and processes to mitigate the effects of and recover from such attacks. The bill authorizes $12 million for each of fiscal years 2002 through 2006.

Legislative History

On October 30, 2001, Science Committee Chairman Sherwood Boehlert introduced H.R. 3178 and it was referred to the Committee on Science. The Committee held a hearing on November 14, 2001 and reported the bill from Committee on November 15, 2001. The bill was passed by the House by a voice vote on December 18, 2001, and subsequently placed on the Senate Legislative Calendar.

Provisions from H.R. 3178, including provisions to: (1) provide assistance for the assessment of vulnerabilities and for equipment to detect vulnerabilities in water systems; (2) monitor in real time a chemical, biological, and radiological attack on a water supply; and (3) mitigate the effects of any such attacks, were included in Conference Committee in Title IV of H.R. 3448, the Public Health Security and Bioterrorism Response Act. H.R. 3448 was cleared for the President on May 23, 2002, and signed into law on June 12, becoming P.L. 107–188.

2.16—H.R. 3400, Networking and Information Technology Research Advancement Act

Background and Summary of Legislation

H.R. 3400 amends the High-Performance Computing Act of 1991 to rename the National High-Performance Computing Program the Networking and Information Technology Research and Development Program, expanding its focus beyond Federal high-performance computing research and coordination to include all Federal networking and information technology activities.

Section 4—Networking and Information Technology Research and Development Program

Requires such program to address the issues of network information systems security as well as more general research goals, including network stability and the social and economic consequences of such technology.

Requires the Director of the Office of Science and Technology Policy's annual report to include a detailed description of the Pro-

gram Component Areas, including changes and activities contributing to network security improvement.

Expands the role of the advisory commission to include program evaluation.

Repeals provisions concerning the National Research and Education Network and the Next Generation Internet Program.

Section 5—Agency Activities

Revises research activities of the National Science Foundation (NSF), the National Aeronautics and Space Administration, the Departments of Energy and Commerce (including the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration), and the Environmental Protection Agency to incorporate networking and information technology. Authorizes appropriations for FY 2003 through 2007.

Section 6—Reports

Requires the Director of the NSF to: (1) arrange for an assessment of the state of research on networking and information technology in the United States; and (2) continually collect and arrange for the analysis of data on the information technology workforce, including size, occupation category, education, training, compensation, and the role of foreign workers. Requires the results of the assessment and data analysis to be reported to Congress as specified.

Section 7—Research Center

Directs the NSF to establish a center for research on information technology questions related to crisis management as part of the National High-Performance Computing Program. Authorizes the use of funds for human-computer interface technologies, network-based collaboration tools, network compatibility and reliability, wireless networks, and software and simulation.

Authorizes appropriations for FY 2003 through 2007.

Legislative History

On December 4, 2001, Chairman Nick Smith of the Research Subcommittee of the Committee on Science introduced H.R. 3400. The Committee on Science held a markup on December 6, 2001 and ordered the measure reported, as amended, by a voice vote. On June 18, 2002, the Committee filed H.Rept. 107–511. No further legislative action was taken on this measure.

2.17—H.R. 3488, Federal Information Security Management Act of 2002

Background and Summary of Legislation

The National Institute of Standards and Technology (NIST) is required under the Computer Security Act (P.L. 100–235) to promulgate standards for information security for the Federal Government. The government-wide adoption of such standards has been uneven in consistency of application. The bill clarifies that such NIST standards shall be government-wide standards and shall be implemented in a consistent manner throughout the Federal Government. The bill also establishes an Information Security and Pri-

vacy Advisory Board that shall advise NIST, the Secretary of Commerce, and the Director of Management and Budget on information security and privacy issues.

Legislative History

Representative Tom Davis introduced H.R. 3488 on March 5, 2002. The bill was referred to the Committee on Government Reform and sequentially referred to the Committee on Science. Provisions of the bill were incorporated as Section 3 of H.R. 2458, the "E-Government Act of 2001." H.R. 2458 was considered and passed by the House on November 15, 2002 and received and passed under unanimous consent by the Senate on the same day. The President signed H.R. 2458 into law on December 27, 2002 which became P.L. 107–347.

2.18—H.R. 3929, Energy Pipeline Research, Development, and Demonstration Act

Background and Summary of Legislation

The purpose of the bill is to establish a Federal research, development, demonstration and standardization program to be formed by the heads of the Department of Energy, the Department of Transportation, and the National Institute of Standards and Technology (the "participating agencies") to ensure the integrity of "energy pipelines" and "next-generation pipelines." The bill defines "energy pipeline" as a pipeline system used in the transmission or local distribution of natural gas, crude oil, or refined petroleum products and "next-generation pipelines" as a transmission or local distribution pipeline system for transmitting energy or energy-related products, in liquid or gaseous form, other than energy pipelines. Finally, the bill authorizes appropriations to carry out the purposes of the bill.

Legislative History

Science Committee Ranking Minority Member Ralph Hall introduced H.R. 3929 on March 12, 2002. It was referred to the Committee on Science and, in addition, the Committee on Transportation and Infrastructure and the Committee on Energy and Commerce.

The bill was then referred to the Subcommittee on Energy, which held a hearing on March 13, 2001. Testifying before the Subcommittee were Mr. Terry Boss, Vice President of Environment, Safety and Operations at Interstate Natural Gas Association of America, Mr. Tim Felt, President of Explorer Pipeline Corporation on behalf of the Association of Oil Pipe Lines, Dr. Nirmal Chatterjee, Vice President of Environmental, Health and Safety and Corporate Engineering at Air Products and Chemicals, Inc., and Mr. Stan Wise, Commissioner of Georgia Public Service Commission on behalf of NARUC, the National Association of Regulatory Utility Commissioners.

On March 20, 2002, the Committee on Science held a markup on H.R. 3929 and ordered the measure reported, as amended, by a voice vote.

On May 16, 2002, the Committee on Science filed H.Rept. 107–475, Pt. 1. During committee consideration of H.R. 3609, the Pipeline Infrastructure Protection to Enhance Security and Safety Act, by both committees of primary jurisdiction over the pipeline safety program, the provisions of H.R. 3929 were incorporated by amendments offered in the Transportation and Infrastructure Committee by Representative Jerry Costello and in the Energy and Commerce Committee by Ranking Minority Member Hall.

On July 23, 2002, the House Committee on Transportation and Infrastructure and the Committee on Energy and Commerce both reported H.R. 3609 (H.Rept 107–605, Part 1 for the Committee on Transportation; H.Rept. 107–605, Part 2 for the Committee on Energy and Commerce). H.R. 3609 passed the House under suspension of the rules on the same day, July 23, 2002, by a vote of 423–4 (Roll Call No. 334).

Since the H.R. 4 conference on comprehensive energy legislation was already underway and the Senate amendment to H.R. 4 contained comprehensive pipeline safety provisions, the House-passed pipeline safety bill (H.R. 3609) formed the House position in negotiations with the Senate during the conference on H.R. 4. A compromise pipeline safety provision was negotiated between the House and the Senate with the participation of Science Committee conferees. On September 12, 2002, the Energy bill Conferees approved the text of the negotiated pipeline safety portion of the bill, including provisions on RD&D, taken from the text of H.R. 3929. However, negotiations on the rest of the H.R. 4 Conference failed to reach a final agreement on the bill.

On November 13, 2002, when it became clear that final action on an Energy bill was not possible, the Senate took up the House-passed free-standing pipeline safety bill (H.R. 3609), amended it to read as approved by the House and Senate Conference on H.R. 4, and passed the bill without objection and without further amendment. On December 9, 2002, H.R. 3609, Pipeline Infrastructure Protection to Enhance Security and Safety Act was presented to the President for signature. He signed the measure on December 17, 2002 and it became P.L. 107–355.

2.19—H.R. 4966, National Oceanic and Atmospheric Administration Act

Background and Summary of Legislation

The purpose of H.R. 4966 is to improve the conservation and management of coastal and ocean resources by reenacting and clarifying provisions of a reorganization plan authorizing the National Oceanic and Atmospheric Administration.

Section 1. National Oceanic and Atmospheric Administration

Section 1 of this bill amends the material preceding Title I of the 1992 National Oceanic and Atmospheric Administration Authorization Act (P.L. 102–567) to update the short title, the definitions, and to replace Reorganization Plan #4. This section also adds several new sections to the Act: Section 3 establishes the primary missions of NOAA and the line office structure; and Sections 4 through 8 authorize the position of the Under Secretary, the Assistant Sec-

retary, the Deputy Under Secretary, the General Counsel and the Assistant Administrators, respectively. Section 9 assures that current appointees continue to serve in the listed jobs, and makes conforming amendments.

Section 2. NOAA Ocean and Coastal Programs

Section 2 of the bill amends sections of Title II of the Act, and adds several new sections at the end of that title. Section 201 of the Act is amended by striking 'the development of ocean technology' as a goal of the Coastal Ocean Program. Section 202 is updated to include authorization for NOAA's coastal and ocean-related laboratories, including the Great Lakes Environmental Laboratory, the Pacific Marine Environmental Laboratory, and the Atlantic Oceanographic and Meteorological Laboratory. Section 203 replaces outdated authorizations of appropriations with an authorization for the National Undersea Research Program. Sections 206 through 209 are new sections of the Act; these authorize the Ocean Exploration Program, a Coastal Ocean Observing System, a Science Advisory Board, and appropriations for operations, research, and facilities relating to ocean, coastal and Great Lakes research. The Ocean Exploration and National Undersea Research Programs, the Science Advisory Board, and the Coastal Ocean Observing System already exist in NOAA but have no specific statutory authorization.

Section 3. Program Support; Notice of Reprogramming

Section 3 amends Title IV of the Act. Here, the 'Corporate Services,' 'Marine Operations and Maintenance' and 'Notice of Reprogramming' sections are modified to reflect current practices. A 'Facilities' section is also added that authorizes appropriations for maintenance, repair, and associated activities.

Legislative History

H.R. 4966 was introduced on June 19, 2002 by Representative Wayne Gilchrest and was referred Committee on Resources and, in addition, to the Committee on Science. On June 20, 2002, the Committee on Science referred the measure to its Subcommittee on Environment, Technology, and Standards. Within the Committee on Resources, the bill was referred to the Subcommittee on Fisheries Conservation, Wildlife, and Oceans. On September 12, 2002, the Full Resources Committee met to consider the bill. The Subcommittee was discharged from further consideration of the bill by unanimous consent. Representative Gilchrest offered an amendment in the nature of a substitute that added several authorizations for NOAA's marine research programs. It was adopted by unanimous consent. The bill, as amended, was then ordered favorably reported to the House of Representatives by unanimous consent. On October 16, 2002, the referral to the Committee on Science was extended to October 18, 2002 at which time it was again extended to November 22, 2002. No further legislative action was taken on this measure.

2.20—H.R. 5303, CHARLES "PETE" CONRAD ASTRONOMY AWARDS ACT

Background and Summary of Legislation

The Charles "Pete" Conrad Astronomy Awards Act authorizes the Administrator of the National Aeronautics and Space Administration (NASA) to: (1) establish the Charles "Pete" Conrad Astronomy Awards Program to reward outstanding amateur astronomers who make asteroid discoveries, and to augment the Government's asteroid discovery efforts; and (2) contract with the Minor Planet Center of the Smithsonian Astrophysical Observatory to administer the program.

The Act also sets forth three annual award categories for: (1) the amateur astronomer who, using amateur equipment only, discovers the largest absolute magnitude new asteroid having a near-Earth orbit during the preceding calendar year; (2) pre-discovery and recovery efforts; and (3) the amateur astronomer, or professional not funded for optical astronomy, who provides the greatest service to update the minor planet catalogue.

Legislative History

The Charles "Pete" Conrad Astronomy Awards Act was introduced on July 26, 2002 by Space and Aeronautics Subcommittee Chairman Dana Rohrabacher and referred to the Committee on Science. On July 31, 2002, the measure was referred to the Subcommittee on Space and Aeronautics. On September 30, 2002 the House agreed to suspend the rules and pass H.R. 5303, as amended, by a voice vote.

The Senate received the bill on October 2, 2002 and referred the measure to the Senate Committee on Commerce, Science, and Transportation. No further legislative action was taken on the measure.

Chapter III—Commemorative Resolutions Discharged by the Committee on Science

3.1—H.CON.RES. 27, HONORING THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY AND ITS EMPLOYEES FOR 100 YEARS OF SERVICE TO THE NATION

Background and Summary of Legislation

Honors the National Institute of Standards and Technology and its employees for 100 years of service to the Nation.

Legislative History

H.Con.Res. 27 was introduced on February 13, 2001 by Representative Constance Morella and referred to the Committee on Science. On February 28, 2001, the Committee discharged the measure and the House agreed to suspend the rules and pass H.Con.Res. 27 by: Y–413, N–1 (Roll Call No. 20). On March 1, 2001, it was received in the Senate, considered, and agreed to without amendment and with a preamble by unanimous consent.

3.2—H.CON.RES. 108, HONORING THE NATIONAL SCIENCE FOUNDATION FOR 50 YEARS OF SERVICE TO THE NATION

Background and Summary of Legislation

Recognizes and acknowledges the 50th anniversary of the National Science Foundation (NSF) and its achievement and service to the United States.

Reaffirms commitment for the next 50 years to support research, education, and technological advancement and discovery through the NSF, the premier scientific agency in the Federal Government.

Legislative History

H.Con.Res. 108 was introduced on April 25, 2001 by Research Subcommittee Chairman Nick Smith and referred to the Committee on Science. On May 8, 2001, it was discharged by the Committee and the House agreed to suspend the rules and pass the measure by a voice vote. The Senate agreed to H.Con.Res. 108 by unanimous consent on May 9, 2001.

3.3—H.CON.RES. 157, RECOGNIZING AND HONORING JOSEPH HENRY FOR HIS SIGNIFICANT AND DISTINGUISHED ROLE IN THE DEVELOPMENT AND ADVANCEMENT OF SCIENCE AND ELECTRICITY

Background and Summary of Legislation

Recognizes and honors Joseph Henry for his significant and distinguished role in the development and advancement of science and electricity.

Legislative History

H.Con.Res. 157 was introduced by Representative Michael McNulty on June 12, 2001 and referred to the Committee on Science. On November 27, 2001, the Committee discharged the measure and the House agreed to suspend the rules and pass H.Con.Res. 157 by a voice vote. It was received in the Senate on

November 28, 2001 and referred to the Committee on the Judiciary. No further legislative action was taken on this measure.

3.4—H.CON.RES. 387, RECOGNIZING THE AMERICAN SOCIETY OF CIVIL ENGINEERS FOR REACHING ITS 150TH ANNIVERSARY AND FOR THE MANY VITAL CONTRIBUTIONS OF CIVIL ENGINEERS TO THE QUALITY OF LIFE OF OUR NATION'S PEOPLE INCLUDING THE RESEARCH AND DEVELOPMENT PROJECTS THAT HAVE LED TO THE PHYSICAL INFRASTRUCTURE OF MODERN AMERICA

Background and Summary of Legislation

Acknowledges the American Society of Civil Engineers for its 150th Anniversary and encourages it to continue its tradition of excellence in service to the profession of civil engineering and to the public. Commends the many achievements of the Nation's civil engineers.

Legislative History

H.Con.Res. 387 was introduced by Representative Joe Barton on April 25, 2002 and referred to the Committee on Science. On May 14, 2002, the Committee discharged the measure and the House agreed to suspend the rules and pass H.Con.Res. 387 by a voice vote. It was received in the Senate on May 15, 2002 and referred to the Committee on the Judiciary. The Senate Committee on the Judiciary ordered H.Con.Res. 387 reported, without amendment, by a voice vote on June 13, 2002. The Senate agreed to the measure by a voice vote on June 18, 2002.

3.5—H.CON.RES. 476, EXPRESSING SUPPORT FOR THE GOALS AND IDEAS OF A DAY OF TRIBUTE TO ALL FIREFIGHTERS

Background and Summary of Legislation

Supports the goals and ideas of a day of tribute to all firefighters who have died in the line of duty.

Recognizes the important mission of the National Fallen Firefighters Foundation in assisting family members to overcome the loss of their fallen heroes.

Legislative History

H.Con.Res. 476 was introduced by Representative Curt Weldon on September 19, 2002 and referred to the Committee on Science. On September 30, 2002, it was discharged by the Committee. The House agreed to suspend the rules and pass H.Con.Res. 476 by: Y–407, N–0 (Roll Call No. 428) on October 2, 2002. It was received in the Senate on October 3, 2002. No further legislative action was taken on this measure.

CHAPTER IV—Oversight, Investigations and Other Activities of the Committee on Science, Including Selected Subcommittee Legislative Activities

4.1—COMMITTEE ON SCIENCE

4.1(a)—The Nation's Energy Future: Role of Renewable Energy and Energy Efficiency

February 28, 2001

Hearing Volume No. 107–24

Background

The purpose of the hearing was to address three questions: (1) What are the current and projected near- and mid-term contributions of renewable energy and energy efficiency to the Nation's energy mix? (2) Have renewable energy and energy efficiency initiatives performed as expected, and if not, why not? (3) What programs and/or policies are needed to ensure that renewable energy and energy efficiency achieve their potential?

The witness panel included: (1) Ms. Mary J. Hutzler, Director, Office of Integrated Analysis and Forecasting, Energy Information Administration, U.S. Department of Energy; (2) Dr. John P. Holdren, Harvard University, Chair, President's Committee of Advisors on Science and Technology (PCAST) Energy Research and Development Panel; (3) Mr. Kenneth K. Humphreys, Senior Staff Engineer, Energy, Science and Technology Division, Pacific Northwest National Laboratory; and (4) Mr. Joel Darmstadter, Senior Fellow, Energy and Natural Resources Division, Resources for the Future.

Summary of Hearing

Ms. Hutzler testified that EIA's twenty-year forecasts project continued increases in energy efficiency and in the use of renewable resources, whose market penetration is slowed by the competitive low cost of fossil fuels and related technologies. Many cases were examined, and the historical record proves that increased oil prices lead to reduced consumption. Mr. Humphreys testified that 50 to 100 year planning horizons are required to determine which large-scale technologies should be implemented, and that his forecasts show 40 percent of U.S. energy use being supplied by renewable energy sources by 2100, assuming a carbon-constrained economy and a doubling of overall energy use, even providing for large efficiency increases. Professor Holdren testified that the country faces challenges of imported oil dependence, air pollution and

greenhouse effect that require private market and public policy actions to greatly increase energy efficiency and renewable energy use. He estimated that the recommended actions could be funded by two cents per gallon from the federal gasoline tax. Professor Holdren stated that increased efficiency standards and a carbon tax are needed. Mr. Darmstader testified that the percentage of electric power generated by renewable energy sources is expected to increase but to remain low in the next several decades. The cost of electric power from renewable energy has decreased more than expected in the past 30 years due to technological improvement, but so has the cost of the competing energy from conventional sources, forestalling greater market penetration by renewables.

4.1(b)—K–12th Grade Math and Science Education: The View From the Blackboard

March 7, 2001

Hearing Volume No. 107–3

Background

The purpose of the hearing was to get teachers' perspectives on how the Federal Government can help improve K–12th grade science and math education. Four teachers representing elementary, middle, and secondary math and science educators testified before the Committee. Three members of the panel received the 2000 Presidential Award for Excellence in Science and Mathematics Teaching, and the fourth was a volunteer for Teach for America, a national "teacher corps" that places recent college graduates into K–12th grade teaching positions.

The Committee heard from: (1) Ms. Julia Anne Lewis, an elementary mathematics teacher at the Academy School in Brattleboro, Vermont; (2) Mr. Jonathan Brenner, a former middle school science teacher at the Eleanor Roosevelt Intermediate School 143 in Washington Heights, New York; (3) Ms. Felicity Messner Ross, a secondary mathematics teacher at Robert Poole Middle School in Baltimore, Maryland; and (4) Mr. Michael Stephen Lampert, a secondary science teacher at South Salem High School in Salem, Oregon who is also a Presidential Awardee.

Summary of Hearing

Chairman Boehlert opened the hearing by noting the extent to which progress depends on an informed and intellectually curious citizenry, and the common link of education in helping create this type of society. He stated that people in Washington spend a lot of time talking *about* teachers, but not enough time talking *to* them, and that the purpose of the hearing was to begin to correct that imbalance. The Chairman also noted that he intended to make this hearing an annual event.

Ms. Lewis discussed ways to assess children and noted that:

- Spending a year out of the classroom to provide staff development helped tie together different parts of her career.
- Knowing how to reach every child means working with families, extra assignments, networking, and perseverance.

- Federal funding provides wonderful opportunities for both students and teachers.
- Students benefit from the programs that teachers take part in.

Mr. Brenner stated that the following must be done in order to put quality people in schools:

- A systemic review of the quality of education programs.
- Financial incentives offered to educators willing to teach in under served areas.
- Provide science teachers with the appropriate tools to teach.
- Fostering the development of partnerships between universities and local schools.

Ms. Ross noted that external funding sources increase teacher performance in the classroom and said that:

- Many inner city teachers felt overwhelmed with demands and exceptional students may fall through the cracks.
- Teachers must be flexible, know their students, and be dedicated to being a life-long learner.
- Teachers can use their experiences to train others.
- The Federal Government should support mentoring and professional development opportunities for math and science teachers.

Mr. Lampert stated that school children should have math and science role models and noted that:

- Teaching affects many people's lives.
- The Federal Government needs to keep funding the National Science Foundation and the National Science Bowl program.
- Support for the Eisenhower program, which provides professional development for science teachers, should continue.
- Support programs that intervene directly with classrooms and students.

4.1(c)—Climate Change: The State of the Science

March 14, 2001

Hearing Volume No. 107–13

Background

The federal climate change research program has been the recipient of much scrutiny lately as the Administration moves to formulate its policy on dealing with the threat posed by climate change. The Committee is contemplating reauthorizing the 10-year-old U.S. Global Change Research Program and this hearing was held to help the Committee assess whether it needs to be restructured and/or redirected and whether its funding is adequate. The hearing examined: (1) the state of our understanding of climate science, (2) the gaps in our understanding that limit our ability to detect, attribute, and predict climate change, and (3) the adequacy of the Federal Government's approach to filling these gaps.

The Committee heard from three witnesses: (1) Dr. Daniel L. Albritton, Director, Aeronomy Lab, National Oceanic and Atmospheric Administration; (2) Dr. Berrian Moore, Director, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire; and, (3) Dr. Charles Kennel, Director, Scripps Institution of Oceanography.

Summary of Hearing

Dr. Albritton, who helped write the recent Intergovernmental Panel on Climate Change report, testified that:

- Science holds with very high certainty that there is a greenhouse effect due to water vapor, CO_2, and methane keeping our planet warmer than it otherwise would be, and that the concentration of greenhouse gases in the atmosphere is increasing. The causes of the increase in greenhouse gases are largely human in origin. Over the industrial era the concentration of CO_2 has increased about 30 percent and that of methane has doubled. The question for science to answer about climate change is whether our changes to the concentration of these gases are altering the greenhouse effect.
- Global temperatures have increased about 0.4 to 0.8 degrees centigrade (0.7 to 1½ degrees Fahrenheit) over the last century. This conclusion is drawn from surface temperature readings in the northern hemisphere, ice cores, corals, tree rings and other historical measurements.
- There is new and stronger evidence that most of the observed warming over the past 50 years is due to human activities. Climate models cannot reproduce the temperature record of the past 100 years based on the current understanding of natural variability alone. Only when the increase in greenhouse gases are included do the models match the temperature record closely.
- A continued increase in greenhouse gases is projected, although with some degree of uncertainty, to lead to very significant increases in global temperatures and global sea level, based on a range of plausible future scenarios of economics, technology, and population growth.
- If the climate is affected by the increasing concentrations of greenhouse gases, the extremely long half-life of those gases in the atmosphere and the extremely large heat capacity of the world's oceans will prevent any hope of quick recovery.

Dr. Moore outlined the key scientific challenges in order to better understand the nature of climate and climate change:

- We must halt and reverse the decline in our observational systems throughout the world, especially in the developing world and we must expand the kinds of climate-related data collected, for example by monitoring carbon dioxide in the oceans, from space and in the atmosphere.
- We understand better how different gases trap or reflect heat.
- We must unlock the secrets of how clouds, ice and snow affect the climate.

- We must better understand the natural variability and probabilistic nature of the earth's climate.
- We must improve the computer resources available to climate researchers.
- We must better understand climate and climate change at the regional scale, linking climate to its effects on human activities.
- We must improve international cooperation because climate change is a global problem.

Dr. Kennel advocated the creation of an environmental information system that integrates the physical and social sciences and relevant information for the public and private sectors.

- While scientists now study climate mostly at the global scale, if we are to put the science to use we must endeavor to focus on smaller scales, first at the continental level, then the national and finally the regional.
- We must also have a firm understanding of how the various ecosystems on the land function.
- Finally, we must link regional climate models with ecosystem function to form a comprehensive environmental information system.

Creation of this system will require a high-level governmental authority to ensure the focused dedication of resources and to foster interagency cooperation.

4.1(d)—Space Station Cost Overruns

April 4, 2001

Hearing Volume No. 107–8

Background

The hearing reviewed NASA's management of the Space Station program, the status and underlying causes of recent cost growth, risks associated with increased reliance on international partners, the re-prioritization of planned science, and actions NASA is taking to address these issues.

The hearing consisted of two panels of witnesses. The first panel included: (1) Ms. Marcia Smith, Specialist, Aerospace and Telecommunications Policy, Congressional Research Service; (2) Mr. Robert J. Polutchko, Member, Cost Assessment and Validation (CAV) Task Force; and (3) Mr. Russell A. Rau, Assistant Inspector General for Audits, NASA. The second panel included Mr. Daniel S. Goldin, NASA Administrator.

Summary of Hearing

Ms. Smith provided testimony on the history of the Space Station program since its inception, including a history of cost growth and program delays.

Mr. Polutchko provided testimony on the findings and recommendations of the 1998 Cost Assessment and Validation (CAV) Task Force; his assessment of the current cost overrun in light of

the recommendations of the CAV Task Force; and recommendations to minimize the probability of further unforeseen cost growth. Mr. Polutchko concluded that NASA must take a fresh look at conservative planning and that the program will require significant additional funding to fully realize its potential as a research laboratory.

Mr. Rau provided testimony on the overall management and adequacy of cost and schedule reporting on the Space Station program; NASA's management of Space Station contracts; and the adequacy of NASA's independent review process and cost estimating capabilities. Mr. Rau concluded that NASA must strengthen its program management practices and improve its oversight of contracts.

Mr. Goldin provided testimony on the current status and cost growth on the Space Station program; the underlying causes of the cost growth; and the steps NASA is taking to control cost growth and schedule slippage, manage risks associated with increased reliance on international partners, and address the re-prioritization of planned science. Mr. Goldin highlighted the extraordinary technical accomplishments of the Space Station program and provided an overview of actions the agency is taking to address cost control and management problems. Specifically, he testified to actions to improve cost estimating quality, management reporting, and the increase in use of civil servants while examining options with the International Partners.

4.1(e)—Proposed R&D Budget for FY 2002

April 25, 2001

Hearing Volume No. 107–14

Background

The hearing was held to consider President Bush's budget request for research and development. Four witnesses reviewed their agencies' budget requests in the context of the Administration's overall priorities in science and technology. In addition, the witnesses described the mechanisms that agencies use to determine priorities across scientific disciplines and the mechanisms that are used to coordinate scientific research and technical development activities with other federal agencies.

The Committee heard testimony from: (1) The Honorable Dan Goldin, Administrator, National Aeronautics and Space Administration; (2) The Honorable Rita Colwell, Director, National Science Foundation; (3) The Honorable James Decker, Acting Director, Office of Science, Department of Energy; and (4) The Honorable Scott Gudes, Acting Administrator, National Oceanic and Atmospheric Administration.

Summary of Hearing

Mr. Goldin praised the President's proposed funding level of $14.5 billion, a two percent increase over FY01. He said that it contained a disciplined budget plan for Space Station development and operation including management reform and budget restructuring. In addition, the budget would advance the privatization of Space Shuttle activities, create a more robust Mars Exploration Program

and increase funding for a second generation Earth Observing System. Science and technology funding would make up 42 percent of NASA's overall funding.

Dr. Colwell stated that NSF requested $4.47 billion, which is $56 million more than last year. Highlights include: the Math and Science Partnerships, a $200 million initiative which will join states and local school districts with institutions of higher learning; $8 million to increase the stipends in its graduate research fellowships; and $20 million for the Interdisciplinary Mathematics Research Program. Four areas of emerging opportunity are also emphasized—biocomplexity in the environment, information technology, nanoscale science and engineering, and learning for the 21st century.

Dr. Decker described their $3.16 billion request to support the basic research that underpins the science, energy, environment and national security missions of the DOE. He addressed how the DOE determines priorities across scientific disciplines, how they coordinate their scientific research with that of other federal agencies, and he gave some examples of promising areas of research in their budget request (including Genomes to Life, Physics of the Standard Model and beyond, and Nanoscale Science).

Mr. Gudes described NOAA's budget request of $3.152 billion, a decrease of $61 million from current levels. The primary focus of the budget is investing in people ($60 million) and infrastructure. Other important programs included Severe Weather Forecasts, U.S. Weather Research Program, the national Polar Orbiting Environmental Satellite System, climate forecasting and ocean exploration.

4.1(f)—Acid Rain: The State of the Science and Research Needs for the Future

May 3, 2001

Hearing Volume No. 107–5

Background

The purpose of the hearing was to examine the progress that has been made in the reduction of acid rain and its harmful effects on the environment, as well as to identify the problems that still persist today. The Committee heard testimony regarding what types of research and monitoring networks were necessary to preventing the harmful effects of air pollution.

The Committee heard from: (1) Dr. Charles Driscoll, University Professor of Environmental Systems Engineering at Syracuse University; (2) Dr. Ellis Cowling, University Distinguished Professor at Large at North Carolina State University; (3) Dr. Jill Baron, Research Ecologist of the Biological Research Division of the U.S. Geological Survey and Senior Research Ecologist at the National Resources Ecology Laboratory at Colorado State University; (4) Dr. Jerry Keeler, Associate Professor of Civil and Environmental Engineering at the University of Michigan.

Summary of Hearing

Dr. Driscoll summarized the research of the past decade documenting the damage acid rain has caused to sensitive ecosystems like those that occur throughout the Northeast. He noted that:

- Sulfur dioxide and nitrogen oxides strip critical nutrients like calcium and magnesium from the soil, which can make trees vulnerable to frost.
- In sensitive ecosystems, such as those in the Adirondack Mountains of New York, recovery has been slow or non-existent. More extensive control efforts are necessary if those ecosystems are to recover within our lifetimes.
- Human exposure to mercury primarily comes from eating fish; mercury bioconcentrates up to ten million times greater in fish than in water. Mercury deposition in the sediment cores of the Adirondack lakes peaked in 1980, but has slightly declined since then. Still, acid rain exacerbates the mercury problem, as the metal becomes more "bioavailable" in acidic conditions.
- More extensive monitoring efforts are necessary if we are to understand how ecosystems, especially living things in the ecosystems, recover from acid rain.

Dr. Cowling testified that, unlike other parts of the country, the South has not seen improvements in air quality. He recommended improving the dependability of monitoring programs like the National Atmospheric Deposition Program (NADP).

Dr. Baron outlined the sources and effects of atmospheric deposition in the Western United States regarding nitrogen. He believes that the environmental community and the U.S. Geological Survey need better measurement of, long-term monitoring and research about atmospheric deposition. He explained that:

- Nitrogen, which makes up 80 percent of the atmosphere, needs combustion for it to release the nitrogen oxide that eventually comes down in the form of acid rain. However, nitrogen can come from agricultural sources, such as fertilized fields or large manure piles, as well.
- The West also suffers from substantial nitrogen deposition, due to high population density and high agricultural activity. Because cleaner sources of energy, such as low sulfur coal and hydroelectric power, are used in the West acid rain is less of a problem.
- Ecosystems respond to nitrogen increases in unexpected ways. In Colorado, increasing rates of nitrogen cycling have been linked to better forest growth. However, higher elevation Rocky Mountain ecosystems that are accustomed to low levels of nutrients can respond negatively to excess nitrogen.

Dr. Keeler believes that the causes of acid and mercury deposition are similar, though he concentrates more specifically on the nature and causes of mercury deposition. He explains that, while recent studies have yielded new information about mercury con-

tamination, these threats are still not fully understood. He says that:

- Mercury, a dangerous toxin especially to children and fetuses, is most exposed to humans through fish. Consequently, mercury has a disproportionate effect on low economic status groups such as Native Americans who rely heavily on fish in their diet. Mercury-related fish consumption advisories have been issued in 39 states, which have affected recreational and commercial fisheries across the country.
- A decade ago, alarming levels of mercury contamination in Florida were attributed to runoff and natural processes. Studies by the EPA have shown that theory to be incorrect; 95 percent of the mercury in the Everglades and 90 percent of the mercury in Lake Michigan is from atmospheric sources.
- More information is needed on the different forms of mercury emitted from all types of sources. For example, natural sources in the western part of the country could have a significant impact on the mercury in aquatic ecosystems.
- Since it has been established that mercury is locally, regionally, and globally transported, it is necessary to determine how a specific ecosystem is affected by each of these modes of transport.
- Mercury II is a highly reactive mercury compound that deposits more readily than the other forms of mercury. Studies indicate that Mercury II may be responsible for much of the local and regional contamination in the Great Lakes and Florida.

4.1(g)—Improving Voting Technologies: The Role of Standards

May 22, 2001

Hearing Volume No. 107–20

Background

The purpose of the hearing was to examine the role of standards in voting technology, keeping in mind the number of issues brought to light by the 2000 presidential election. The House Science Committee focused specifically on voting technology as part of a larger congressional effort to pass legislation reforming the voting process.

The Committee heard from: (1) Dr. Stephen Ansolabehere, Professor of Political Science at the Massachusetts Institute of Technology and the Project Manager of the CalTech-MIT Voting Project; (2) Dr. Rebecca Mercuri, Assistant Professor of Computer Sciences at Bryn Mawr College; (3) Dr. Doug Jones, Associate Professor of Computer Sciences at the University of Iowa and Chairman of the Iowa Board of Examiners for Voting Machines and Electronic Voting Systems; and (4) Mr. Roy Saltman, consultant and retired employee of the National Institute of Standards and Technology.

Summary of Hearing

Dr. Ansolabehere believes that there are several fundamental problems with current voting technology. Referring to a number of studies undertaken in the months following the 2000 presidential election by a team of MIT and CalTech specialists, Dr. Ansolabehere notes:

- Punch cards and electronic equipment have higher rates of uncounted, unmarked, and spoiled ballots than do hand-counted, lever machined, and optically scanned ballots.
- Voter registration databases pose a management and technical problem because of their large size. According to the 2000 census, 7 percent of voters who did not vote reported registration problems as the reason.
- The accessibility of voting equipment for use by the disabled is an issue.
- Electronic equipment poses new problems for ensuring the security and integrity of the count.

In terms of standards, Dr. Ansolabehere suggests that:

- Minimum criteria standards implemented by the National Association of State Elections Directors covering equipment durability and accuracy should be extended to the areas of usability, accessibility, and auditability.
- Federal agencies should compile and distribute information about equipment performance, cost, and administration.
- Uniform specifications for voting technology, such as electronic and Internet security, must be made available by NIST and the House Science Committee.

Dr. Mercuri identifies a number of inherent flaws in the application of computer technology to the voting process. She believes that these flaws are both technologically and sociologically based, making both short and long-term solutions difficult. She points out:

- Electronic systems of voting do not allow the voter to independently verify that the ballot they filled out was actually recorded, transmitted, or tabulated.
- No encryption programs can be relied on to provide total privacy assurance.
- Internet voting raises new concerns about ballot authentication and vote selling.
- In the case of an election challenge, electronic balloting and tabulation does not allow poll workers or election officials to perform bipartisan checks. Since no clear audit trail exists, a manual hand-count of the ballots is impossible.
- Newer electronic voting systems can make the balloting process more lengthy, tedious and confusing.
- Technology does not, at present, provide a comprehensive solution to the problems of ballot tabulation.

Mr. Saltman, the author of two NIST reports in the 1980s on the problems caused by advanced voting technology, believes that the Federal Government should play a leading role in voting reform

without conducting the elections themselves. He urges that the Federal Government:

- Undertake data collection, data analysis and reporting, accreditation of independent laboratories, and documentation of voting equipment performance.
- Support statewide voter registration programs and encourage grant programs for states and local governments.
- Make research into voting technology a primary objective, especially in the areas of voter usability of different vote-casting methods, new types of voting systems, techniques to help the sight-impaired and new methods of vote identification. In all cases, however, the auditability of non-ballot voting systems must be maintained.

Dr. Jones believes that setting strong standards on voting technology is necessary and that the FEC Voluntary Certification Process standards are not stringent enough. He argues that:

- Electronic voting lacks an independent, verifiable record of the voter's actions. It is for this reason that he feels that the country should not rush towards making the transition to computerized voting systems.
- Internet voting should be forbidden until truly solid standards are in place and audit requirements are met.
- The country should work to slowly phase out poor voting systems, such as the punch card, and move cautiously toward using the newer voting technologies available. He stresses that there is no perfect voting technology, and that the Nation must not yet abandon "old tech" voting systems.

4.1(h)—National Energy Policy—Report of the National Energy Policy Development Group

May 23, 2001

Hearing Volume No. 107–42

Background

The purpose of the hearing was to receive testimony on the National Energy Policy Development Group's May 16 report to President Bush, *National Energy Policy—Report of the National Energy Policy Development Group.*

The panel of outside witnesses, who represented industrial and environmental organizations, consisted of: (1) The Honorable William F. Martin, Chairman, Washington Policy and Analysis, Inc., who testified on behalf of the Alliance for Energy and Economic Growth; (2) Ms. Katherine H. Hamilton, Co-Director American Bioenergy Association; and (3) Mr. David G. Hawkins, Director, Natural Resources Defense Council (NRDC), Climate Center.

Summary of Hearing

Mr. Martin testified that the industrialized world's dependence on imported oil is a major security concern, and if nothing is done will lead to shrinking economies as oil prices increase. He supported government action to spur markets toward energy efficiency

and believes in the use of all our resources through application of science and technology. He stated that consumers have no expectation of rising energy prices, so that they have no incentive to invest in energy efficiency. Ms. Hamilton testified that DOE's Office of Energy Efficiency and Renewable Energy (EERE) needs much more support and stimulus from the government. Her coalition criticized the President's Energy Plan as relying too much on conventional sources and slighting EERE. Mr. Hawkins testified that NRDC has published its own energy plan for the 21st Century and provided a critique of the Administration's plan.

4.1(i)—National Energy Policy—Report of the National Energy Policy Development Group—Administration View

June 21, 2001

Hearing Volume No. 107–44

Background

The purpose of the hearing was to receive testimony from Secretary of Energy Spencer Abraham on the National Energy Policy Development Group's May 16, 2001 report to President Bush.

Summary of Hearing

The Secretary's testimony expanded upon the NEPD Report by stressing the importance of science and technology in meeting today's energy challenges. He stated, "Promising developments in science and technology encourage us to believe that we can address this Nation's serious energy challenges in a way that balances our concerns for environmental protection with our needs for enhanced domestic supplies of energy."

4.1(j)—Cyber Security—How Can We Protect American Computer Networks From Attack?

October 10, 2001

Hearing Volume 107–41

Background

The purpose of the hearing was to examine the vulnerability of our nation's computer infrastructure as well as research-related challenges and opportunities facing the Nation's computer networks. Witnesses representing industry, academic, government and non-profit organizations testified before the Committee. They commented on gaps in research and education in the computer security field. Since most of the infrastructure in the United States is owned and controlled by the private sector, witnesses also commented on ways to encourage collaborative approaches to shore up our ability to predict, prevent, and mitigate attacks.

The Committee heard testimony from: (1) Dr. William Wulf, President, National Academy of Engineering; (2) Dr. Eugene Spafford, Director of the Center for Education and Research in Information Assurance and Security; Professor of Computer Sciences

and Professor of Philosophy, Purdue University; (3) Ms. Terry Benzel, Vice President of Advanced Security Research, Network Associates, Inc.; and (4) Mr. Robert Weaver, Director, New York Electronic Crimes Task Force; Assistant Special-Agent-in-Charge, U.S. Secret Service, New York, New York.

Summary of Hearing

Dr. Wulf discussed the problem of the minuscule size of our research base in computer security. This may be due to the fact that there has never been a funding agency that believed that it was its responsibility to develop the community of scholars researching in this area, he suggested. Because there is little funding, research is very conservative. Dr. Wulf stressed that we need money to fund out-of-the-box thinking.

Dr. Spafford focused his testimony on the important role that university researchers bring to information security and some of the challenges they have faced. Investing in computer security education and research is vital to securing the information infrastructure of the Nation. He then described challenges in five critical areas affecting university research: support, infrastructure, real-world data, personnel, and legal impediments.

Ms. Benzel stated that the threats to computer systems and networks are extensive and serious. These challenges will require federal funding and policy changes. We need to perform an in-depth vulnerability analysis in order to have a more complete understanding of the threats so that we can construct an R&D map. Three areas that need to be investigated are interdependencies, converged networks, and control systems.

Mr. Weaver reiterated the vulnerability of our critical infrastructure and financial payment systems and described the work of the Task Force. He stressed the importance of partnerships.

4.1(k)—Cyber Terrorism: A View From The Gilmore Commission

October 17, 2001

Hearing Volume No. 107–40

Background

The hearing was the Committee's second examining of the vulnerability of our nation's computer infrastructure as well as research-related challenges and opportunities facing the Nation's network security infrastructure and management.

The Honorable James S. Gilmore, III, Governor of the Commonwealth of Virginia and Chairman of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, testified. Governor Gilmore assessed the threats to our nation's information infrastructure, described the level of preparedness to address these threats, and described steps that need to be taken to ensure that Federal, state, and local governments are prepared to respond.

Summary of Hearing

Governor Gilmore summarized the key recommendations of the Advisory Panel. He emphasized the need for a national strategy including all levels of government, the private sector and universities. To safeguard our information networks, we need to protect both hardware from a physical attack and software and Internet controls from a cyber attack. Protection against physical attacks will be primarily conventional procedures; security against cyber attacks will require far greater coordination and cooperation. He then discussed Virginia as a case study for both vulnerability and model response. Some of the Panel's recommendations included: the creation of an interagency cyber security panel and Congressional independent advisory board to conduct a thorough review of federal statutes and to update statutes; unprecedented partnership between the public and private sectors; the establishment of a special cyber court patterned after the court established in the Foreign Intelligence Surveillance Act; the creation of an entity to develop and implement a comprehensive plan for research, development, test and evaluation of processes to enhance cyber security; and, the continuation of the Y2K offices as cyber security offices in all government agencies.

4.1(l)—The Space Station Task Force Report

November 7, 2001

Hearing Volume No. 107–49

Background

The hearing reviewed the findings and recommendations of the International Space Station (ISS) Management and Cost Evaluation (IMCE) Task Force report, the credibility of NASA's cost estimates and program plan, and whether the Space Station as currently planned will be able to achieve meaningful scientific objectives. In addition, the Administration presented its assessment of the management challenges facing the Space Station program.

Witnesses for the hearing were: (1) Mr. A. Thomas Young, Chairman, IMCE Task Force; and (2) Mr. Sean O'Keefe, Deputy Director, Office of Management and Budget (OMB).

Summary of Hearing

Mr. Young provided testimony on the findings and recommendations of the IMCE Task Force Report. The Task Force found that the program was "not credible." They found deficiencies in management structure, institutional culture, cost estimating, and program control. The Task Force recommended that NASA overhaul program management, clearly define the science goals, and significantly reduce workforce levels to keep the planned three-person U.S. core program within the projected budget. In addition, the Task Force recommended that the Shuttle flight rate be reduced to four flights per year to save funds which could be used to offset increased Space Station costs. The Task Force recommended a performance-based approach whereby NASA must demonstrate credibility over a sustained period of time as a prerequisite to pro-

ceeding beyond the U.S. core. The Task Force did caution that it would be very difficult for NASA's culture to change to the degree required to make the program succeed.

Mr. O'Keefe provided testimony on the Administration's strategy to ensure that NASA fully implements the recommendations of the IMCE Task Force. Mr. O'Keefe stated that OMB agreed in general with the findings and recommendations of the Task Force, but had yet to review all of the recommendations in detail. He did state, however, that it would be a big mistake to begin adding content back to the program now, when nobody has confidence that NASA can manage to finish the core complete Station and operate it within the available budget. He testified that Space Station capabilities should be driven by research priorities and that a change in NASA's management culture is essential for the station program and the agency to succeed.

4.1(m)—The Decontamination of Anthrax and Other Biological Agents

November 8, 2001

Hearing Volume No. 107–39

Background

The purpose of the hearing was to receive testimony regarding the decontamination of anthrax and other biological agents from public facilities. Specifically, this hearing explored the challenges of decontaminating civilian facilities, the experience gained by the U.S. Army in decontaminating property at Fort Detrick, and the potential of new decontamination technologies and methods.

The Committee heard from: (1) Dr. James Baker, Jr., Director of the Center for Biologic Nanotechnology and Professor of Internal Medicine, University of Michigan; (2) Mr. Manuel Barbeito (retired), Chief of Aerobiology Section, Agent Control Division, U.S. Army Biological Warfare Laboratories, Fort Detrick; (3) Dr. Charles Haas, Professor of Environmental Engineering, Drexel University; and (4) Dr. Lynn Goldman, Professor of Environmental Health Sciences, John Hopkins University Bloomberg School of Public Health.

Summary of Hearing

Chairman Boehlert stated that there is much to be learned regarding the decontamination of buildings. The efforts to decontaminate the Hart Building illustrate that we need to develop an ongoing, coordinated way to evaluate different decontamination strategies. We need to know how clean a building needs to be to prevent disease when re-occupying the facility, and how to better communicate with the American people. With regards to decontamination of buildings, the Federal Government needs a more coordinated emergency response, improved research and development (R&D) programs and improved communications with the public.

Dr. Goldman testified that knowledge about decontamination for infectious agents has been developed for concerns such as drinking water, food safety, medical facilities, and industrial applications. The Environmental Protection Agency (EPA) and the Food and

Drug Administration (FDA) have responsibility for approving and regulating disinfecting agents. Very little proactive disinfectant R&D has been done by these agencies. She noted that prior to October 2001, there was no incentive for the private sector to engage in research in this area, and coupled with the fact that little research was ongoing in government agencies, we are now in a situation where nobody has given it much thought. She also noted that:

- The need for disinfection is immediate, and a fundamental understanding of the infectious organisms is crucial in selecting what kind of disinfectant to use. To kill anthrax, radiation, heat, and other various disinfectants may be used but none have been tested in contaminated civilian buildings.
- She called for a safety assessment to look at three factors: (1) the efficacy of the treatment options; (2) the side-effects and risks to health and the environment from using certain treatment options; and (3) feasibility in terms of the time, cost, and destruction of property that might occur from various treatment options.
- The government needs to develop a clear method of assessing the safety of buildings and protection of people, and managing the risks. We need to develop a clear rationale for assessing buildings and we need statistically based sampling protocols for decontaminating these buildings.
- We also need a set of rapid and reliable laboratory assays with good sensitivity and specificity.
- The decontamination strategies need to take into account the safety needs of the public and decontamination personnel.
- She also suggested that the Centers for Disease Control (CDC) should be responsible for the issue of public health pesticides.
- We also need to have a better understanding about exposures to people in the postal system that may handle contaminated mail.
- Officials need to better communicate these risks to the public in a straightforward fashion that provides facts, but does not contribute to undo fear or terror.
- It is critical to strengthen our nation's public health system, including the areas of epidemiology, laboratory capacity, data-tracking systems, and the training and development of the public health workforce.

Dr. Baker testified that biological decontamination is simply defined as removing organisms that are potentially infectious or dangerous from the building. However, in order to do this, you have to analyze the type of organism, the residual risk and/or the chronicity of exposure. He noted that:

- We need to develop an understanding for what is needed to carry out a decontamination and what would be a medically acceptable residual level of contamination. This is important in determining when people can safely return to decontami-

nated buildings. We do not know what a safe level is for residual anthrax contamination in a building.

- Every anthrax spore will not be removed from a contaminated building. Therefore, standards need to be set in terms of anthrax exposure that take into account variables such as immuno-compromised persons, pregnancy, or underlying respiratory conditions.
- Due to the varying designs of buildings, it is difficult to develop a general approach to decontamination. Different technologies will need to be used in different circumstances.
- We need to learn and understand from our decontamination experience of the Hart Senate building, and apply this knowledge when decontaminating other buildings in the future.
- Individuals who return to decontaminated buildings need to be given complete medical and psychiatric support, and followed prospectively once returning to the building.
- He suggested that a commission should be set up to review data, provide protocols and advice on how to move forward with the decontamination process.

Dr. Haas testified that chlorine dioxide has been disinfecting drinking water for over 50 years and is known to be effective against viruses, bacteria and protozoa. He noted that:

- While the mechanism of how chlorine dioxide kills microorganisms is well understood, relatively little is known about how it kills bacterial spores. It is clear that spores are among the most resistant organisms to chlorine dioxide.
- Chlorine dioxide gas has been used as a disinfectant for over 20 years. However, there have been no studies pertaining to its use as a disinfectant for buildings or for the specific efficacy against anthrax spores.
- A basic task in developing a decontamination strategy is setting a target clean up level. It must be recognized that it is impossible to be absolutely certain that all anthrax spores will be destroyed after any decontamination efforts.
- A second task is to set technical specifications for the amount of reduction that needs to occur if the initial contamination and the pathogen dose response characteristics are known.
- The time required for decontamination using a gas will be determined by factors such as the rate of decay during application and time of removal of the residual disinfecting gas.
- Four important knowledge bases to better understand this problem are: (1) analytical microbiology, the ability to measure the organism in the state in which they occur; (2) chemical analysis of the disinfectants and of the byproducts that may result; (3) the modeling of air movement and movement of contaminants through the indoor environment; and (4) the health effects from inhaled chemical byproducts.

- There needs to be a degree of coordination between multiple federal agencies and multiple disciplines outside the Federal Government.

Mr. Barbeito testified that the Safety Division at Fort Detrick, a highly regarded biological warfare laboratory, needed to periodically decontaminate facilities because of yearly maintenance, major renovations, changing research agents, and following exposure incidences. He noted that:

- The importance of selecting the most effective decontaminant. Some possible techniques include the use of liquid disinfections, vaporization of formalin, ethylene oxide, vaporization of peracetic acid, vaporization of beta-propriolactone, and the depolymerization of paraformaldehyde for the formation of formaldehyde gas.
- The last of these techniques was the preferred method for large building decontaminations. It is easy to use, however it is a potential cancer hazard and is highly irritating.
- 3/10 of a gram of paraformaldehyde per cubic foot of space in an open container with a heat source needs to be depolymerized, in a room with a temperature of 75 ±5 degrees Fahrenheit and relative humidity to 75 percent. Time of contact should be 24 hours.
- The residual gas can be neutralized using ammonium bicarbonate.
- By using a surrogate *Bacillus subtilis variety Niger* spores instead of an actual *Bacillus anthracis* spores, it can be determined whether or not the decontamination process was effective.
- Anthrax is present in 43 states. The Public Health Service has reported nine deaths between 1948 and 1964.
- Activities in contaminated postal buildings should be terminated, an irradiation program on the incoming mail should be in effect, and a comprehensive quality-qualitative environmental surveillance program needs to be set up.

4.1(n)—H.R. 3178 and the Development of Anti-Terrorism Tools for Water Infrastructure

November 14, 2001

Hearing Volume No. 107–29

Background

The purpose of the hearing was to receive testimony on H.R. 3178, the Water Infrastructure Security and Research Development Act. The September 11, 2001 attacks on our nation highlighted the critical need for increased research on and development of technologies and techniques to prevent, mitigate, and respond to physical and cyber threats facing drinking water and wastewater systems.

The Committee heard from: (1) Mr. James Kallstrom, Director of New York State's Office of Public Security; (2) Dr. Richard Luthy, Silva H. Palmer Professor of Engineering, Stanford University, and

Chair of the National Research Council's Water, Science, and Technology Board; (3) Mr. Jeffrey Danneels, Department Manager, Security Systems and Technology Center, Sandia National Laboratories; and (4) Mr. Jerry Johnson, General Manager of the District of Columbia's Water and Sewer Authority, representing the Association of Metropolitan Water Agencies and the American Water Works Association Research Foundation.

Summary of Hearing

Chairman Boehlert opened the hearing by addressing the vulnerability of our water supplies and sewage systems to cyberterrorism and bioterrorism. Based on the Committee's review, we know that we are not yet equipped with the knowledge or tools to respond adequately to the threat of terrorism. To fill in these gaps, we need to learn more about how to assess and prevent terrorist threats, how to respond to terrorist incidents, and how to remedy any damage terrorists might cause. At present, however, we do not invest enough in research and development to meet these needs.

Mr. Kallstrom testified that New York State strongly supports H.R. 3178. Governor Pataki has charged him with developing a comprehensive statewide strategy to secure New York State from acts and threats of terrorism. He noted that:

- The Office of Public Security will tie together all state efforts to detect, identify, address, respond to, and prevent terrorist attacks in New York.
- The risk to New York's drinking water supplies or wastewater treatment facilities is small, but real enough to justify implementation of H.R. 3178.
- H.R. 3178 authorizes funding for research that would help find new means to protect the drinking water supplies at more than 4,000 community water systems serving approximately 17 million New Yorkers daily.
- Physical destruction of a drinking water or wastewater system could deprive a population of its essential water supply, as well as cause severe secondary effects, such as the inability to ensure sanitation or to provide protection to the affected population. It could also deprive manufacturers and other businesses of water, resulting in serious consequences for local economies.
- Although all water systems in New York State are on alert for catastrophic terrorist attacks, we need to improve analytical testing methodologies, to identify possible biochemical threats, and enable a rapid response to them.
- The Wadsworth Center for Laboratories and Research at the New York State Department of Health, among others, has begun to research new methodologies that could help rapidly identify a contaminant introduced into a water supply.

Dr. Luthy testified that he supports H.R. 3178 and the development of anti-terrorism tools to protect the Nation's water supply, but that funding level needs to be at least $50 million to start to address these problems. He noted that:

- Top priority should be given to protection of physical structures for water storage and transmission that serve large populations and would be very difficult to replace, and to maintaining water quality through better monitoring, new treatments, and incorporating the concept of multiple barriers.
- Since many components of our water systems are aging and need repairs, new approaches to increase security should also look to enhance the reliability and the capability of such systems.
- We need to understand (1) what elements of the water system are most vulnerable to physical damage and how we can protect them; (2) what chemicals or biological agents, and in what amounts, may do the most harm; (3) how we can achieve early detection of chemical or biological agents in time to take corrective action; (4) how operations can be reconfigured to provide greater interconnectedness among source supplies and among water distribution systems; (5) how multiple barriers may be incorporated in treatment plant operations and in the distribution system to ensure greater safety, and (6) how vulnerable our water systems are to cyber attack.
- Any new research program must be organized and administered with great rigor and include a peer-review process.

Mr. Danneels testified that the steps already taken to improve security, such as adding guards and additional water-testing protocols, are neither sustainable, nor provide a balanced approach for improving security in all parts of the water infrastructure. Research should begin immediately on intermediate and long-term solutions that will significantly reduce risk to America's water infrastructure. He noted that:

- H.R. 3178 should support security risk assessment methodology for water systems being developed by Sandia Laboratory, new security technologies, real-time monitoring, Supervisory Control and Data Acquisition system research (SCADA), and advanced treatment techniques.
- The security risk assessment methodology being developed by Sandia will require significant improvement in coming years to both reduce the cost of performing the assessments and incorporate new features into the methodology.
- New security technologies are needed for specific infrastructure threats. Examples for water utilities include on-line radiation monitors to detect radiation contamination in large flows and active access delay systems for remotely controlled facilities.
- A significant effort will be required to design, integrate, miniaturize, and cost-effectively produce a knowledge-based, real-time monitoring system.
- Most basic research on new identification schemes is scattered around the country at numerous institutions, resulting in the need for a new model of cooperation to develop inte-

grated sensors into real-time water quality monitoring capability.

- Research and development of standards, security and operation protocols, and secure platforms is needed to protect the current computerized control systems like SCADA.
- H.R. 3178 provides flexibility in approaches and funding to support this type of effort. Current water protection programs, such as the Safe Drinking Water Act, may need to be extended or altered to meet the new enhanced security requirements.
- H.R. 3178 provides accountability, focus, and structure for a security program for water infrastructure.

Mr. Johnson testified that the drinking water community supports H.R. 3178 and similar bills that provide for improved security of our drinking water facilities. Additionally, he identified a strong need for more research and development in the area of water infrastructure security. He noted that:

- Since September 11, the Nation's drinking water utilities have been on a heightened state of alert, but prior to the terrorist attacks, the water supply community was already at work with the EPA, the FBI, and other federal agencies to develop new methods and tools to protect water systems and facilities, and ultimately, consumers.
- The water security research bill provides up to $12 million a year for five years, which would substantially improve the investment in water infrastructure, security, research, and development.
- The EPA needs to place anti-terrorism research among its top research goals, and the passage of H.R. 3178 would accomplish this most effectively.
- More knowledge must be "gained and disseminated" on the characteristics of possible biological and chemical toxins, instantaneous and on-line probes that detect contaminants, and remedial preventive actions to neutralize those contaminants.
- The American Water Works Association Research Foundation, the EPA, and other water organizations have sponsored a number of research and development projects addressing water system security issues.
- Rapid development of additional tools, technologies, and processes is needed to help water systems, especially on the local level, where water systems are stretching very limited resources to safeguard the delivery of water to consumers.
- Increased computerization has increased efficiency, but also creates vulnerabilities to cyber attacks that could disrupt water systems and operations on a broad scale.

4.1(o)—Science of Bioterrorism: Is the Federal Government Prepared?

December 5, 2001

Hearing Volume No. 107–51

Background

The purpose of the hearing was to receive testimony regarding the role of federal agencies in responding to bioterrorism. Specifically, this hearing explored the research and development underway at various federal agencies to improve our nation's ability to detect, prevent, respond to, and remediate bioterrorist attacks. In addition the hearing explored the relationship and information sharing among federal agencies and what efforts the Administration has underway to better coordinate the response to bioterrorism, particularly in the area of research and development.

The Committee heard testimony from: (1) Dr. John H. Marburger, III, Director, Office of Science and Technology Policy, Executive Office of the President, (2) Hon. Linda Fisher, Deputy Administrator, Environmental Protection Agency, (3) Dr. Anna Johnson-Winegar, Deputy Assistant to the Secretary of Defense for Chemical and Biological Defense, Department of Defense, and (4) Dr. Donald A. Henderson, Director, Office of Public Health Preparedness, Department of Health and Human Services.

Summary of Hearing

Chairman Boehlert opened this hearing by stating that it is the Science Committee's responsibility to ensure that America is investing in the research and development (R&D) needed to combat terrorism and that the war against terrorism will be won in the laboratory as much as on the battlefield. And in order to accomplish this victory, we need a clearly led, well-organized, well-planned R&D effort. He stressed that while the Federal Government has done a remarkable job in responding to terrorism, by necessity this response has been ad hoc and put together on the fly. However, if this is still true six months from now, then we will have failed to respond adequately to the terrorist threat.

Dr. Marburger testified that the Office of Science Technology and Policy (OSTP) has broad mandates from both the Congress and the Executive Branch to coordinate scientific activities within the federal agencies. And in particular, OSTP can play an important role in coordinating the various science and technology activities related to antiterrorism. He indicated that he will draw upon the technical expertise housed in our science and technology agencies, making sure that relevant information and test results are disseminated to the appropriate parties, preventing unproductive duplication of effort and identifying opportunities for collaboration. Specifically, he testified that:

- The National Security Council under this Administration established the Policy Coordinating Committee on Preparedness Against Weapons of Mass Destruction. The R&D subgroup of this committee will continue under a new National Science and Technology Council forum.

- Under the structure of the National Science and Technology Council, OSTP is establishing an Interagency Task Force with several working groups. The fifth working group, a Technical Response Team, will establish subgroups on an ad hoc basis to serve as a clearinghouse for technical reviews of the incoming proposals on technologies related to homeland security. The goal of this subgroup is to review all proposals for scientific merit, and refer them as necessary to the appropriate agency for further review.
- He stressed that as we fight this war against terrorism, we need a taxonomy and a common language to assess threats, avoid duplication and facilitate interagency cooperation and coordination.
- OSTP has sought assistance from the National Academies and the RAND Corporation to develop such a taxonomy. The RAND Corporation's database, called Radius, is proving to be useful in this endeavor.
- He also highlighted an ongoing interagency effort to address mail security issues. Following a request from Governor Ridge, OSTP convened an interagency meeting to ascertain the technical issues the U.S. Postal Service was encountering with regards to anthrax contaminated mail. Dr. Marburger met with chief science officials from 15 different federal agencies to create an interagency technical team to evaluate irradiation facilities in Lima, Ohio and Bridgeport, New Jersey.

Deputy Administrator Fisher testified that the Environmental Protection Agency (EPA) has several specific missions regarding their role in counter-terrorism activities. These missions are a result of Presidential Decision Directives and include assisting the Federal Bureau of Investigation (FBI) during crisis management in threat assessments and determining the types of hazards associated with releases of materials in a terrorist incident. Also, the EPA should provide environmental monitoring, decontamination and long-term cleanup at the site of an attack. And the EPA must help ensure the safety and security of America's drinking water. Specifically, she testified that:

- Administrator Whitman has made reliance of sound science one of her highest priorities and despite the need for rapid response following the September 11 attacks, the EPA has continued to adhere to this goal.
- In response to killing anthrax spores in buildings, the EPA has established a hotline for vendors who believe they have a product that can effectively kill anthrax, and the EPA is working quickly to verify these claims. In addition the EPA is conducting a review of specific cleanup technologies for anthrax and has determined that a number of liquid and foam applications, including Sandia foam and liquid chlorine dioxide, are effective in killing the spores. Also, the EPA has found that high efficiency particulate air (HEPA) filters are effective in removing anthrax spores. However, it is clear that many science and technology issues still remain unresolved.

- The EPA is expanding their biological testing capabilities, and are in the process of modifying an EPA lab in Cincinnati, Ohio so that tests involving anthrax and other biological agents can be done.
- The EPA, along with the Centers for Diseases Control and Prevention (CDC) and other federal agencies are developing a state-of-the-knowledge report that will address the chemical and biological threats to our water supply, the capabilities of detecting these threats, and the ability to mitigate these threats.
- The EPA is also working closely with the Department of Health and Human Services (HHS) in areas of sampling strategy, remediation processes, and criteria for judging remediation processes to be effective.
- She noted that the working relationship between EPA and the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) was invaluable as remediation of the anthrax-contaminated buildings progressed.
- The formation of the Homeland Security Working Group within EPA will develop a strategic plan describing the Agency's effort at preparedness and resource needs. The plan will be shared with other federal agencies that are part of the Office of Homeland Security.

Dr. Johnson-Winegar testified that while the primary mission of the Department of Defense (DOD) is to ensure that the war-fighter is protected, DOD is working with other federal agencies so as to provide technologies that can protect all U.S. citizens. The DOD has been addressing the use of biological weapons as a means of trying to counter America's overwhelming conventional war-fighting strength, and that much of this investment should be helpful to the civilian community. Specifically, she testified that:

- Within the program for biological defense, the DOD's efforts are categorized into three operational principles. These include contamination avoidance, protection of the war-fighter and restoration capabilities.
- The DOD currently uses a biological integrated detection system mounted on a military vehicle. This technology is capable of detecting a number of different biological warfare agents in a relatively short period of time. However, DOD is working to reduce the time required for these systems to work, as well as increasing the specificity and sensitivity of these devices.
- Other technologies currently in use by the DOD are the M99 Portal Shield that uses an immuno-based system to detect eight biological agents and the M291 skin decontamination kit that uses a resin-based material to remove chemical and biological agents from the skin.
- In closing, Dr. Johnson-Winegar gave her commitment that DOD will continue to work closely with other federal agencies to develop and provide anti-bioterrorism technologies.

Dr. Henderson testified that the newly created HHS Office of Public Health Preparedness has been charged with providing direction to the many different HHS programs dealing with bioterrorism, and serving to direct and coordinate these activities with other federal agencies. He stressed that there is much we must still learn about bioterrorism and that R&D pertinent to bioweapons is desperately needed. Specifically, he testified that:

- We do not as yet have an overall anti-bioterrorism research strategy and program, although activities with OSTP, the National Academy of Sciences, and others are playing an important role in beginning to move toward that important and much needed blueprint.
- Until very recently, most academic institutions excluded anything to do with biological or chemical weapons from their educational and research programs. Because of this, there is little bioweapons expertise currently in academia.
- There has been little support for research in the diseases and agents that might be used in a biological attack. Moreover, research biologists, academia and the biotechnology industry have had relatively little contact with the biological defense programs. Thus the development of new and creative research programs, involving particularly HHS and DOD, with academia and biotechnology firms, are needed.
- HHS has identified several especially urgent R&D needs, which are all being pursued very aggressively. These include the development of a smallpox vaccine from tissue cell culture origin, development of a second-generation recombinant anthrax vaccine, development of antiviral drugs for treatment of complications from smallpox vaccination, and the development of reasonably priced diagnostic instruments capable of being used in field situations.
- HHS has placed contracts to provide enough smallpox vaccine to vaccinate all U.S. citizens, and is anticipating that a second-generation anthrax vaccine will come online within 18 months.
- In closing, Dr. Henderson stated that after many years of permitting our public health infrastructure to deteriorate, we cannot expect to recover the level of competency and control that we need in one or two years. But certainly, a good beginning has been made in recent months.

4.1(p)—The Future of DOE's Automotive Research Programs

February 7, 2002

Hearing Volume No. 107–82

Background

The hearing addressed the Administration's newly announced FreedomCAR program, and its similarities and differences with the Partnership for a New Generation of Vehicles (PNGV) program. PNGV was established and operated as a joint cooperative research

and development (R&D) program between the Federal Government and the United States Council for Automotive Research (USCAR), which was formed by the "Big Three" auto manufacturers (Chrysler [now Daimler Chrysler], Ford and General Motors).

Witnesses included: (1) The Honorable David K. Garman, Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy; (2) Dr. Vernon P. Roan, Vice Chair, National Research Council Panel on the Partnership for a New Generation of Vehicles, and Professor and Director, Fuel Cell Laboratory, Mechanical Engineering Department, University of Florida at Gainesville; (3) Dr. Daniel Sperling, Director, Institute of Transportation Studies and Professor of Civil & Environmental Engineering, University of California at Davis; and (4) Mr. Ross Witschonke, Vice President of Electrics and Power Electronics, Ballard Power.

Summary of Hearing

The hearing helped to flesh out the FreedomCAR proposal and how it differs from PNGV while addressing other, more philosophical questions, i.e., what is the proper goal for government in automotive research. The Administration made clear that FreedomCAR will continue much of the research that began under PNGV, will focus on hydrogen fuel cells, and will drop vehicle-specific goals while creating technical milestones for components and subsystems.

Mr. Garman gave the Committee little new detail about the FreedomCAR program, but pointed out that the appropriate role for government was higher risk, longer-term basic research. Hydrogen fuel cells meet the Administration's goal of providing an alternative to petroleum-based fuels.

Dr. Roan discussed the NRC panel report findings that PNGV was largely successful in achieving its goals, but would have fallen short in producing a pre-production prototype at a reasonable cost by 2004.

Dr. Sperling agreed with the change of emphasis from vehicle-based technology goals in PNGV to the component and subsystem emphasis in FreedomCAR. Dr. Sperling felt that incentives and regulations will be essential to the future of hydrogen and drew attention to the need to increase hydrogen-related engineering training in universities and resolve hydrogen infrastructure questions.

Mr. Witshonke discussed Ballard's role in PNGV and was upbeat about the potential for FreedomCAR. He also indicated that the government should avoid duplicating fuel cell research and focus instead on hydrogen supply and infrastructure questions.

Questioning revolved around the broad themes of defining research needs and goals, the appropriate role for government and industry research and the fate of PNGV research. Chairman Boehlert asked the panel how to maintain research focus without strict goals. Mr. Garman responded that FreedomCAR will have goals but they will be on the component level and will be applicable to all vehicles. He added that DOE is "not good at putting things together" and should focus instead on developing breakthroughs in components and subsystems.

Dr. Roan, Dr. Sperling and Mr. Witshonke discussed the difficulty of bringing new technologies to market in response to a

question from Representative Nick Smith. Dr. Roan said that there were no real breakthroughs in vehicle technology short of fuel cells. Dr. Sperling spoke several times about Detroit having plenty of innovation and research—"garages full of concept cars"—but little of that innovation making it to production. Mr. Witshonke said that many good ideas fall short in the real world of production constraints and costs, for example both Dr. Sperling and Mr. Witshonke agreed that without a hydrogen infrastructure, hydrogen research would be meaningless.

Representative John Larson asked about the appropriateness of using buses and trucks as platforms for nearer term deployment of fuel cells. The panel agreed that these larger vehicles, mostly operated from depots would be ideal.

Chairman Boehlert asked what guarantees exist that new technologies would be adopted once developed. Dr. Sperling responded that incentives and regulation are necessary technology drivers. Mr. Witshonke stated that Ballard "is totally committed" to making its hydrogen fuel cells commercially viable.

Representative Vernon Ehlers asked where the hydrogen needed for fuel cells will come from, and, if the hydrogen comes from hydrocarbons, what happens to all of the carbon. Mr. Garman responded that there are several DOE programs looking at sequestering carbon from the production of hydrogen.

4.1(q)—The R&D Budget for Fiscal Year 2003: An Evaluation

February 13, 2002

Hearing Volume No. 107–57

Background

The hearing was held to consider President Bush's budget request for research and development. Four witnesses reviewed their agencies' budget requests in the context of the Administration's overall priorities in science and technology. In addition, the witnesses were asked to describe the mechanisms that the agencies use to determine priorities across scientific disciplines and the mechanisms that are used to coordinate scientific research and technical development activities with other federal agencies.

The Committee heard testimony from: (1) Dr. John H. Marburger, III, Director, Office of Science and Technology Policy, Executive Office of the President; (2) Dr. Samuel W. Bodman, Deputy Secretary, Department of Commerce; (3) Dr. Rita R. Colwell, Director, National Science Foundation; and (4) Dr. Bruce Carnes, Chief Financial Officer, Department of Energy.

Summary of Hearing

Dr. Marburger testified that the Administration's R&D budget is the largest in U.S. history. In his testimony, he noted that:

- At $111.8 billion, the budget represents an eight percent increase over the FY02 budget—the largest requested R&D budget increase in more than a decade.

- The Administration's greatest priority in drafting the budget was combating terrorism. Funding for anti-terrorism programs, including homeland security and critical infrastructure protection, is tripled from $1 billion in FY02 to $3 billion in FY03.
- Nanotechnology, another priority of the Administration, would increase by 17 percent under the President's proposed budget. At $679 million, this multi-agency initiative focuses on long-term research on molecular- and atomic-sized matter.
- Networking and information technology R&D is funded in the budget at $1.9 billion, an increase of three percent over FY02.
- The budget meets the President's commitment to double the FY98 budget of the NIH by FY03.
- Climate change research was also an important priority in drafting the budget with two new initiatives receiving $40 million each: the Climate Change Research Initiative, and the National Climate Change Technology Initiative.
- It is a goal of the Administration to measure the effectiveness of R&D programs, but such a "score card" approach is still in the development stage.

Dr. Bodman provided a brief overview of specific budgetary items within the President's proposed budget pertaining to science programs and agencies within the Department of Commerce. He noted in his testimony that:

- The budget for the Technology Administration, which is responsible for technology policy and partnerships between government and industry, remains unchanged for FY03 at $8 million.
- At $577 million, total requested funding for NIST represents a $116 million decrease from FY02. Dr. Bodman attributed this decrease to a change in administrative procedure: beginning with FY03, employee retirement benefits will be included in the departmental budgets rather than the NIST budget.
- Funding for NIST laboratories is increased $60 million to $396 million, of which $50 million is for the completion of the Advanced Measurement Laboratory.
- NIST's nanotechnology program receives a $4 million funding increase to a total of $40 million.
- Dr. Bodman stated that the Administration has serious concerns with the Advanced Technology Program and the Manufacturing Extension Partnership. This is reflected by a substantial decrease in proposed funding from over $100 million to $13 million.
- Proposed funding for NOAA is $3.3 billion, a decrease of $136 million.
- Specific areas deemed "critical" by the Administration would receive increased funding under the President's proposed budget—homeland security: $26.4 million, an increase of $23

million; extreme weather forecasting improvements: $766 million, an increase of $84 million; and climate services: $137 million, an increase of $36 million.

Testifying on the National Science Foundation's budget request, Dr. Colwell stated that NSF's use of public funds hinges on two conditions: its research and educational investments are aimed at "the frontiers of understanding," and all awards are competitive and merit-based, with clear criteria for measuring success. The total budget request for the NSF is $5,036,000,000, a five percent increase over FY02 funding levels. Dr. Colwell testified that the total proposed budget includes:

- The second $200 million installment of the five-year, $1 billion Math and Science Partnership, a program aimed at improving K–12 education in disciplines of math and science.
- A $37 million investment that would increase annual stipends for graduate fellows to $25,000 in an effort to attract the Nation's most talented students to the fields of science and engineering.
- Funding levels of $221 million for nanotechnology research, $286 million for information technology research, $185 million for the NSF Learning for the 21st Century Workforce initiative, and $75 million for research on biocomplexity in the environment, including microbial genome sequencing and ecology of infectious diseases.

Dr. Carnes testified that funding for the Department of Energy in the Administration's proposed FY03 budget totals $21.9 billion, of which $8.3 billion is appropriated for R&D. He further asserted that the budget is focused on the central mission Secretary Abraham set for the Department: national security. In accordance with this mission, Dr. Carnes told the Members of the Committee that the budget:

- Focuses on programs that increase energy supply through an increase in domestic production, conservation and efficiency, as well as an expanded array of energy resource options.
- Seeks to develop the potential of hydrogen/fuel cells as a viable fuel by requesting $150 million for the FreedomCAR initiative.
- Recognizes as high priority areas the President's Coal Research Initiative and a new generation of nuclear energy systems.
- Focuses the Nation's research in areas such as energy, threat detection, and climate change.
- Funds research in the cutting-edge areas of nanoscience, microbial science, and "the fundamental understanding of matter."

Dr. Carnes further stated that DOE programs and laboratories are being examined to determine the extent to which they further the central mission established by Secretary Abraham. DOE, he said, is also working toward integrating R&D performance measurements in an effort to evaluate these programs throughout the government.

4.1(r)—NASA's FY 2003 Budget Request

February 27, 2002

Hearing Volume No. 107–58

Background

The hearing addressed NASA's scientific priorities as reflected in the budget request, the criteria by which these priorities were established, the high priority technologies proposed, and the program and management changes contemplated to support the President's Management Agenda. NASA Administrator Sean O'Keefe was the only witness.

Summary of Hearing

Mr. O'Keefe provided testimony on NASA's FY 2003 budget request and several initiatives he is undertaking to set priorities for NASA. Mr. O'Keefe testified that his first priority is a vigorous and aggressive implementation of the President's Management Agenda with special focus on management of human capital, competitive sourcing, e-government, financial management, and integration of budget and performance. Mr. O'Keefe highlighted the new Nuclear Systems Initiative as a major new program aimed at improving power and propulsion technologies to enable more capable solar system exploration programs. He also highlighted the increased focus on education initiatives.

Mr. O'Keefe endorsed the Young Commission's report as a blueprint on how to proceed with reforming the International Space Station (ISS) program. He identified the following five major areas that NASA will focus on for the Space Station: (1) ISS must be science-driven and have a clear set of science priorities; (2) address the engineering challenges to assembling and operating Space Station; (3) establish an independent cost estimate; (4) comply with the international agreements; (5) examine the operational requirements to support Space Station.

Mr. O'Keefe testified that NASA failed its audit this year. The auditors were unable to give NASA a clean opinion because there was insufficient documentation to support a clean opinion. While there is nothing NASA can do to change this audit, Mr. O'Keefe assured the committee that NASA would provide the documentation required to perform a complete audit next year.

Mr. O'Keefe would not give a definitive answer on whether the U.S. Core Complete Space Station would fulfill the U.S. obligation under the Intergovernmental Agreement (IGA). Instead, O'Keefe stated that NASA would comply with the IGA over the next two years and assess, in consultation with the partners, whether to move forward beyond U.S. Core Complete. U.S. Core Complete was defined as the successful integration of Node 2 to the Space Station.

Mr. O'Keefe testified that NASA was investigating various alternatives to the Crew Rescue Vehicle (CRV). He stated that the probability of a CRV's use would be extremely remote and implied that it would not justify the expense. He indicated that a better solution might be to pursue a Crew Transfer Vehicle (CTV), which could

perform the CRV mission and replace the Shuttle for other manned missions.

Mr. O'Keefe also provided testimony on Space Shuttle safety and upgrades, Space Shuttle privatization, NASA's aeronautics program, proposed space science missions to Pluto.

4.1(s)—Learning From 9/11—Understanding the Collapse of the World Trade Center

March 6, 2002

Hearing Volume No. 107–46

Background

The purpose of the hearing was to analyze the investigation into the collapse of the World Trade Center (WTC). Witnesses from industry, academia, and government testified on the catastrophic collapse of the WTC complex and subsequent efforts by federal agencies and independent researchers to understand how and why the structures failed. Witnesses described why it was important to scrutinize the steel and other debris, blueprints and other documents, and recorded images of the disaster, so that engineers, designers, and construction professionals could learn valuable lessons that could ultimately improve the safety of buildings. Witnesses also described the many impediments they encountered, such as: no federal agency believed it was clearly charged with investigating building failures; nothing ensured that an investigation would begin quickly enough to preserve evidence; no federal agency had the investigative authority, akin to that of the National Transportation Safety Board, to ensure access to all needed information; and no one kept the public informed of the progress of the investigations.

The Committee heard testimony from: (1) Mr. Robert Shea, Acting Administrator, Federal Insurance and Mitigation Administration, Federal Emergency Management Agency (FEMA), accompanied by Mr. Craig Wingo, Director, Division of Engineering Science and Technology, Federal Emergency Management Agency; (2) Dr. W. Gene Corley, P.E., S.E., American Society of Civil Engineers (ASCE) and Chair of the Building Performance Assessment Team (BPAT) reviewing the WTC disaster; (3) Mr. Glenn Corbett, Assistant Professor of Fire Science, John Jay College, City University of New York; (4) Dr. Abolhassan Astaneh-Asl, Professor, Department of Civil and Environmental Engineering, University of California, Berkeley; and (5) Dr. Arden Bement, Director, National Institute of Standards and Technology (NIST).

Summary of Hearing

Leading investigations of building failures:

Chairman Boehlert opened the hearing by recognizing that reviewing how the Federal Government investigated the collapse of the WTC was both a sensitive and difficult topic. However, he stated that it was the Committee's duty to do so for two fundamental reasons. First, the families of the victims had a right to know how the Federal Government investigated the collapse. Second, the

Committee must assess how the Federal Government, as a matter of course, investigates building failures to determine if changes are necessary. He noted that the investigation of the WTC collapse ran into a number of troubling obstacles. Obstacles identified by the Committee include: federal agencies did not coordinate sufficiently, and some were slow to react; no organized team was at the site for weeks; potentially valuable evidence had been lost irretrievably; and blueprints were unavailable for months. Finally, he stated that the Federal Government must have standard protocols for conducting investigations to overcome many of the obstacles encountered during this investigation. He also added that it was the Committee's intent to work toward achieving this goal and to thoroughly review other matters relevant to this issue.

Witnesses testified as to the confusion that characterized the Federal Government's efforts to investigate the collapse of the WTC buildings. It became clear that while the federal agencies represented at the hearing tried to respond to the disaster in some fashion, no agency believed it had the authority to lead an investigation of a major building failure.

During the hearing when the witnesses were asked to indicate who was in charge of the investigation of the WTC collapse, several witnesses raised their hands. FEMA clearly believed it was initially in charge because it deployed the BPAT. However, Mr. Shea testified that FEMA did not have the authority to investigate the building disaster, but only to study it. Dr. Bement also appeared unclear as to where authority lay to conduct an investigation of the collapses. While he testified that he was acting as though NIST was in charge, it is clear that NIST initially took no action to conduct an investigation in response to the collapse of the WTC.

Ultimately, Mr. Shea concurred with the Chairman that for several months after the attacks it was uncertain who was in charge of investigating this disaster. In addition, Mr. Shea testified that FEMA turned to NIST to lead an investigation because FEMA does not have the technical capability or resources to conduct investigations of major building failures. Mr. Shea said that based on his experience, an overall Federal Government strategy for responding to building failures is needed and NIST should be vested with this authority.

Preserving evidence and gaining access to critical information:

Witnesses testified that confusion regarding who was in charge of the investigation and the BPAT's lack of investigative authority led to delays in deploying the BPAT team, problems in gaining access to the WTC site, an inability to preserve valuable steel evidence from the site, and problems gaining access to information the BPAT requested.

During the hearing, Members voiced concern about why the BPAT had not been deployed immediately after the attacks and whether the delay had hindered the team's ability to preserve important evidence. Dr. Corley testified that immediately following the attacks, ASCE began assembling a team of experts to study the disaster. Although this team later became part of the official BPAT that FEMA created, that official designation did not occur until

late September, 2001. Furthermore, it was only at that time that the team was able to gain access to the disaster site. Dr. Corley believed that one possible reason for this delay was the uncertain relationship between the BPAT and ongoing search and rescue efforts, as well as the criminal investigation. During the time the team was not present on site, the City of New York decided to haul away and recycle the steel, which could have been useful as evidence for the investigation.

Even after the BPAT was on site and had actively assumed its duties, there was still confusion abut whether the BPAT had the authority to preserve evidence. Mr. Shea said that the BPAT was in charge of gathering the necessary evidence for an investigation. However, Dr. Corley, who led the BPAT team, said that he did not know whether anyone had the authority even to ask the City of New York to stop recycling the steel. When Dr. Bement was asked if NIST could presently sequester evidence for its investigation, he said that NIST could request that evidence be preserved, but that it had no power to enforce the request.

Dr. Astaneh-Asl, who was funded by the National Science Foundation to study the collapse, testified that he experienced the same problems that Dr. Corley's team faced in terms of gaining access to the site, and studying and preserving the steel evidence. He testified that he had, without any assistance from any federal agency, directly negotiated with the plants recycling the steel, and it was only because of their cooperation that he was given access to the steel.

Professor Corbett described the consequences of losing pieces of steel evidence. He said with steel from critical areas of the building (such as where the planes hit the building) would help the BPAT make more definitive statements as to the specific cause and chronology of the collapse.

Several witness commented on the problems the BPAT faced in gaining access to information it required as part of its investigation. The BPAT requested access to the WTC building blueprints, design drawings, and maintenance records. It planned to use these to validate physical and photographic evidence and to develop computer models to explain why and how the buildings failed and how similar failures might be avoided in the future. The BPAT did not get immediate access to the full set of these documents and eventually, FEMA had to intercede on behalf of the BPAT. However, there was a significant delay in FEMA making this request. Mr. Wingo testified that FEMA did not ask the Port Authority of New York and New Jersey for blueprints and design specifications for the buildings until December 21, nearly four months after the disaster, and Dr. Corley testified that the BPAT did not receive full copies of the blueprints and design drawings until January 8, 2002.

In addition to the structural records, the BPAT team requested video footage from the television networks and tapes of 911 calls from the New York City Police Department. Dr. Corley testified that the BPAT team was only able to obtain from TV networks video footage of the collapse that had been played on air; the networks would not release unaired footage. The BPAT ultimately gave up on attempting to obtain the 911 tapes. During the May 1 follow up hearing held by the Science Committee (later described

herein), Dr. Jonathan Barnett, Professor, Center for Fire Safety Studies, Worcester Polytechnic Institute, Worcester, Massachusetts, who was also a BPAT member, said that after being denied access to the 911 tapes for several months, he withdrew the request for the tapes because the computer modeling that would have used the 911 tapes would not be completed in time for the BPAT report.

Dr. Bement explained that NIST's planned investigation could run into the same impediments as the BPAT in terms of gaining access to this information. Dr. Bement explained that, while NIST could request information, it lacked the power to issue subpoenas for information it deemed critical to its investigation, and that he therefore could not ensure that NIST would have total access to this information.

Informing the public:

Members expressed great concern about the lack of regular public briefings by FEMA, as well as the status of the BPAT investigation and its factual findings. Witness generally agreed that briefing the public was an important component of any investigation, but the hearing revealed that there were problems with how FEMA handled communications with the public during the BPAT study. While Mr. Shea testified that he believed FEMA did try to respond to inquiries from the public, he also said that BPAT participants were asked to sign confidentiality agreements that prohibited them from publicly disclosing the conversations and opinions discussed during the course of the team's deliberations. He said this was standard practice with BPATs in order to protect the scientific integrity of the process. However, several Members point out that much of the public criticism and leaks to the press regarding the BPAT initial findings could have been prevented by regular public briefings.

Funding investigations:

Witnesses and Members expressed concern about the resources federal agencies were able to commit to investigate the WTC building collapses. Dr. Corley testified that the total amount of money (both public and private) supporting the BPAT study was about $1 million, and that, in his opinion, $40 million would be required to conduct a comprehensive study of the WTC disaster. Dr. Bement concurred with this figure by stating that $40 million "wasn't too far out of the ballpark" of what NIST would need to complete its proposed investigation. Professor Corbett summarized the general funding problems of this effort by saying that, "a disaster of such epic proportions demands that we fully resource a comprehensive, detailed investigation." He further emphasized that "instead, we are staffing the BPAT with part-time engineers and scientists on a shoestring budget."

4.1(t)—The 2001 Presidential Awardees for Excellence in Mathematics and Science Teaching: Views From the Blackboard

March 20, 2002

Hearing Volume No. 107–55

Background

As demonstrated by the results of the Third International Mathematics and Science Study (TIMSS) in 1994, and the repeat study in 1999, while fourth grade students in the United States perform above the international average in science and mathematics, U.S. middle school students perform at the international average and high school students perform well below their international peers. Perhaps even more disturbing, when the cohort of students who performed well at the fourth grade level in 1994 were tested as eighth graders in 1999, there was a marked drop in performance despite an increased focus on improving math and science instruction in the wake of the 1994 TIMMS results. Factors believed to contribute to poor student performance in math and science include: limited uninterrupted time-on-task in class, limited access to high-quality curricular materials, a shortage of teachers with solid academic preparation in math and science, insufficient faculty planning time, and a lack of stimulating, long-term professional development opportunities for teachers.

In this hearing, the Committee on Science heard testimony from the Nation's best math and science teachers—recipients of the 2001 Presidential Award for Excellence in Science and Mathematics Teaching—on how to improve mathematics, science and technology education in the U.S. In addition to an open-microphone session in which all Presidential Awardees were invited to participate, the Committee heard testimony from: (1) Ms. Susan Kielb, a 7th grade mathematics and life science teacher at Tappan Middle School; (2) Ms. Jana D. Rowland, a 5th grade science teacher at Hydro-Eakly Elementary School; (3) Mr. Bill H. Schrandt, a math teacher at Valley High School; and (4) Dr. Frances Hess, a science teacher at Cooperstown Central School.

Summary of Hearing

Chairman Boehlert opened the hearing by stating that there is no issue within the Committee's jurisdiction that he cares about more deeply than science and math education. None of the other things the Committee wants to do—whether it's understanding global climate change or completing the International Space Station—none of these things can be done unless we have the scientists and engineers to do the work and a scientifically literate citizenry who will support it and learn from it. And, of course, there's only one way we can create those scientists and engineers and educated citizens, and that's through education—starting from earliest childhood. The Chairman asked panelists to provide their reaction to H.R. 1858, House-approved legislation authorizing programs designed to create partnerships between universities, busi-

nesses and school systems, and to attract more top college students into teaching.

Ms. Keilb testified that in order to provide high quality math and science education to students, teachers must have a firm foundation in mathematics and science themselves. She credited her own training and experience as a scientist for her success as a math and science teacher and made the following recommendations:

- Top graduates of mathematics and science degree programs should be encouraged to pursue careers in teaching and should be given grants to earn teaching credentials;
- Educators must have high-quality professional development opportunities throughout their careers and must have time during the regular work day to collaborate and share new ideas about teaching;
- Educators must be exposed to the outside world of science and mathematics so they can understand advances in science and mathematics; and
- Students should be challenged to utilize reasoning and problem-solving skills in math and science rather than demonstrating knowledge solely through multiple choice tests.

Ms. Rowland commented that her training as a medical laboratory technologist helped her become a capable science teacher and that a primary concern for teachers in rural areas is the number of non-English speaking, transient students who don't stay in one school long enough to master basic skills. She made the following comments and recommendations:

- There are inadequate resources for high quality teacher training and professional development in mathematics, science and technology;
- Test scores may not reflect a school's real progress in improving math and science education when the school has a large number of non-English-speaking, transient students who are not in a single school long enough to gain the fundamental skills and knowledge required to be successful;
- Programs need to be implemented to encourage college students in the science fields to consider entering the teaching profession;
- Students at the K–12 level need to be shown that the job opportunities in the future will be from the math and science fields; and
- The Federal Government needs to support regional science resource centers.

Mr. Schrandt discussed the need to provide teachers with the same opportunities that other professionals are routinely provided in the area of continuing education, professional development, and ongoing collaboration. He testified that:

- Teachers need to teach content in the context of applications that students value and understand so that students can see why learning math is useful and important;

- Teachers need to be provided with regular opportunities to work together, formally or informally, so they don't feel isolated from one another in their professional lives;
- Teachers are not perceived as professionals, largely because of low salaries; this leads to low expectations.
- The government needs to promote the role and importance of teachers and to support workshops and collaborations among teachers to increase the degree of professionalism; and
- Professional development opportunities, such as the ones provided by the NSF, should be expanded.

Dr. Hess noted the need for continued professional growth among teachers and better curricula for students. She recommended that:

- Additional federal funding should be provided to help teachers grow professionally, develop better curriculum, purchase science equipment for classrooms and ease budget tensions among local school districts;
- Teachers should be compensated for the money and time they invest in professional development programs; and
- More programs should be created to encourage businesses to contribute resources and expertise to local schools.

4.1(u)—New Directions for Climate Research and Technology Initiatives

April 17, 2002

Hearing Volume No. 107–56

Background

The purpose of the hearing was to receive suggestions on how to focus the Federal Government's climate change research and technology programs. The hearing assessed how the new Climate Change Research Initiative (CCRI), intended to complement ongoing federal global change research activities, could be structured to yield more useful information for decision-makers and how the new National Climate Change Technology Initiative (NCCTI) can be designed to be more effective than past programs at developing technology options that can assure our future energy security and at delivering those technologies to the marketplace.

Witnesses included: (1) Dr. Radford Byerly, Jr., Visiting Scholar, Center for Science and Technology Policy Research, University of Colorado; (2) Dr. Eric Barron, Director, Earth Systems Science Center, Earth and Mineral Sciences Environment Institute, Pennsylvania State University; (3) Dr. Edward Miles, Principal Investigator, Pacific Northwest RISA, JISAO Climate Impacts Group, University of Washington; (4) Dr. James Edmonds, Senior Staff Scientist, Pacific Northwest National Laboratory, Battelle Memorial Institute; and (5) Mr. Scott Bernstein, President, Center for Neighborhood Technology.

Summary of Hearing

Chairman Boehlert opened the hearing by stating that this is a critical moment for global change research programs. While in many ways, the successes of these programs are inarguable, their future contours have never been more uncertain. Some experts suggest that the science program is focused on the wrong issues entirely, paying too much attention to long-range questions that will always be hard to resolve, while resource managers who raise shorter-range climate questions go begging for answers. Others suggest the need for heightened attention to a small set of long-range questions, such as the nature of the carbon cycle, and to providing the modeling and observational tools needed to answer them. Similar issues have been raised about focusing the government's technology programs, which have led to significant incremental technical improvements, but haven't usually been as successful at "great leaps forward" or market penetration.

The Chairman asked the witnesses to explain what they would do if they were put in charge of the science and technology programs. What research goals would they set out and how would they set up an agenda to achieve them? We will then follow up on today's hearing with a hearing in late May or in June to hear from government witnesses to learn exactly how the Administration plans to proceed with the climate program.

Dr. Byerly began his testimony by telling the committee that having the data to make accurate climate change predictions does not make policy decisions easier.

- CCRI will not help make better policy decisions on climate change because its data collection process was not designed with the needs of end users in mind.
- Legislation should focus on developing research programs that cater to the needs of data users.

Dr. Barron took the view that the United States' Global Climate Research Program (USGCRP) and the development of (CCRI) are steps towards developing an "Environmental Intelligence Center" that should centralize climate data for decision-makers.

- Multiple stresses and environmental factors affect climate and research should focus on the impact of a variety of human activities.
- Collaboration across agencies will allow climate data sets to be analyzed for other environmental assessment programs, especially for evaluating health threats.

Dr. Miles provided testimony on behalf of Regional Integrated Sciences and Assessments Program.

- While climate data is recorded annually, this data is used on the regional level for more seasonal predictions, such as expected monthly rainfall.
- The climate change data that is most useful for decision-making varies by region, whether it is interdecadal Pacific Decadal Oscillation in the Pacific Northwest, or the El Niño Southern Oscillation data for Florida.

Dr. Edmonds testified that stabilizing the concentration of greenhouse gases in the atmosphere requires carbon dioxide emissions to peak and then decline indefinitely, effectively falling to zero.

- Stabilizing greenhouse gas concentrations in the atmosphere will require a revolutionary change in the global energy system, which would be extremely expensive if undertaken with present technology. Scientific developments are needed to facilitate new technologies.
- Significant advances must be made in hydrogen, fuel cells, carbon capture and disposal technologies.
- Biotechnology investments have the potential to return great dividends in terms of energy security and clean fuel production.
- Since all technologies are unlikely to be successfully developed and deployed into the marketplace, it is critical to maintain a broad portfolio of investments in new technologies

Mr. Bernstein testified about steps the Federal Government could take to better align energy technology programs with climate and economic goods, total household energy consumption trends and their effect on greenhouse emissions.

- Mitigation efforts would be enhanced if the federal R&D programs were focused more on deployment of technology and projects were organized by community needs rather than technologies or sectors.
- Because building turnover is slow, (80 years on average for houses) programs should be shifted to focus on retrofitting buildings instead of just building efficient new ones.
- Real-time information on consumption, demand and prices would create positive incentives for reducing energy consumption, lowering demand at peak usage times.

4.1(v)—The Investigation of the World Trade Center Collapse: Findings, Recommendations, and Next Steps

May 1, 2002

Hearing Volume No. 107–61

Background

The purpose of the hearing was to examine the key findings and recommendations of the Federal Emergency Management Agency's (FEMA) investigation into the collapse of the World Trade Center (WTC). The hearing also reviewed the plans of the National Institute of Standards and Technology (NIST) to conduct a more extensive follow-up investigation and to establish a comprehensive research and development plan to improve standards, practices, and codes for buildings and fire. In addition, the witnesses were asked to comment on H.R. 4687, a bill that would confer to NIST additional investigative powers.

The Committee heard testimony from: (1) Mr. Robert Shea, Acting Administrator, Federal Insurance and Mitigation Administra-

tion, Federal Emergency Management Agency; (2) Dr. W. Gene Corley, P.E., S.E., American Society of Civil Engineers, Chair of Building Performance Assessment Team reviewing the World Trade Center disaster; (3) Dr. Arden Bement, Director, National Institute of Standards and Technology; and (4) Mr. Glenn Corbett, Assistant Professor of Fire Science, John Jay College, City University of New York.

Summary of Hearing

Chairman Boehlert opened the hearing by describing the Committee's findings from the March 6, 2002 hearing that examined the Federal Government's investigation of the WTC collapse. The main findings were that the study of the collapse had been hampered by: bureaucratic confusion, hesitation and delay; a lack of investigative tools; and excessive restrictions on the flow of information. He then described how legislation he had introduced with Representative Weiner (the National Construction Safety Team Act, H.R. 4687) would solve each of those impediments for future investigations.

The Chairman stated that the three main goals of the hearing were to: examine the findings of the American Society of Civil Engineers (ASCE) team that was responsible for studying the collapse of the WTC; discuss the NIST plan for a follow-up investigation of the ASCE study; and facilitate a public discussion of the National Construction Safety Team Act. Finally, he declared that it was the Committee's intent to push for enactment of the National Construction Safety Team Act and to secure funding for NIST's follow-on investigation of the WTC collapse.

Mr. Shea introduced the report of the Building Performance and Assessment Team, entitled: "World Trade Center Building Performance Study: Data Collection, Preliminary Observations, and Recommendations" (FEMA publication #403). He commended the team's work, and expressed his sense of the human tragedy.

Dr. Corley described the building performance team, the tools they used to evaluate eight buildings in the World Trade Center complex, and the findings and recommendations of the report. He noted that:

- The team comprised 25 people including structural engineers, designers, analysts, professors, firemen, investigators, etc.
- The scope of the BPAT's work included collecting and preserving data, undertaking preliminary analyses, recommending areas for further work, and offering suggestions that might improve the performance of buildings in the future. The BPAT was not intended to make final conclusions.
- The impacts of the aircraft were not sufficient on their own to bring down either of the towers. Because of the buildings' redundant design, the loads were redistributed to intact columns after the impact, enabling the buildings to stand for nearly an hour. The collapse occurred because of the compounding effects of the ensuing fire.
- The impacts dislodged some of the fireproofing from the steel, and also damaged the stair enclosures, thereby block-

ing all three stairwells in Tower 1 and two of the three in Tower 2.

- Several lessons can be learned from the performance of the WTC buildings. For all buildings: elements that connect beams and columns should be fire-rated. For buildings identified as potential terrorist targets:
  1. Redundancy (buildings being able to transfer loads to other structural elements should some fail) and robustness (designing elements in a manner in which they can carry additional loads in extreme circumstances) are necessary to avoid collapse;
  2. Fireproofing should better adhere to the steel, making dislodgement in an impact less likely;
  3. The sprinkler systems in buildings should have redundant water supplies; and
  4. Redundancy, distribution, and impact resistance of exit pathways should be improved.
- Additional research is needed to understand the performance of structural connections under fire conditions, why Building 7 collapsed as a result of fire alone (not physical damage), and the human elements of the evacuation.

Dr. Bement testified on NIST's proposed follow-on investigation into the collapse of the WTC buildings. He said that the plan consists of three key program elements:

- A 24-month building and fire safety investigation into the collapse of WTC buildings 1, 2, and 7 that will look at building construction, materials used, and technical conditions after the impacts;
- A multi-year research and development program (examining fire safety, prevention of progressive collapse, and equipment standards for first responders) to provide the technical basis for improved building and fire codes, standards, and practices; and
- An industry-led program to provide practical technical guidance for facility owners, contractors, designers, and emergency personnel in preparation for responses to future disasters.

Dr. Bement further testified that:

- All of the BPAT recommendations map into the three elements of the NIST response plan, which has been shared with public and private organizations.
- NIST continues to revise the plan as more technical information becomes available and in response to the suggestions of stakeholders.
- NIST believes strongly that the lessons learned from the investigation will be applicable to a broad range of building types.
- NIST will liaise with professional communities and families of victims, consult with local authorities in New York, and share the details of the plan with the public.

- The Administration has expressed a strong commitment to the plan and has asked for $16 million as a part of FEMA's FY 2002 supplemental budget request to support the NIST investigation.
- The President's FY 2003 budget request includes $2 million in base funding for the plan, and $2 million of existing base NIST funds have been redirected toward this effort as well.

Professor Corbett argued that the generalized nature of the BPAT's recommendations and the limited scope of its assessment leave us with little hard evidence with which to make specific improvements to codes, design practices, and emergency response procedures. He said that:

- The report recommendations are a useful starting point, but much work remains to be done.
- The proposed NIST investigation is the type of large-scale forensic inquiry the Federal Government should have launched in September 2001.
- He has reviewed the plans for the NIST investigation and identified three areas of concern: the need for rapidly assembling individuals to form the core Federal Advisory Committee; the need for subpoena power; and the need to develop defensible and detailed proposals for changes to building and fire codes, response procedures, and emergency response technologies.
- The Federal Advisory Committee's oversight is important because of the multidisciplinary nature of the investigation, which involves some issues that are outside NIST's traditional realm of expertise.
- The Federal Advisory Committee should contain a variety of individuals from different disciplines in order to avoid making the same mistakes as the BPAT team.
- A legal means for obtaining information that would otherwise be unavailable (subpoena power) is necessary in order to conduct a complete investigation from which conclusions may be drawn.
- NIST must make recommendations to specific sections of model building codes accompanied by the corresponding supporting evidence in order for the lessons learned to ultimately be applied in building codes, standards, and practices.
- It is critical that the investigation be as comprehensive as planned and be funded at appropriate levels so that the lessons of the WTC disaster may be learned and applied.

When asked to comment on a draft of H.R. 4687 during the question and answer period, the witnesses made the following observations:

- Professor Corbett suggested that the bill's use of "building failure" be altered so that it also includes failures of design in cases not involving collapse. He felt that the bill should also apply to situations involving chemical or biological attacks on buildings. Additionally, he argued that there should

be a formalized relationship between code-writing organizations and the Construction Safety Teams.

- Dr. Corley commented that the bill addresses many of the difficulties he encountered in the BPATs in which he has participated. He suggested that the bill be clarified with regard to its coverage of building damage due to earthquakes, tornados, and hurricanes. Additionally, he suggested that the teams contain a minimum of ten members in order to cover various fields of engineering expertise. And finally, he felt that the section about changes in building codes should be worded more carefully.
- Mr. Shea explained that he met with the leadership of the National Transportation Safety Board (NTSB) to discuss whether their authorizing legislation provides them with the range of authority they require. NTSB indicated that it does, and Mr. Shea noted that H.R. 4687 parallels the NTSB legislation. He also expressed support for the bill's inclusion of the U.S. Fire Administration in the teams' efforts.

4.1(w)—Health Effects of Particulate Air Pollution: What Does the Science Say?

May 8, 2002

Hearing Volume No. 107–60

Background

The purpose of the hearing was to examine what is known about the impact of small particle air pollution on human health. The hearing assessed the state of our scientific knowledge about small particle air pollution and its effects on health and asked how we should go forward with a research agenda to address outstanding questions.

The Committee heard from: (1) Mr. Daniel S. Greenbaum, President, Health Effects Institute; (2) Dr. Ron Wyzga, Technical Executive, Air Quality, Health, Risk and Electric Power Research Institute; (3) Dr. Joel Schwartz, Associate Professor of Environmental Epidemiology, Harvard School of Public Health; and (4) Dr. Praveen K. Amar, Director of Science and Policy, Northeast States for Coordinated Air Use Management.

Summary of Hearing

Mr. Greenbaum summarized the current scientific literature linking particulate air pollution to premature mortality. He noted that:

- In 1997, EPA promulgated ambient air quality standards based on epidemiological studies that suggested a correlation between daily levels of air pollution and hospitalization and found that the risk of premature death was elevated 17 to 24 percent for residents of the most polluted cities.
- Since then, more comprehensive studies have corroborated these initial findings. Although the influence of particulate matter on mortality may be smaller than the initial data suggested, there is solid evidence that the effect is real.

- There is a need for research on what types of particulate pollution are most toxic. Several such studies are underway, but would benefit from a boost in resources from EPA.

Dr. Wyzga's testimony focused on the need to determine which categories of particulate air pollution present health risks and the current research conducted by the Electric Power Research Institute (EPRI) in this field. He noted that:

- While ample evidence suggests that particulate air pollution contributes to adverse health effects, there is a dearth of knowledge about the biology of this interaction and the types of particulate matter which pose the greatest risk.
- Research conducted by EPRI suggests that different types of air pollution differentially affect respiratory and cardiovascular health, and that fine particulates containing carbon are an important player. By contrast, there is little evidence that acid aerosols, soluble metals, ultrafine particles or sulfates pose a health risk.
- Pollution controls need to be targeted at those pollutants which present real health risks.

Dr. Schwartz used his testimony to refute claims which question the link between health and particulate matter and the quality of research. He noted that:

- Particulate matter is strongly correlated with premature mortality, even when gaseous pollutants and seasonal effects are controlled for.
- The premature mortality is not a "harvesting effect," that is, the deaths do not occur exclusively in a population of individuals who would have soon died anyway. Studies that control for this effect, rather than relying on day-to-day comparisons of ambient air quality and mortality, actually find a substantially larger correlation between mortality and particulate air pollution.
- Studies suggest that there is not a threshold of air quality beneath which further reductions have no beneficial consequences.
- Since 1997, a number of careful studies have begun to establish the precise biological links between particulate air pollution and adverse respiratory and cardiovascular effects.
- Multiple studies indicate that an individual's exposure to particulate matter is well correlated with ambient air quality.

Dr. Amar testified on the current extent of particulate air pollution, the available control technologies, and the barriers to their deployment. He noted that:

- Both the East and West coasts have major air quality problems, and often are not in attainment of the national ambient air quality standards.
- Particulate pollution is often formed from gaseous pollutants (such as NO_X and SO_X) components that we have been regulating for years and for which good control technologies exist.

- Combinations of control technologies—such as electrostatic precipitators with baghouses and scrubbers with selective catalytic reduction—are often very effective. Baghouse and scrubber use needs to be increased.
- Vehicles burning diesel gas should be equipped with filter systems.
- Setting clear emissions targets without specifying control technologies is the best way to control pollution, as evidenced by the success in controling power plant emissions of NO_X and SO_X.

4.1(x)—Drought Prediction, Preparation, and Response

June 3, 2002

Hearing Volume No. 107–77

Background

The purpose of the hearing was to examine issues related to drought prediction, preparation and response in Utah. Drought is a normal part of the climate cycle and occurs throughout many regions. The impacts of drought on our economic, environmental and social systems are significant. The Federal Emergency Management Agency (FEMA) estimated annual losses attributable to drought in the U.S. were $6–$8 billion in 1995.

The Committee heard from: (1) Mr. Mark Eubank, meteorologist, Channel 5, KSL TV; (2) Dr. Thomas D. Potter, Director, NOAA Cooperative Institute for Regional Prediction, University of Utah; (3) Mr. David G. Ovard, General Manager, Jordan Valley Water Conservancy District; (4) Mr. Leon Bowler, Farmer and Rancher; (5) Dr. Michael J. Hayes, Climate Impacts Specialist, National Drought Mitigation Center, University of Nebraska-Lincoln; and (6) Mr. Robert Morgan, Executive Director, Utah Department of Natural Resources.

Summary of Hearing

Dr. Potter provided some historical data on droughts in the Western United States and compared those incidences with the current drought. He indicated that much of the Western United States is experiencing a drought with consequences reaching into agriculture, water resources and fire risk. He also suggested the global climate change may make drought conditions both more common and more severe.

Mr. Eubank addressed short- and long-term weather prediction systems. He noted that:

- Better assessments of soil moisture are needed to compliment precipitation data.
- Better predictions of the intervals between precipitation events are necessary.
- Global and solar climate patters correlate to drought incidence; more data is needed to pursue these long-term predictors, especially for mid-range latitudes.

- The Federal Government should promote research into long-term drought prediction, perhaps by giving grant money or prize money.

Mr. Morgan summarized the current drought conditions in Utah as well as the government's response. He noted that:

- Governor Leavitt's water conservation initiative is an important step towards responsible water use.
- Better data on snowpack and hydroclimatic variables are necessary.

Mr. Bowler provided a rancher's perspective, characterizing this year's drought as the worst in living memory. He and other ranchers are being forced to sell cattle at severely reduced prices, and some ranchers are being driven out of business.

Mr. Hayes addressed issues related to long-term water and drought planning. He noted that:

- It is very difficult to assign specific dollar values to the economic losses associated with drought.
- The National Drought Mitigation Center has made important progress in working with States to prepare for droughts and minimize their consequences.
- A difficult but important step will be to move from drought response to drought preparedness.

4.1(y)—Homeland Security: The Federal and New York Response

June 24, 2002

Hearing Volume No. 107–71

Background

The hearing was the third in a series of hearings examining the vulnerability of our nation's computer infrastructure. The Committee also examined research and education challenges and opportunities in computer and network security, as well as the connections between the Nation's science and technology enterprise and U.S. law enforcement and other first responders in the fight against cyberterrorism. Witnesses from government, academia, and industry testified on issues such as the potential ramifications of a cyber attack, as well as the steps that could be taken to improve the research and development of the United States' computer infrastructure.

The Committee heard testimony from two panels of witnesses. Panel 1: (1) Dr. John Marburger, Science Advisor to the President, Director of the Office of Science and Technology Policy, The White House; (2) Mr. James K. Kallstrom, Special Advisor for Public Security to Governor George S. Pataki; (3) Mr. John S. Tritak, Director, Critical Infrastructure Assurance Office (CIAO), The White House; and (4) Dr. James Engle, Deputy Undersecretary for Science and Technology, United States Air Force. Panel 2: (1) Mr. Robert Weaver, Deputy Special Agent-in-Charge, New York Field Office, Director, New York Electronic Crimes Task Force, United

States Secret Service; (2) Dr. Yacov Shamash, Dean of Engineering, State University of New York at Stony Brook; and (3) Mr. Michael Miravalle, President & CEO, Dolphin Technologies, Inc., Rome, New York.

Summary of Hearing

Panel 1:

Dr. Marburger discussed the newly created Critical Infrastructure Protection Board and its standing committees. In his oral statement, he explained that:

- The standing Committee for Research and Development (CR&D), which he chairs, is responsible for coordinating a program of Federal Government R&D for the protection of critical infrastructure as well as ensuring coordination of government activities with corporations, universities, and federally funded research centers.
- CR&D's goal is to create a national critical infrastructure that is trustworthy and resilient.
- The two primary objectives of the federal program in critical infrastructure technology are the promotion and coordination of research to reduce vulnerabilities in the critical infrastructure, and the promotion of R&D technologies that will detect, contain, and mitigate attacks against infrastructure failures.
- In order to cover all of the areas that are affected by critical infrastructures, CR&D has created eight working groups: (1) Information and Communication; (2) Banking and Finance; (3) Energy; (4) Transportation; (5) Vital Human Services; (6) Interdependencies; (7) Outreach; and (8) Physical Asset Protection.

Mr. Kallstrom explained the efforts of Governor Pataki and the Office of Public Security to neutralize security breaches throughout New York State. He testified that:

- The threats posed to networks and systems are related to a deficiency in systems redundancy and physical security standards of critical cyber infrastructure sites, as well as a lack of surplus generators, transformers, and other infrastructures, which would result in prolonged system outages in the event of an attack.
- The State's cyber security task force is tasked with evaluating the state's critical cyber infrastructure, identifying potential means of cyber attack, and devising security practices for private industry, State-operated information systems, and the general public.
- Government and academia must communicate with the private sector to avoid duplication of efforts resulting from federal grants and development projects.
- Outdated public disclosure laws at the State and federal level hinder homeland security efforts, causing public and private infrastructure operators to be unwilling to share information with the government because of fear of public exposure under the Freedom of Information Act. Mr. Kallstrom

hopes the passage of the President's Homeland Security measure will rectify the problem.

Mr. Tritak spoke of the ways in which cyber attacks can be just as dangerous as physical attacks. In his testimony he noted that:

- National security and economic security are now interconnected in such a way that the Federal Government cannot provide adequate safeguard merely on its own; our economy and infrastructure are largely privately owned and operated.
- The successful actions of the State and local governments in coordinating response efforts during and after the 9/11 attacks provide a case study in what critical infrastructure assurance is all about.
- Cyber attacks are often thought to be less hazardous because they are more removed from the public. In pointing out the dangers of such an attack, Mr. Tritak wondered what could have happened had emergency services communications been disrupted on 9/11.
- Information sharing between the private sector and the government needs to improve because critical infrastructure security needs to be analyzed by using a business-type model of examining capabilities and potential vulnerabilities—how disruptions in one area can create disruptions in other areas.

Dr. Engle explained the Air Force's reliance on critical information infrastructures in combating terrorism. He noted in his oral testimony that:

- The Air Force needs assured and dependable information for war fighters, requiring strong investments in science and technology.
- Air Force investments are focused on the highest priorities needed at a given time as the Air Force works with the intelligence community, universities, and industry on a number of leading edge activities to secure information networks.
- In terms of cyber security, the Air Force system requires the following capabilities and focuses its research on these areas: the ability to transfer information across coalition networks; the ability to test and exercise information operation of personnel, equipment, etc. in a realistic setting; the ability to assess the risk of information systems; and the automatic ability to globally correlate attack information.
- Even before 9/11, the Air Force directed much of its science and technology research toward cyber security.

During the question and answer period, the following issues were discussed:

Role of DOD laboratories:

- Dr. Marburger said that DOD laboratories have enormous capabilities in terms of investing in vital technologies and training professionals. Other laboratories can look to labs such as AFRL, which have reoriented themselves with mod-

ern needs, including those of the military and the Nation as a whole.

- Dr. Marburger concurred with Chairman Boehlert that the coordination of cyber protection will be problematic, but he believes that consolidation under the Department of Homeland Security could address many problems.

Relationship between the government and the private sector:

- Mr. Kallstrom agreed with the other witnesses in describing the difficulties in getting private operators of critical information infrastructures, such as operators of power grids, to openly discuss cyber security laws with the government because of freedom of information laws. He believes that these laws need to be modified accordingly.
- Mr. Tritak concurred with Mr. Kallstrom, and went on to testify that industry and government need to be co-partners in dealing with cyber protection because homeland security relies on both working together.

Secrecy and Overspending:

- Dr. Marburger acknowledged Representative Nick Smith's concerns about wasteful spending on protection and the secret nature of some research and development activities. He testified, however, that expenditures on cyber security could serve a dual purpose of providing protection and of creating economic competitiveness because research expenditures made by the private sector could add value to products and make them more desirable to a larger market. Also, he testified that the Department of Homeland Security would narrowly identify the kinds of information that needs to be protected so that secrecy is not rampant.

Panel 2:

Mr. Weaver explained the role of the Secret Service in protecting against a cyber attack. He noted in his testimony that:

- The Secret Service fights cyber crime as part of its core mission to protect the Nation's financial payment systems through its working relationship with the banking and financial sectors as well as the telecommunications industry.
- The partnership between law enforcement, industry, and academia has a demonstrated importance because law enforcement is not sufficiently equipped to face cyber security unaided.
- The Secret Service provides physical assistance to other government departments for training and for performing computer-related analysis or technical consultation.
- A well-placed cyber attack against a weak technology or support infrastructure system can render an otherwise sound physical plan vulnerable or inadequate.

Dr. Shamash discussed the activities of New York State's higher education and information technology industry sectors, as well as ways in which the State's resources may be used to address cyber threats. He specifically noted that:

- The shutdown of New York stock exchanges last fall provided a brief glimpse of what could happen if critical information systems are not protected in the near future.
- Among other resources, the State is home to five national security agency centers for academic excellence and information assurance, and two federal research labs including the Air Force Research Facility in Rome, NY. These resources combine the efforts of the government and the private sector in researching the security of information systems.
- A national cyber security center should be created to mobilize the best academic, research, and industry resources of the State and the Nation to define cyber threats, to develop effective solutions through new countermeasures and strengthened systems, and to use its expertise in assisting in the implementation of those solutions.

Mr. Miravalle discussed the importance of giving researchers the freedom to collaborate on the issues raised by cyber terrorism. In his testimony, he noted that:

- In much the same way that the private sector approaches R&D, cyber security R&D needs to develop a business-type model that would create a research agenda and connect private, public, and academic organizations.
- Along with fulfilling long- and short-term cyber security objectives, the research agenda needs a technology transition process to ensure that new knowledge emerges from the research community and enters a process of implementation.
- It is important to allow government agencies to work in conjunction with each other and the private sector to maximize the information learned from research activities. If the government creates products that it will not utilize, the knowledge should be made available to private industry, where it could be used in the development of cyber security innovations.

During the question and answer period, the following issues were discussed:

Potential for growth in Central New York:

- Mr. Miravalle testified that the existence of the Air Force Research Lab and the National Institute of Justice (NIJ) Cyber Science Lab, as well as local academic institutions, could create a Cyber Security Valley similar to a Silicon Valley. The fragmented nature of the research in Central New York is similar to the splintered nature of information assurance in the economic community, an area that needs to come together somewhere.
- Mr. Weaver testified that because 80 percent of cyber crime occurs on the State and local level, the role of labs such as the NIJ Cyber-Science Lab has become more significant.

Creating a national cyber security research center:

- Dr. Shamash testified that business and software companies, academia, and labs such as the Air Force facility in Rome

are already engaged in cyber security research. The intellectual and financial capabilities of these institutions need to be brought together in creating a national center.

- Mr. Miravalle testified that all parties engaged in cyber security research must be brought together as a team. A system of incentives and rewards for work based on partnering could be offered.

Computer and information systems education:

- Dr. Shamash acknowledged Representative Nick Smith's concern that INS's tougher enforcement of immigration laws could cause a shortage of workers in math, science, and engineering in the U.S. However, he hopes that if a student graduates and has a job in industry, the individual would still be eligible for employment, pending necessary security and background checks.

4.1(z)—Science and Technology to Combat Terrorism

June 25, 2002

Hearing Volume No. 107–68

Background

The House Science Committee and the Subcommittee on Science, Technology, and Space of the Senate Committee on Commerce, Science, and Transportation held a joint hearing to examine how science and technology can best be utilized to defend our nation against the threat of terrorism. The hearing focused on a comprehensive study by the National Academy of Sciences (that was released on the day of the hearing) on science and technology to counter terrorism. The two Co-chairs of the study—entitled *Making the Nation Safer: Science and Technology for Countering Terrorism*—testified at the hearing. The hearing addressed questions over the types of research programs needed to combat terrorism, harden civilian infrastructure systems, and understand terrorist motives as well as the impact of the threat of terrorism on research.

In December 2001, the National Academy of Sciences, using its own funds, initiated a study of science and technology to counter terrorism with the purpose of helping the Federal Government effectively mobilize the Nation's scientific and technical resources to respond to the threat of terrorism. The focus of the Committee's work was on improving our nation's resilience to likely or emerging terrorist threats. The Committee's approach was to identify current and likely threats to the Nation, understand the most likely vulnerabilities in the face of these threats, and identify opportunities for science and technology to contribute to counter-terrorism in both the near- and long-term.

The Committee heard from: (1) Dr. Lewis M. Branscomb, Emeritus Aetna Professor of Public Policy and Corporate Management and Emeritus Director of the Science, Technology, and Public Policy Program in the Center for Science and International Affairs at Harvard University's Kennedy School of Government; (2) Dr. Richard D. Klausner, Executive director, Global Health Programs, Bill

& Melinda Gates Foundation; (3) Dr. John L. Hennessy, President, Stanford University; (4) Mr. Paul H. Gilbert, Director Emeritus, Parsons Brinckerhoff Inc.; and (5) Dr. William Happer, Professor, Department of Physics, Princeton University.

Summary of Hearing

Dr. Branscomb discussed the recommendations and themes inherent in the National Academy of Sciences Report, *Making the Nation Safer: Science and Technology in Countering Terrorism.* In his oral statement he explained that:

- There are three types of recommendations included in the report: those which do not require research, but rather seek to reorganize existing technologies to improve our security; those which recommend available technologies to be deployed and new research activities to be undertaken; and those which deal with the deployment, construction, and funding of such activities.
- The report is not a catalogue of the Nation's vulnerabilities, but in some cases identifies vulnerabilities to encourage investment.
- Nuclear issues were largely dealt with in a classified report available to government employees with adequate clearance.
- The report covers nuclear threats, biological threats, chemical issues, information technology, energy infrastructure, transportation, and complex systems, but it is very difficult to prioritize without knowledge of terrorist capability and intent.
- The report lists seven things that could be done now with existing technologies and seven research activities that ought to be undertaken immediately.
- There are many areas with overlapping problems and technologies that can be, and should be, addressed at one time.

Dr. Klausner spoke about the concept of "dual use," or the integration of civil society and government research and development. He explained that:

- An integrated approach is the most productive and beneficial approach to research and development.
- One of the strong recommendations is the development of a Homeland Security Institute, to advise the Federal Government at the highest levels on vulnerabilities through independent analytical work.
- The Government must engage the universities that are so vital to research and development, without compromising the independence and functionality of such institutions.
- We need to focus on the introduction of new individuals to the fields of science and technology, particularly women and minorities.

During the question and answer period the following issues were discussed:

New Technology and Innovations:

- Dr. Branscomb agreed with Senator Wyden that we need a strategy for new technologies, particularly those intended to thwart terrorism, to cut through the bureaucratic mess. A process is needed for deciding what arm of the Federal Government will purchase and coordinate the development of the technologies, and another process is needed for implementing said technologies.
- Dr. Klausner emphasized the points raised by Dr. Branscomb regarding the daunting confusion associated with Government bureaucracy. He pointed out that a solution to this problem was an intention of the report, or at the least an initiation of a process to resolve this issue.

Under Secretary for Research and Development:

- In response to a question from Chairman Boehlert, Dr. Klausner pointed out that the proposed Department of Homeland Security is going to have to deal with a broad range of technical information. In his opinion an Under Secretary for R&D is needed to coordinate this massive effort. The Under Secretary might also serve as the logical office to which the Homeland Security Institute reports.
- Dr. Branscomb addressed this issue in his personal opinion, as it was not a concern of the report. The proposed Under Secretary would be the senior technical officer for the Federal Government and should be in control of the entire budget allotted to R&D within the proposed Department of Homeland Security.

Cyber Security:

- Dr. Hennessy acknowledged that cyber security research is lagging. Standards need to be set for cyber security throughout the Federal Government, and adequate support needs to be given to local agencies to survive a terrorist attack to their computer systems.

Security of the Energy Sector:

- In response to questioning from Ranking Minority Member Hall, Mr. Gilbert mentioned that the energy sector is broken into several sections, each regulated differently. With these differences (between for example, a regulated utility and a private sector company), it is hard to have a standard of redundancy and security in the system as a whole. The report addresses this issue and recommends some actions to prevent a cascading failure of systems across broad areas.

NIST and Information Security:

- Dr. Hennessy reiterated that the important step in cyber security is setting standards, particularly for computer systems on the local level. In response to a question from Congresswoman Morella, he stated that he did not believe NIST should be moved to the proposed Department of Homeland Security.

- Dr. Branscomb agreed to the latter, but emphasized that NIST and the private sector do not provide for adequate research.
- Mr. Gilbert added that fire codes, such as those brought to light in the wake of the WTC collapse, are outdated, and NIST should be the lead agency in reworking standards to current science.

Recruitment/Retention of Science and Technology Professionals:

- Dr. Hennessy agreed with Representative Lynn Woolsey that we are lacking sufficient interest in the physical sciences and engineering. He attributed a large part of this to little recruitment of women and minorities.

First Responders:

- Mr. Gilbert testified that the real importance of first responders lay in the cities. He also testified that sufficient protection and training need to be distributed to local officials for regular use, so as to pre-empt the harm caused to unsuspecting first responders.

Public/Private Research Partnerships:

- Dr. Klausner, when questioned by Representative Nick Smith over the coordination of NGO's such as NSF with the government, responded that it is hard to predict what science may reveal in the future and science may be stunted by direction. He proposed research investment aligned with a subject rather than a goal.

Quick Response Capacity:

- Dr. Branscomb, when questioned by Representative Brian Baird over the ability of the science community to study tragedies such as the WTC attacks immediately, responded that the NSF, had in fact responded within days to the eruption of Mt. St. Helens. He suggested special rules for extenuating circumstances and said that the report laid out a plan for an expedited scientific review leading directly to the production of new technology.
- Dr. Klausner added that the agencies in question often rely on Congress, and that it is not that the agencies do not wish to move quickly, but that government often restrains them. He suggested this might be a goal of the Committee.

Psychological Aspects of Terrorism:

- Dr. Branscomb commented that while he felt concerned about psychological factors, this was not included in the report, much to the chagrin of Rep. Baird.

Science and Technology in Identifying Priorities:

- Dr. Branscomb, responding to Representative Roscoe Bartlett's question over the role of science and technology in determining the most likely terrorist targets, said he intended for the Institute of Homeland Security to do just that. Also in the field of war gaming, Dr. Branscomb suggested more use of the private sector.

Women and Minorities in Science and Technology:

- Representative Sheila Jackson Lee commented on the need to expose minorities to science and technology.

Local Responses:

- Rep. Jackson Lee commented on the need to coordinate even the simplest responses in local communities, for protection against mass confusion.
- Representative Vernon Ehlers commented that he thought the Homeland Security Institute to be a very important step.

Eliminating the Source of the Threat:

- Dr. Happer testified that steps we can take proactively to prevent terrorism include hastening the reduction of nuclear arms in Russia and undermining the teaching of hatred.

Openness of Information and Security Concerns:

- Senator Wyden asked what one might recommend for maintaining secrecy in National Security Research without slowing scientific progress. He asked to apply the debate over security and freedom to the scientific realm.
- Dr. Klausner replied that this is of concern and he believes that the steps need to be taken in coordination rather than unilaterally by a government agency.
- Dr. Hennessy cautioned the security move as to not constrain current Research Centers.
- Returning to this issue, Representative Zoe Lofgren asked how we can conserve and share information at the same time, and inquired as to whether the proposed Homeland Security Institute would resemble the DARPA.
- Dr. Klausner replied that he did not believe the proposal would follow a DARPA model in that it would repeat its imperfections.
- Dr. Branscomb testified that we must be careful to only restrict information that might be used by would be terrorists.

Roadblocks to Sensor Research, Development, and Deployment:

- Representative Felix Grucci sought an explanation of the roadblocks to Sensors from those testifying.
- Dr. Klausner answered that technology has not yet solved the dilemma of recognizing a particular object. He also said that the Homeland Security Institute is designed to solve these types of problems.

Information Sharing and Foreign Scientists:

- Dr. Klausner, after being pressed by Rep. Grucci, testified that we must be careful not to impede the very important work of foreign scientists.

DOE Labs and The Department of Homeland Security:

- When asked about this topic by Chairman Boehlert, Dr. Happer testified that if done carefully he foresaw a workable relationship created by the new proposed department.

Information Sharing:

- Dr. Klausner, responding to Senator Wyden's question, testified that standards need to be set in order to achieve the level of information sharing we are planning for in the creation of the proposed Department of Homeland Security. He added that the proposed new department has to embrace innovation for it to function as proposed, but also for the standard to be raised throughout the Federal Government.

The Marketplace and Homeland Security:

- Dr. Klausner pointed out that a priority of the proposed Institute of Homeland Security is to set standards to eliminate the marketing of scientifically inferior products to the emotional fervor surrounding terrorism of all kinds.

Protecting Communities:

- Dr. Klausner testified that communication between communities was one of the Committee's top seven priorities, and something the government should take action on immediately.
- Dr. Branscomb added that technology has to be distributed in collaboration with local officials in order to best integrate technology and the education level of the community.

The Role of NASA in Combating Terrorism:

- Dr. Branscomb testified that the proposed Institute would be a think tank and acknowledged that NASA is a valuable resource.

4.1(aa)—Creating a Department of Homeland Security

June 27, 2002

Hearing Volume No. 107–73

Background

The hearing examined the President's proposed legislation creating a Department of Homeland Security (DHS). The hearing focused on issues within the jurisdiction of the Science Committee including the organizational structure for research and development (R&D) within the new department, and the transfer of functions from existing agencies to it. The hearing helped guide the Committee in drafting its legislative proposal regarding the establishment of a Department of Homeland Security. The Director of the Office of Science and Technology Policy testified along with officials representing the Departments of Commerce and Energy.

The Committee heard from: (1) Dr. John H. Marburger, Director, Office of Science and Technology Policy (OSTP), Executive Office of the President; (2) Dr. Raymond L. Orbach, Director, Office of Science, Department of Energy; and (3) Mr. John S. Tritak, Director, Critical Infrastructure Assurance Office (CIAO), Bureau of Industry and Security, U.S. Department of Commerce.

Summary of Hearing

Dr. Marburger discussed the role of science and technology in the new department. He said:

- President Bush's vision is that the Department of Homeland Security will have four primary missions: 1) it will control our borders and prevent terrorists and explosives from entering the country; 2) it will work with state and local authorities to respond quickly and effectively to emergencies; 3) it will analyze intelligence and law enforcement information from all government agencies; and 4) it will bring together scientists and engineers to develop technologies that detect and protect against biological, chemical, and nuclear weapons.
- The Under Secretary for Chemical, Biological, Radiological, and Nuclear (CBRN) Countermeasures would be responsible for coordinating the science and technology element of the new department.
- There would be four priorities for this Under Secretary: 1) securing the U.S. from acts of terrorism involving chemical, biological, and nuclear weapons and other emerging threats; 2) conducting homeland security-related R&D as well as developing a national policy for coordinating federal efforts to counter threats; 3) establishing priorities for directing funding, and conducting R&D and procurement of technology related to countering weapons of mass destruction; and 4) establishing guidelines for State and local government efforts to counter these threats.
- The new department would enjoy maximum flexibility to quickly adapt to new and changing threats, something the current homeland security infrastructure does not allow.

Dr. Orbach explained that the proposed changes in the Office of Science will allow for more efficient protection of the homeland. He noted in his testimony that:

- The program in pathogenic microbes would be transferred to the new department and would be involved in DNA sequencing, technology development, computational tools, and databases.
- The new department needs the in-house capability to understand the nature of this type of threat and the ability to respond to the threat.
- A director of homeland security has been appointed in each of DOE's ten national laboratories. Through Dr. Orbach's office, each director will serve as a single point of contact for both universities in the surrounding region and DHS.

Mr. Tritak discussed the transfer of the Department of Commerce's Critical Infrastructure Assurance Office and the National Institute of Standards and Technology's (NIST) Computer Security Division (CSD) into DHS. He noted:

- The responsibilities of CIAO are to promote national outreach with the private sector and State and local government, to assist federal agencies in analyzing their depend-

encies on critical infrastructures, and to coordinate the preparation of a national strategy for critical infrastructure assurance.

- Because a majority of critical infrastructures are privately owned and operated, the government cannot secure them alone. CIAO attempts to translate the concerns of critical infrastructure assurance into terms that business leaders understand.
- An Information Integration Program Office within CIAO would serve to improve the coordination of information sharing that is essential to combating terrorism.
- The CSD works with industry and government to establish secure interoperable information technology systems and networks.
- NIST has statutory responsibilities under the "Computer Security Act" and the "Government Information Security Reform Act" for developing standards to assist federal agencies in the protection of sensitive and classified systems. In support of this mission, the CSD conducts research to help industry produce more secure, yet cost effective products for the marketplace.
- The President's homeland security proposal is an attempt to balance consolidating multiple functions under one agency and coordinating the remaining agencies in their efforts.

During the question and answer period, the following issues were discussed:

Need for a DHS Under Secretary for R&D:

- Dr. Marburger testified that the assignment of responsibilities under Title III to the Under Secretary for CBRN effectively provides leadership for R&D.
- Chairman Boehlert advocated the Committee's recommendation that an Under Secretary for Science and Technology was needed in the new department to provide a focal point for guiding key R&D programs across the new department, and to maintain a degree of involvement with agencies from the major science, engineering, and medical fields that will not be a part of DHS.

Transfer of NIST Computer Security Division to DHS:

- In response to Representative Zoe Lofgren's concern that moving CSD to DHS would damage the agency's relationship with the private sector and NIST, Mr. Tritak testified that the new department would be a civilian agency whose structure would encourage a collaborative relationship with private industry.
- Mr. Tritak testified that a decision had not yet been made to physically move CSD from NIST. The focus was to develop a transition process that looks at bringing groups together organizationally. At the same time, CSD will retain its close relationships with private industry in the field of computer security.

Setting the Homeland Security Research Agenda:

- According to Dr. Marburger, the research agenda for Homeland Security is the responsibility of the Undersecretary for CBRN. OSTP would continue to provide interagency coordination of research and would continue to provide technical support to the Office of Homeland Security.

Creating a Modern, Agile Department:

- Dr. Marburger concurred with Representative Vernon Ehlers that an objective of the new department is agility and rapid response. The objective is not merely to collect departments; rather, it is to give DHS certain capabilities so that it can be responsive to the needs of Homeland Security.
- Dr. Marburger testified that the decision to pull certain units into the new department while leaving others out (like the FBI and CIA) is a judgment call; the desire is to establish a capability that permits the translation of science into action.

Cyberspace Capabilities:

- Mr. Tritak testified that there is increased awareness that harms in cyberspace don't necessarily remain in cyberspace; rather, in certain situations, these attacks can do serious physical harm. The U.S. depends on information systems and networks to operate physical assets. Part of the goal of DHS will be to make the owners and operators of these infrastructures aware of that dependency and to manage that risk accordingly in a collaborative fashion.

Timeline for Establishing DHS:

- Dr. Marburger testified that the President would like a one year transition period between passage of the bill and activation of DHS. The hope is that the integration of a number of agencies into the new department will not be especially difficult or time consuming.

Protecting Our Critical Infrastructure from Cyberterrorism:

- Dr. Marburger concurred with Representative Roscoe Bartlett's concerns that the opportunities for cyber attacks outnumber the capability of addressing them all simultaneously. DHS will accept the responsibility for prioritizing threats and presenting them to the President, as well as proposing a budget that addresses those threats by utilizing threat assessments and scenarios produced by other agencies and departments, such as the Department of Defense and DOE laboratories.

Broadening the Scope of DHS:

- In response to Representative Nick Smith's concerns about over emphasizing protection against an outside attack at the expense of an inside problem (such as a natural disaster), Dr. Marburger testified that DHS can perform double duties in many areas. In making systems for everyday life more ro-

bust and less vulnerable to terrorist attacks, these systems will also be more useful and less vulnerable in general.

- Dr. Orbach concurred on the duality of purposes by discussing the research of pathogens, which can be introduced by an enemy or merely exist in nature, and which can cause severe diseases and epidemics.

Openness of the Administration to Outside Suggestions Regarding DHS:

- Dr. Marburger testified that the President's proposal is intended to set a general framework that embraces certain principles but provides flexibility for modification. His office has been working with the National Academies on the proposal and will consider using some of the Academies' recommendations, which are more detailed. The Academies' report will not be ignored nor its recommendations rejected without having been thoroughly examined.

4.1(bb)—The Administration's Climate Change Initiative

July 10, 2002

Hearing Volume No. 107–75

Background

The hearing reviewed the Administration's climate change research and technology programs. The hearing assessed the goals of the President's Climate Change Research Initiative (CCRI), how it relates to ongoing federal climate change research activities, and how it could be structured to yield more useful information for decision-makers. The hearing also assessed the goals of the President's National Climate Change Technology Initiative (NCCTI), how it relates to existing climate technology programs, and how federal climate technology investments could do more to enhance our energy security and ensure that new technologies are deployed in the marketplace.

This hearing built on an April 17, 2002 hearing, at which the Committee heard from climate change science and technology experts outside the government about possible new directions for the Nation's climate change science and technology programs.

The Committee heard testimony from: (1) Dr. John H. Marburger, Director of the Office of Science and Technology Policy, Executive Office of the White House; (2) Dr. James R. Mahoney, Assistant Secretary for Oceans and Atmosphere, National Oceanic and Atmospheric Administration, Department of Commerce; (3) Mr. Robert G. Card, Under Secretary for Energy, Science, and Environment, Department of Energy.

Summary of Hearing

Chairman Boehlert opened the hearing by stating that it's been extremely hard to figure out what the Administration is doing in, or planning for its climate change science and technology programs. We have had trouble getting answers to our questions, we've heard contradictory descriptions of programs from different agencies and

even from different parts of the White House, we've had trouble learning how the Administration plans to spend the $80 million for its initiatives, and the list goes on and on.

He continued, stating that we want to get on the record a clear sense of what the Administration intends to be the focus of the Climate Change Research Initiative and the National Climate Change Technology Initiative, and how those relate to each other and to the U.S. Global Change Research Program, which this Committee created in 1990. We want to know how the Administration's new organizational structure can enhance the coordination of the programs. And finally, we want to know how we will finally get a coherent, cohesive budget for climate change programs.

Dr. Marburger started by reaffirming the President's commitment to the United Nations Framework Convention and its central goal, to stabilize atmospheric greenhouse gas concentrations at a level that will prevent dangerous human interference with the climate.

- The Administration's position is that the policy challenge is to act in a serious and sensible way, given the limits of our knowledge. While scientific uncertainties remain, we can begin now to address the factors that contribute to climate change.
- Much of the climate change discussion and its impacts centers on the use of computer models, but today's climate models cannot be used for definite predictions of regional or local conditions.
- The Administration established a new management structure to advance and coordinate climate change science and technology research, including a Cabinet level Committee on Climate Change Science and Technology Integration to oversee the effort.

Dr. Mahoney stated that the status of the earth system, including potential impacts of climate and ecosystem variability, is a capstone issue for our generation and will continue to be so for our children.

- Much scientific progress has been made since 1990, but substantial uncertainties remain to be addressed. Resolving this scientific uncertainty in global climate models will have a major impact on determining the optimal types, amounts and schedules of greenhouse gas emission management.
- An interagency group is currently developing a fully updated strategic plan for the United States Global Change Research Program (USGCRP) and the Climate Change Research Initiative (CCRI) activities. The updated draft proposal will be posted on the USGCRP/CCRI website by November 1, 2002, with a workshop to be held in early December 2002, and a final plan will be published in March 2003.
- The Administration wants to initiate a new three-tiered research strategy: (1) continued scientific inquiry; (2) increased emphasis on measurements and monitoring systems for climate and ecosystem information; and (3) substantially in-

creased focus on providing information useful to decision-makers.

Mr. Card testified that a number of technologies exist that may be used to mitigate climate change options, though they are currently prohibitively expensive for broad use.

- Greenhouse gas reduction has been used as an explicit and top tier funding criteria for making R&D investment decisions.
- Tax incentives are being used to pull technology forward such projects as high graded and fuel cell vehicles.
- The Department of Energy is committed to meeting the President's commitment of 18 percent greenhouse gas intensity reduction by 2012.

4.1(cc)—"The State of the Nation's Ecosystem," The Heinz Center Report and Its Implications

September 24, 2002

Hearing Volume No. 107–87

Background

The hearing examined the key findings and recommendations of The Heinz Center's report on *The State of the Nation's Ecosystems.* The Committee heard testimony regarding what is known and, in many cases, still unknown about the condition of our ecosystems, and received recommendations for filling data gaps and ensuring the ongoing collection of scientifically credible information.

The Committee heard testimony from: (1) Dr. William Clark, Chair, Design Committee and member of the Senior Advisory Group of the Heinz Center Report, and Professor, John F. Kennedy School of Government; (2) Ms. Kim Nelson, Assistant Administrator, Office of Environmental Information, U.S. Environmental Protection Agency; (3) Ms. Lynn Scarlett, Assistant Secretary, Policy, Management and Budget, Department of Interior; (4) Mr. Fred Krupp, Executive Director, Environmental Defense; and (5) Ms. Kim Coble, Maryland Senior Scientist and Assistant Director, Chesapeake Bay Foundation.

Summary of Hearing

Chairman Boehlert opened the hearing by praising the report for being the only recent effort to develop a compendium of available data on ecosystems, as well as for pointing out how far we have to go to fill in incomplete or missing data. He warned, however, that more data is not a panacea and that decision-makers in both the Executive and Legislative branches have some tough decisions to make about what data we want to gather and how much we want to spend to do so. Which data we do collect will shape policy decisions, though it is not likely to be the "Holy Grail" of environmental policy. We know that good economic data has not put an end to debates on fiscal policy, and good quality environmental data on air quality that we now collect has not ended debates on clean air policy.

Dr. Clark began his testimony by outlining the importance of identifying a set of scientifically credible and well-respected national environmental indicators in order to frame policy debates.

- The report details the current condition and historical trends of the Nation's coasts and oceans, farmlands, forests, fresh waters, grasslands and shrublands, and urban and suburban lands.
- It identifies 103 indicators—statistics that represent the health of ecosystems. However, there are complete data for only 32 percent of the indicators, and partial data for another 24 percent. It is not possible to report nationally on close to 45 percent of the indicators, because either the data is unavailable, or the indicator itself needs further scientific development.
- Experts from the business community, environmental organizations, all levels of government, and academia developed the reporting framework, selected the ecosystems, identified the key characteristics of those ecosystems, and chose the measurable indicators included in the report.
- The report presents data and trends but does not draw conclusions about the meaning of the data or evaluate specific policy choices.
- The Nation needs a place to collect and report on national environmental indicators over time, much the same way the Nation collects data on economic indicators.
- The Heinz Center plans to produce annual web-based updates of the data in the report, and prepare a second written report in 2007.

Ms. Nelson emphasized the importance of scientifically valid and measurable indicators, and reminded the committee about EPA's "State of the Environment" report, expected to be released in November 2002.

- EPA strongly supports the Heinz Center effort and provided technical and financial resources to prepare it.
- In addition to reporting on ecosystem conditions (though in a more streamlined way than the Heinz report), EPA's upcoming study will report on (1) the impact of environmental quality on air, water and land and public health, and (2) the stressors affecting environmental quality.
- The Heinz report is significant for bringing a variety of representatives and viewpoints together to agree on indicators.

Ms. Scarlett outlined the Department of Interior's role in preparing the report, emphasizing the data provided by the U.S. Geological Survey (USGS).

- The Department sees the development of national indicators as a step towards establishing stronger accountability through the Government Performance and Results Act.
- The USGS and other divisions of the Department are available for future partnerships with State and private organiza-

tions in order to further the development of indicators for policy-making.

Mr. Krupp praised the collaborative approach that made the selection of indicators for the report possible and added that the transparency and objectivity of the report will make it a useful tool for policy-making.

- The Heinz Report sends an important message that we do not have a sufficient picture of the health of our nation's ecosystems.
- Many of the indicators are not well established enough to be reported nationally.
- However, incomplete national information should not hinder important local actions, where sufficient data often exists.
- The most surprising finding of the Heinz Center report is that nearly all the monitored streams in the United States show contamination from one or more pollutants.

Ms. Coble briefly described the Chesapeake Bay Foundation's experience developing a "State of the Bay" indicators.

- The Foundation has developed 12 quantitative and qualitative indicators, organized in three categories that impact habitat, fisheries and pollution and reflect the effects of stressors on the health of the bay.
- The Foundation's indicators provide a quantitative score for the state of the Bay, and help inform environmental and economic policy and legislation.
- The Heinz Report is important on a local level because it will raise awareness of specific indicators and may assist in the development of new regional measures.

4.1(dd)—Meeting the Needs of the Fire Services: H.R. 3992 and H.R. 4548

October 2, 2002

Hearing Volume No. 107–88

Background

The purpose of the hearing was to: receive testimony on H.R. 3992, the Staffing for Adequate Fire and Emergency Response Act of 2002; and H.R. 4548, concerning the Assistance to Firefighters grant program.

The Committee heard testimony from: (1) Mr. Steve Williams, President, Houston Professional Firefighters Association (testifying on behalf of Harold Schaitberger, General President, International Association of Firefighters); (2) Mr. Randy Bruegman, President, International Association of Fire Chiefs and Chief, Clackamas County, Oregon Fire District; (3) Mr. Jim Monihan, Chairman, National Volunteer Fire Council Legislative Committee and Director, Delaware Volunteer Fire Council; (4) Mr. David James, Chief, Weedsport, New York Fire Department; and (5) Mr. William Antilla, Director of Maritime Science and Fire Science, Clatsop Community College, Astoria, Oregon.

Summary of Hearing

Chairman Boehlert opened this hearing by noting that most of us think of fire as a distant, perhaps even archaic threat, yet it kills about 4,000 Americans each year. Since the Federal Government began investing in fire protection in 1974, the number of fire deaths has dropped by two-thirds, but we need to do better. While firefighting is, and should remain, a local responsibility, the Federal Government also has a role to play in saving lives and property.

Chairman Boehlert also stressed the long history of the Science Committee's role in helping to improve fire safety in the United States, noting that the Hotel-Motel Fire Safety Act was one of the first bills he sponsored as a Member of Congress. He described his legislation, the SAFER Act, and stated that he saw this hearing as a first step in our continuing effort to ensure that the Federal Government does its part in seeing that our nation's fire departments are adequately trained, equipped, and staffed.

Mr. Williams discussed the effect of September 11, 2001 on the Nation and on the International Association of Fire Fighters, noting that the IAFF lost 343 members that day. He testified that 9/11 was a defining moment for IAFF, and that H.R. 3992 represents the most significant contribution that the Federal Government could make toward building a living memorial to those firefighters that died on 9/11. He also stated that:

- ⅔ of all fire departments in America lack adequate personnel, and the problem is growing. He cited several examples of municipalities that have had to eliminate firefighter positions for various reasons.
- Several studies exist showing a direct correlation between staffing levels and the safety and effectiveness of emergency response operations.
- The need for adequate fire services personnel has been recognized by both Federal Government standards (Occupational Safety and Health Administration), as well as fire service industry standards (National Fire Protection Association).
- The events of 9/11 and the new threat of terrorism should eliminate any question regarding whether the Federal Government should be involved in fire protection.
- Federal Government grant programs work best when funds are directly awarded to local fire departments, best exemplified by the successful FIRE Act grants.

Mr. Bruegman declared the International Association of Fire Chiefs support of H.R. 3992, noting the legislation has garnered bipartisan support in both house of Congress, as well as the support of all the major fire service organizations. He testified that:

- Hiring additional firefighters will (1) enhance on-scene efficiency; (2) increase safety for both firefighters and victims; and (3) enhance planning and training to protect both firefighters and the communities they serve.
- While most jurisdictions require four firefighters to staff a single piece of fire apparatus, most staff with only three.

- H.R. 3992 will help fire departments meet nationally recognized standards for operating procedures.
- The FIRE Act grant program is an example of good government: targeted, efficient, and effective. The only problem with the program as it is currently administered is the size of the funding. It is also important that the program is not consolidated into the President's proposed first responder initiative, per the language of H.R. 4548.

Mr. Monihan testified that nearly 75 percent of all firefighters are volunteers, who save taxpayers amounts estimated to be as much as $40 billion annually. He noted that today's fire departments are being asked to respond to emergency calls involving hazardous materials, wildland fires, search and rescue, natural disasters, clandestine drug labs, and terrorism. He praised the Assistance to Firefighters grant program's (FIRE Act) effectiveness in helping volunteer fire departments meet equipment, apparatus, and training needs to better meet these new challenges. He also testified that:

- The Assistance to Firefighters grant program is successful because it is the only federal program that provides funding to fire departments, and that far too often funds intended to aid fire departments are diverted to other uses by state and local officials.
- The National Volunteer Fire Council (NVFC) supports H.R. 4548, and believes that Assistance to Firefighters grant funds should remain separate and distinct from the President's new counter-terrorism initiative.
- The NVFC supports passage of H.R. 3992, but believes that any initiative by Congress to address personnel shortfalls should include a significant recruitment and retention component, which is the number one challenge facing volunteers, whose ranks have decreased by ten percent in the last 20 years. The biggest factor in this decrease has been increased time demands on volunteers.

Mr. James discussed his experiences as Chief of a small volunteer fire department in upstate New York. He noted that his department is also experiencing personnel shortfalls. He discussed the proud tradition held by America's firefighters, but noted that time and money have become the two worst enemies of the fire service, and most people are now simply too busy to get involved. He also testified that:

- The Assistance to Firefighters grants have allowed many departments across the country to update old equipment and purchase new equipment that was not possible before, certainly improving their ability to respond to incidents.
- Volunteer departments are challenged with maintaining the same standards of training and preparedness that career departments are. While career personnel often receive their training on the job, volunteers have to do this at night after completing a full day's work.

- The shortage of manpower is putting firefighters lives at risk. Mr. James's fire department recently had to activate six different departments to a fire so an incident could be handled effectively.

Mr. Antilla discussed the challenges associated with maritime firefighting. He noted that each year, 60,000 ships traverse the Nation's waterways (20,000 of which carry petroleum or other chemicals), and that fire departments tasked with fire protection in such areas often lack the resources and training to handle a major shipboard fire without significant assistance. He also discussed:

- The unique dangers incurred when land-based firefighters are asked to respond to incidents on ships, noting they have no personal knowledge of the vessel's design, layout, or cargo.
- He stressed that, without a financial incentive to provide an increased scope of maritime firefighting training, many departments will not go forward until a response to a fire reveals the need.

4.1(ee)—Conducting Research During the War on Terrorism: Balancing Openness and Security

October 10, 2002

Hearing Volume No. 107–90

Background

The hearing was held on balancing the need for greater security with the need for open scientific communication. Since the September 11th attacks and subsequent anthrax incidents, Congress, the executive branch, and the scientific and technical communities have begun discussions on how to prevent scientific research results and information from becoming national security risks. This hearing focused on the treatment of sensitive information and of foreign faculty and students.

The Committee heard testimony from: (1) Dr. John H. Marburger, Director, Office of Science and Technology Policy, Executive Office of the President; (2) Dr. Ron Atlas, President, American Society for Microbiology and Dean of the Graduate School and Professor of Biology, University of Louisville; (3) Dr. M.R.C. Greenwood, Chancellor, University of California-Santa Cruz; and (4) Dr. Sheila Widnall, Institute Professor, Massachusetts Institute of Technology.

Summary of Hearing

Chairman Boehlert opened the hearing by noting that this was the first hearing Congress has held since September 11th on the central question of balancing security and openness in the conduct of research. He stressed that the war on terrorism would be won in the laboratory just as much as on the battlefield. Since war demands secrecy and science thrives on openness, it is important that we determine how a free society balance those competing demands.

Chairman Boehlert noted that today's enemy is more insidious and dispersed than that of the Cold War days. Further compli-

cating matters, in fields such as biology, the exact same research could be used for both benign and malevolent purposes. A balance must be struck however, and it must be finely tuned and constantly recalibrated. The Chairman stated that he sees the Committee as an "honest broker" in those important discussions.

Dr. Marburger updated the Committee on three topics relevant to balancing scientific openness and national security: 1) biosecurity, 2) international students, and 3) homeland security.

- Biosecurity—Progress has been made towards creating safeguards for select biological agents and the laboratories that have them. P.L. 107–188 requires the Department of Health and Human Services to update registration of select biological agents and create a process to register the possession and use of such agents.
- International students—The Interagency Panel on Advanced Science and Security (IPASS) is a new mechanism to review student visa applications, which focuses on graduate and other advanced students who are going into sensitive fields of study. The Office of Homeland Security (OHS) and the Office of Science and Technology Policy (OSTP) will review IPASS to ensure a balance between scientific openness and homeland security.
- Homeland security—The Administration is not considering a pre-publication review policy of sensitive research as is commonly thought. OHS has, however, asked OMB to create a system for handling sensitive homeland security information.

Dr. Atlas testified representing the American Society for Microbiology (ASM), the world's largest life sciences organization. He stated:

- ASM is wary of any new limitations on publications, and fears that new policies may hinder research, though it understands the need to limit access to information that could be useful to terrorists.
- The only way to truly reduce the risks of bioterrorism is through international efforts because so many nations conduct research on infectious diseases.
- Balancing security and scientific freedom places a burden on researchers. A tenet of the scientific method is reproducibility. Research articles must be detailed enough that other scientists can replicate the results. At the same time, care must be taken not to release information that could be useful to our enemies.
- ASM supports National Security Decision Directive 189 (NSDD189), which establishes only two categories for research—unrestricted and classified.

Dr. Greenwood, a biologist and Chancellor of the University of California-Santa Cruz, emphasized that a dialogue between university and government officials is needed before any changes in policy should be made. Additionally, she stated:

- In general, creating new levels of classification should only be considered if there is a real and agreed upon threat. Spe-

cifically, a 'sensitive but unclassified' designation should not be created because of its ambiguous nature.

- Universities usually do not conduct classified research because of the restrictions it places on the open and collaborative nature of the scientific process. However, some universities do manage national labs where classified research takes place.
- Restricting the fields of study available to some students in the U.S. is not an adequate safeguard due to the educational opportunities available in other countries. Currently more Ph.D.s are awarded by European nations than by the U.S. So a more effective defense would be to strengthen the U.S.'s science and technology enterprise by attracting the best students, regardless of nationality.
- It is impossible to completely restrict potential terrorists from access to American universities because terrorists do not represent nations.
- Excessive restrictions may damage America's economy, which would aid terrorists in achieving their goals.

Dr. Widnall concurred with Dr. Greenwood that the sensitive but unclassified designation should not be adopted, and said that it is 'doomed to failure.' The current policy set by NSDD189 is preferred. Dr. Widnall also summarized some of the recommendations made to MIT by MIT's Committee on Access to and Disclosure of Scientific Information, of which she is the chairman. These include:

- No classified research should be done on campus. In addition, no student should conduct classified research or research that requires access to classified information.
- MIT should not agree to have any research reviewed for the inadvertent release of 'sensitive' information.

The physical sciences and engineering communities have balanced scientific openness with national security for 50 years, but for the biological science community this is a new issue. Dr. Widnall made personal recommendations to the biological and health science community. These recommendations are:

- Determine how much of the biological sciences should be classified.
- Establish an institutional and agency framework by which to classify the research.
- Create an advisory committee composed of members of the scientific community to guide the classification process.

Dr. Widnall cautioned that the decision to classify should not be taken lightly because any research so classified would not occur on university campuses nor have the benefit of open collaboration.

4.2—SUBCOMMITTEE ON ENERGY

4.2(a)—H.R. 723: Civil Penalties for Nuclear Safety Violations by Nonprofit Department of Energy Contractors Under the Atomic Energy Act of 1954

March 22, 2001

Hearing Volume No. 107–33

Background

The hearing addressed proposed legislation to amend the Atomic Energy Act of 1954 to eliminate Department of Energy (DOE) nonprofit contractors' exemption from civil penalties related to violations of DOE rules, regulations, and orders related to nuclear safety.

The hearing panel witnesses included: (1) Mr. Eric J. Fygi, Acting General Counsel, U.S. Department of Energy (DOE); (2) Ms. Gary L. Jones, Associate Director, Energy, Resources, and Science Issues, U.S. General Accounting Office (GAO); (3) Mr. Guy Cunningham, Associate General Counsel, Battelle Memorial Institute; and (4) Mr. Robert L. Van Ness, Assistant Vice President for Laboratory Administration, University of California. In addition, the Subcommittee heard testimony from Representative Joe Barton, Chairman of the House Energy and Commerce Subcommittee on Energy and Air Quality, and the author of H.R. 723.

Summary of Hearing

Representative Barton testified on the importance of H.R. 723 to correct a long-standing problem in the management of DOE facilities. Under the 1988 Price-Anderson Amendments, the DOE cannot levy fines against non-profit contractors for safety violations. H.R. 723 would include non-profit contractors as entities liable to fines for safety violations. Mr. Fygi testified that several DOE nonprofit contractors indicated they could accept civil penalties if the amount of the civil penalties was limited to the amount of the fee the contractors received under their contracts with the Department. He commented on the lack of clarity in the definition of the "discretionary fee," the time period covered by the fee, the effective date of the changes in law, and the repeal of automatic remission of civil penalties under H.R. 723. Ms. Jones testified that in a 1999 report on DOE's nuclear safety enforcement program, the GAO recommended that the civil penalty exemption be eliminated.[1] GAO supported eliminating the exemption since the main reason for instituting it no longer exists. The purpose of the exemption under the 1988 Price Anderson Amendments was to ensure that nonprofit

[1] *Department of Energy: DOE's Nuclear Safety Enforcement Program Should Be Strengthened* (GAO/RCED–99–146, June 10, 1999).

contractors operating DOE's laboratories, who were being reimbursed only for their costs, would not have their assets at risk for violating nuclear safety requirements. GAO had four specific comments on H.R. 723: (1) the definition of the amount of fee at risk is unclear; (2) if the Congress decides to limit the amount of fee at risk by specifying that "discretionary fee" means only the incentive fee portion of the total fee, the ability to impose penalties on nonprofit contractors may be limited; (3) under the proposed bill, limitations on payments for civil penalties would be extended to all tax-exempt nonprofit contractors, not just nonprofit educational institutions; and, (4) the penalty provisions specified in H.R. 723 would apply to contracts entered into only after the date of enactment. Mr. Cunningham expressed concern that the definition of "nonprofit" included in H.R. 723 may have the unintended consequence of excluding Battelle and the operating entities at Brookhaven National Laboratory and Oak Ridge National Laboratory from its coverage, even though all three are nonprofit organizations or composed entirely of nonprofit organizations. Mr. Van Ness testified that improvements have been made in integrating safety into labs under University of California management. He expressed support for civil liability for non-profit contractors as long as there was a cap set on those penalties.

4.2(b)—Department of Energy Fiscal Year 2002 Budget Request

April 26, 2001

Hearing Volume No. 107–34

Background

The purpose of the hearing was to consider the Administration's Fiscal Year (FY) 2002 request for the Department of Energy. DOE witnesses addressed the FY 2002 budget request for each of the six DOE Offices with programs under the Science Committee's jurisdiction: (1) Office of Science; (3) Office of Energy Efficiency and Renewable Energy; (3) Office of Fossil Energy; (4) Office of Nuclear Energy, Science and Technology; (5) Office of Environment, Safety and Health; and (6) Office of Environmental Management. Outside witnesses also addressed the FY 2002 request for the DOE Offices of Science, Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy, Science and Technology.

DOE's FY 2002 budget authorization request for its programs are included in the Science, Energy Supply, and Non-Defense Environmental appropriation accounts of the Energy and Water Development Appropriation Bill; and in the Fossil Energy R&D, Energy Conservation R&D, and Clean Coal Technology appropriation accounts of the Interior and Related Agencies Appropriation Bill.

First panel witnesses included: (1) Dr. James F. Decker, Acting Director of the Office of Science; (2) Mr. John Sullivan, Acting Deputy Assistant Secretary for Planning, Budget and Management on behalf of Dr. Abraham E. Haspel, Acting Director of the Office of Energy Efficiency and Renewable Energy; (3) Mr. Bob Kripowicz, Acting Assistant Secretary for Fossil Energy; (4) Dr. Gail Marcus, Principal Deputy Director on behalf of Mr. Bill Magwood, Director

of the Office of Nuclear Energy, Science and Technology; (5) Mr. Steven V. Cary, Acting Assistant Secretary for the Office of Environment, Safety and Health; and, (5) Mr. James M. Owendoff, the Deputy Assistant Secretary for the Office of Environmental Management. Second panel witnesses included: (1) Dr. George H. Trilling, President of the American Physical Society; (2) Dr. Scott W. Tinker, Director of the Bureau of Economic Geology at the University of Texas at Austin; (3) Dr. James A. Lake, President of the American Nuclear Society; and, (4) Mr. Michael L. Marvin, President of the Business Council for Sustainable Energy.

Summary of Hearing

Dr. Decker testified on DOE's budget for FY 2002, which includes $3,159,890,000 in the Science Appropriation to support their scientific user facilities and continue scientific achievements in the physical and life sciences, mathematics, computation, and environmental research. This budget included funding for the "Genomes to Life" program; improvements to the Stanford Linac; continued construction of the Spallation Neutron Source; and funding for increased supercomputing power to develop large-scale scientific simulation as a tool for the solution of complex scientific problems.

Mr. Sullivan, testifying on behalf of Mr. Haspel, talked about the Office of Energy Efficiency and Renewable Energy's (EERE) mission to advance clean energy technologies, including energy efficiency and renewable energy, and how EERE will play an increasingly critical role in securing our energy future, improving our environment and maintaining our economic growth. The FY 2002 budget request for EERE programs within the Subcommittee's jurisdiction is $708,158,000, a decrease of $264,223,000 from FY 2001 enacted levels. He testified on changes within the Partnership for a New Generation of Vehicles (PNGV) designed "to streamline and refocus this program to give greater flexibility to the automakers and even greater benefits to the taxpayer. The current program attempts to balance a portfolio of near-, mid-, and long-term technologies. In agreement with our industry partners, we will shift emphasis to a more long-term research portfolio that is aimed at overcoming fundamental obstacles to the vehicle technologies that offer the highest potential for significant benefits to this country."

Mr. Kripowicz testified on the Office of Fossil Energy's $745,419,000 budget request for FY 2002, which included the $150 million Clean Coal Power Initiative. Other initiatives funded included carbon sequestration; advanced gas turbines; fuel R&D; resource reserve enhancement R&D; and gas hydrate research.

Dr. Gail Marcus, testifying on behalf of Mr. Bill Magwood, talked about the $223 million fiscal year 2002 budget request for the Office of Nuclear Energy, Science and Technology (NE) to conduct nuclear research and development programs; to enhance the Nation's science, technology and education infrastructure; and to manage NE's federal nuclear facilities and materials and provide for a "revitalization of nuclear power."

Mr. Cary testified on the $140.1 million FY 2002 request for DOE's Environmental Safety and Health programs, which included enforcement of nuclear safety rules under Price Anderson and general environmental health and safety oversight and enforcement.

Mr. Owendoff testified that DOE's budget request of $5.913 billion for FY 2002 for the Environmental Management program would enable DOE to continue the cleanup of the contamination and wastes that resulted primarily from nuclear weapons research and production over the past 50 years.

On the second panel, Dr. Trilling testified on the imbalance between DOE research funding and rapidly increasing research funding at the National Institutes of Health. Dr. Tinker testified on the importance of continued R&D in fossil fuels to improve resource recovery. He proposed a new center be established to conduct R&D in such areas as ultra deep water drilling. Dr. Lake testified on the role of nuclear energy in the U.S. energy portfolio and the need for continued DOE R&D. Mr. Marvin testified on the importance of R&D to both increase diversity of energy choices and reduce energy consumption.

4.2(c)—Energy Realities: Rates of Consumption, Energy Reserves, and Future Options

May 3, 2001

Hearing Volume No. 107–35

Background

The purpose of the hearing was to examine advanced technology options to provide additional energy in the future, since energy demand growth is outstripping current production and the Nation faces the increasing risk of energy shortages.

The witness panel included (1) Dr. Albert A. Bartlett, Professor Emeritus of Physics, University of Colorado at Boulder; (2) Dr. Suzanne D. Weedman, Program Coordinator, Energy Resources Programs, U.S. Geological Survey; (3) Dr. W. David Montgomery, Vice President, Charles River Associates; (4) Mr. Howard S. Geller, Executive Director Emeritus, American Council for an Energy Efficient Economy; (5) Mr. Henry A. Courtright, Vice President, Power Generation and Distributed Resources, Electric Power Research Institute; and, (6) Dr. Alexandra von Meier, Director, Environmental Technology Center, Sonoma State University.

Summary of Hearing

Dr. Bartlett testified that the finite nature of our fossil fuel resources has long led scientists to forecast shortages, which have now begun to appear. In Dr. Bartlett's view, the choice is obvious: we need to ". . .embark on a program of continual reduction of the annual consumption of non-renewable energy in the United States." Dr. Weedman testified about current official estimates of U.S. reserves and how they are derived. Dr. Montgomery testified that the recent supply disruptions and price volatility do not reflect the long-term supply outlook. He stated, however, that ". . .there is no long term supply" beyond ~50 years. Mr. Geller testified that ". . .improvements in energy efficiency have contributed a great deal to our nation's growth and increased standard of living over the past 25 years." He recommended that funding of energy efficiency programs be increased, not cut; that corporate average fuel economy (CAFE) standards be increased by six percent a year for

10 years; that a self funded trust fund be established to fund utility energy efficiency programs; and that tax incentives be adopted for advanced energy efficient vehicles. Mr. Courtright testified that a portfolio of diverse energy sources is needed for electric power generation, including fossil, nuclear and renewables. He recommended R&D funding increases in the area of electric power delivery systems and the creation of non-profit "Electricity Innovation Institute" as a public/private partnership. Dr. von Meier testified that energy efficient improvements in buildings and use of renewable energy sources, particularly solar and wind power, combined, potentially provide ". . .everything we need for a positive and sustainable energy solution."

4.2(d)—Department of Energy Office of Science—Issues and Opportunities

May 17, 2001

Hearing Volume No. 107–37

Background

The purpose of the hearing was to examine the status of the Department of Energy (DOE) Office of Science programs, future opportunities, and major issues that confront the Office.

There where two panels of witnesses. The first panel consisted of the chairs of the six Office of Science Advisory Committees: (1) Professor Frederick J. Gilman (Department of Physics Carnegie Mellon University), Chair, High Energy Physics Advisory Panel, and Department of Physics Carnegie Mellon University; (2) Dr. T. James Symons (Nuclear Sciences Division, Lawrence Berkeley National Laboratory), Chair, DOE/NSF Nuclear Science Advisory Committee; (3) Dr. Geraldine L. Richmond (Department of Chemistry, University of Oregon), Chair, Basic Energy Sciences Advisory Committee; (4) Dr. Keith O. Hodgson (Director, Stanford Synchrotron Radiation Laboratory Department of Chemistry, Stanford University), Chair, Biological and Environmental Research Advisory Committee; (5) Professor Richard D. Hazeltine (University of Texas at Austin, Institute for Fusion Studies), Chair, Fusion Energy Sciences Advisory Committee; and (6) Dr. Margaret H. Wright (Bell Laboratories/Lucent Technologies), Chair, Advanced Scientific Computing Advisory Committee. The second panel included: (1) Dr. Robert C. Richardson, Vice Provost for Research, Cornell University, and recipient of the 1996 Nobel Prize in Physics; (2) Dr. Charles V. Shank, Director, Lawrence Berkeley National Laboratory; and (3) Professor James F. Blake, Institute for Plasma Research, University of Maryland.

Summary of Hearing

The first panel consisted of the chairs of the six Office of Science Advisory Committees who testified that DOE has an important R&D role in Advanced Scientific Computing; Basic Energy Sciences; Biological and Environmental Research; Fusion Energy Sciences; High Energy Physics; and Nuclear Physics. The panel pointed out that DOE's Office of Science is the principal supporter of physical science research and a major supporter of research in

biological sciences, mathematics, and computing in our country. On the second panel, Dr. Richardson's testimony concerned the administrative structure of the Department, the effect that the structure has had on the performance of the Office of Science and made recommendations for improvements. Dr. Shank testified that the physical sciences were being shortchanged in funding, especially when compared to the increases being given to life sciences research. Dr. Blake discussed the importance of the Fusion Energy Program at DOE, which continues to make progress in spite of reduced budgets.

4.2(e)—Energy Conservation Potential of Extended and Double Daylight Saving Time

May 24, 2001

Hearing Volume No. 107–30

Background

The hearing addressed the potential energy savings that could result from extending the months during which Daylight Saving Time (DST) and double daylight saving time (DDST) are in effect. It also addressed the societal effects of DST and DDST.

The Subcommittee received testimony from a panel including: (1) Representative Brad Sherman; (2) Ms. Linda Lawson; Acting Deputy Assistant Secretary for Policy, U.S. Department of Transportation; and (3) Mr. James C. Benfield, Bracy Williams & Co.

Summary of Hearing

Representative Sherman testified that saving electric energy at times of peak demand in order to avoid curtailments, and at all times, is important to the affected states and the Nation. He also presented studies that projected a one to two percent electricity savings and discussed public concern over the safety of children during dark morning hours. Ms. Lawson reviewed the history of DOT's 1975 studies during an energy crisis, which found up to one percent electric power savings in addition to small societal effects. She stressed the importance of uniform observance of time and DST in the specified zones, and gave examples of the confusion that existed when local jurisdictions set DST. She recommended further study before changes are made. Mr. Benfield testified based on his experience as founder of the DST Coalition, which worked to extend DST. He also discussed various social effects and the likely unpopularity and long term ineffectiveness of year round DST, and DDST. He suggested merging the Mountain and Pacific Time zones, which could achieve savings and be acceptable to the public.

4.2(f)—President's National Energy Policy: Clean Coal Technology and Oil and Gas R&D

June 12, 2001

Hearing Volume No. 107–45

Background

The hearing examined the *President's National Energy Policy,* developed by the National Energy Policy Development (NEPD) Group, chaired by Vice President Cheney, which recommended that: (1) the Department of Energy (DOE) invest $2 billion to fund research in clean coal technology; (2) DOE and the Department of the Interior promote enhanced oil and gas recovery from existing wells through new technology; and (3) DOE improve oil and gas exploration technology through continued partnership with public and private entities. The purpose of the hearing was to examine the current status of coal and oil and gas technologies, R&D efforts, and the extent to which technologies derived from these R&D efforts would extend the life of these resources.

The hearing consisted of two panels. The first panel considered clean coal technology. Witnesses included: (1) Mr. Robert S. Kripowicz, Acting Assistant Secretary for Fossil Energy at the U.S. Department of Energy (Mr. Kripowicz also appeared on Panel 2); (2) Mr. Ben Yamagata, Executive Director of the Coal Utilization Research Council (CURC), Washington, DC; (3) Mr. James E. Wells, Director of Natural Resources and Environment at the U.S. General Accounting Office; (4) Ms. Katherine Abend, Global Warming Associate at the U.S. Public Interest Research Group (U.S. PIRG); and (5) Mr. John S. Mead, Director of the Coal Research Center at Southern Illinois University-Carbondale. The second panel considered how technologies derived from petroleum and gas R&D could be employed to improve exploration, extraction, refining & processing, and transportation of these fossil fuels. Witnesses included: (1) Ms. Virginia B. Lazenby, Chairman and CEO of Bretagne, GP, Nashville, TN, on behalf of the Independent Petroleum Association of America; (2) Mr. Paul Cuneo, Vice President & Chief Information Officer of Equiva Services, LLC, Houston, TX; (3) Dr. Craig W. Van Kirk, Professor of Petroleum Engineering and Head of the Department of Petroleum Engineering at the Colorado School of Mines, Golden, CO; and (4) Dr. Alan R. Huffman, Manager of Conoco's Seismic Imaging Technology Center, Houston, TX.

Summary of Hearing

Mr. Kripowicz testified on R&D efforts at DOE designed to extend fossil resources while reducing concerns about emissions. These programs included clean coal technologies, innovative drilling techniques and the use of new technologies to squeeze more oil and gas out of existing wells. He also discussed the potential for efficiency increases and emissions reduction through the use of advanced turbines and technologies that create fewer emissions (or help capture emissions). Mr. Yamagata discussed clean coal technology and whether it can be competitive with natural gas technologies in terms of both costs and emissions levels. Mr. Wells

talked about the "lessons learned" from the Clean Coal Technology program and how they may apply to future programs. Ms. Abend discussed environmental concerns about the use of coal even in a clean coal technology plant. Mr. Mead discussed state clean coal programs and their cooperation with federal programs. On the second panel, Ms. Lazenby discussed her company's use of advanced technologies to extend the life of stripper (low production) wells. Mr. Cuneo testified that new technologies installed throughout the oil production and refining process have improved efficiency and reduced emissions. Dr. Van Kirk discussed how technology derived from R&D has made the job of finding new oil and gas easier and has made exploiting unconventional and "tight" gas easier and accessing formerly inaccessible fields possible. Dr. Huffman testified on a proposed U.S. Energy Center that would operate as a research consortium between the private sector and the government. He also talked about a proposed Offshore Technology Program to explore ways to access ultra deep water oil and gas reserves.

4.2(g)—President's National Energy Policy: Hydrogen and Nuclear Energy R&D Legislation

June 14, 2001

Hearing Volume No. 107–45

Background

The hearing examined the President's National Energy Policy developed by the National Energy Policy Development (NEPD) Group, chaired by Vice President Cheney, which made a number of recommendations concerning hydrogen and nuclear energy.

The purpose of the hearing was to receive testimony regarding legislation: (1) to reauthorize the Spark A. Matsunaga Hydrogen Research, Development, and Demonstration Act of 1990/Hydrogen Future Act of 1996; and (2) on nuclear energy R&D provisions contained in H.R. 1679, the Electricity Supply Assurance Act of 2001, introduced by Representative Lindsey Graham (SC–3), and provisions contained in H.R. 2126, the Department of Energy University Nuclear Science and Engineering Act introduced by Representative Judy Biggert (IL–13).

The hearing consisted of two panels. The first panel considered the reauthorization of the Spark A. Matsunaga Hydrogen Research, Development, and Demonstration Act of 1990/Hydrogen Future Act of 1996. Witnesses included: (1) The Honorable David K. Garman, Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy (DOE); (2) Dr. H.M. Hubbard, Chair, Committee on Programmatic Review of the U.S. Department of Energy's Office of Power Technologies, National Research Council; (3) Mr. Arthur T. Katsaros, Group Vice President-Engineered Systems and Development, Air Products and Chemicals, Inc., Lehigh Valley, PA, on behalf of the National Hydrogen Association; (4) Mr. David P. Haberman, Chairman, DCH Technology, Inc., Valencia, CA; and (5) Dr. Peter Lehman, Director, Schatz Energy Research Center, Humboldt State University, Arcata, CA.

The second panel considered nuclear R&D legislation and commenced with testimony from Representatives Graham and Biggert

followed by a group of witnesses that included: (1) Mr. William D. Magwood, IV, Director, Office of Nuclear Energy, Science and Technology, DOE; (2) Mr. Joe Colvin, President, Nuclear Energy Institute; (3) Mr. John Kotek, Argonne National Laboratory-West, Idaho Falls, ID, and Co-Chair, Public Policy Committee, American Nuclear Society; and (4) Ms. Anna Aurilio, Legislative Director, U.S. Public Interest Research Group.

Summary of Hearing

The first panel was comprised of witnesses who discussed hydrogen as a medium for transporting energy. Secretary Garman testified in support of the Spark A. Matsunaga Hydrogen Research, Development, and Demonstration Act of 1990 and the Hydrogen Future Act of 1996, and stated that the next decade is a window of opportunity to affect the pace of transition to a hydrogen economy. Mr. Hubbard testified that the National Research Council's report on the DOE hydrogen programs found that projects are well executed overall. Mr. Katsaros stated that there is a large, successful industrial hydrogen economy now, and the industry is ready to work with the government to make the commercial hydrogen safe and successful. He testified that development is needed in Codes and Standards, demonstration projects are required and tax credits are essential to stimulate markets. Mr. Haberman stated that the industrial hydrogen industry is developing the base for the commercial hydrogen industry, and that government and industry roles in R&D should be kept separate. Government support is needed to ensure competitiveness with other countries, and governments should purchase new hydrogen technologies to help provide a market base. Dr. Lehman testified that his University is engaged in hydrogen technologies R&D because they believe that hydrogen produced from renewable energy sources is the future.

The second panel discussed Nuclear Energy. Congressman Graham testified on the research and development aspects of his bill, H.R. 1679. He favors support for nuclear engineering education, use of DOE sites for new reactors, Generation Four reactors and nuclear technology for medical research and applications. Congresswoman Biggert testified in favor of continued support for university nuclear education, stating that the number of people entering the field is declining. Mr. Colvin stated that nuclear power is the only large expandable source of electric power that preserves air quality, and supports increasing the number of plants, and increased energy efficiency and conservation. Mr. Magwood testified in support of all aspects of nuclear energy and the President's energy plan, stressing the importance of support for nuclear science and engineering education. Mr. Kotek stated that current nuclear power plants are safe, reliable and economic, and that the proposed legislation will strengthen these qualities. He stated that his organization believes that deep geologic storage is a technically acceptable solution to the problem of spent nuclear materials. Ms. Aurilio testified against all aspects of nuclear power and favored rejecting energy sources of the past in favor of increased efficiency and use of renewable energy.

4.2(h)—U.S. Energy Security: Options to Decrease Petroleum Use in the Transportation Sector

November 1, 2001

Hearing Volume No. 107–43

Background

The hearing examined the relationship between national security and the Nation's dependence on imported petroleum, particularly in the transportation sector. The Subcommittee explored the extent to which research and development on alternative fuels—such as electricity and biofuels—and enhanced vehicle fuel efficiency could help enhance energy security. The Subcommittee also heard testimony on the status of the public-private sector Partnership for a New Generation of Vehicles (PNGV) and the United States Council for Automotive Research, or USCAR, an industry research and development (R&D) consortium.

The Subcommittee received testimony from: (1) The Honorable James Woolsey, former Director of the U.S. Central Intelligence Agency; (2) The Honorable David Garman, Assistant Secretary for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE); (3) Mr. Gregory Dana, Vice President of Environmental Affairs at the Alliance of Automobile Manufacturers; (4) Mr. Robert H. Burnette, Project Manager for Bulk Power at Dominion Virginia Power representing the Electric Vehicles Association of the Americas (EVAA); (5) Mr. David D. Doniger, Policy Director of the Climate Center at the Natural Resources Defense Council; and (6) Dr. James J. MacKenzie, Senior Associate for the Climate, Energy and Pollution Program at the World Resources Institute.

Summary of Hearing

Mr. Woolsey testified that the U.S. dependence on imported oil weakens our national security. He spoke about the potential for a catastrophic disruption of Mid-East petroleum and proposed greater energy efficiency and the use of renewable fuels as a potential solution. Mr. Garman testified on the status of a variety of programs in the Office of Energy Efficiency and Renewable Energy (EERE) at DOE, including the Partnership for a New Generation of Vehicles. He outlined progress in improving efficiency in this country and plans for "leapfrogging" present technology to accelerate the introduction of a hydrogen-based economy. Mr. Dana testified on research in the automobile industry designed to increase gas mileage without sacrificing vehicle size or comfort. He also spoke about the need for incentives to jump start demand for alternative fuel vehicles. Mr. Burnette testified on the future of electric vehicles and potential new uses for electricity in innovative mass transit systems. Mr. Doniger testified on the need to improve energy efficiency and increase the use of renewable energy sources as well as using "smart growth" policies and increasing investment in mass transportation. Mr. MacKenzie testified on short-, intermediate- and long-term ways to reduce our energy consumption and the need to use alternative fuels while being aware of each of their "greenhouse gas potentials."

4.2(i)—The Renewable Roadmap to Energy Independence

February 21, 2002

Hearing Volume No. 107–50

Background

The hearing focused on the important role renewable energy resources, as well as energy efficiency and conservation, can plan in the U.S. quest for energy independence. The Subcommittee received testimony from witnesses on the current activities underway in the U.S. Department of Energy and in the State of California to achieve this goal. Other witnesses discussed environmental impacts from continued reliance on offshore oil to meet energy needs.

Witnesses included: (1) Admiral Richard Truly, Director, National Renewable Energy Laboratory, Golden, Colorado; (2) Dr. Daniel M. Kammen, Director, Renewable and Appropriate Energy Laboratory, University of California at Berkeley; (3) Dr. Donald Aitken, Union of Concerned Scientists, Berkeley, California; (4) Mr. Matthew J. Sullivan, Newcomb Anderson Associates, San Francisco, California; and (5) Mr. Richard Charter, Environmental Defense, Bodega Bay, California.

Summary of Hearing

Discussion during the hearing focused on the market viability of renewable energy, the impact of current Federal Government research, development and demonstration projects relating not only to renewable energy, but also energy efficiency, and the role that renewable energy can play in national security.

Admiral Truly's testimony focused on how energy technologies could help the U.S. achieve greater energy independence. His testimony focused on four key points: 1) For reasons ranging from national security to sustainability, our current energy system is in need of an overhaul, over the long haul; 2) There is much evidence that the Nation's transition to this new energy destination has already begun; 3) Energy efficiency and renewable energy technologies will increasingly play a key role in helping the Nation make this transition; and 4) The Federal Government and states must work together to help assure this new energy destination is reached.

Dr. Kammen testified that clean energy technology options and policies are needed to balance, diversify, and safeguard our energy sources and supplies, and to address the challenge of global environmental sustainability. In addition, Dr. Kammen stated that renewable energy technologies and energy efficiency must play a more significant role in protecting our climate as well as our energy future, and these technologies and practices demand far greater examination and commitment to implementation than we have seen to date.

Mr. Sullivan testified to what was working at the community level, and how that related to national energy policy. He focused on the impact of energy efficiency on small businesses and local

governments, and how renewable energy can play a greater role in community energy needs.

Mr. Charter's testimony focused on the environmental benefits of renewable energy, conservation and energy efficiency. He noted the damaging effects that fossil fuel drilling and transportation has had on Northern California ecosystems. He also briefly spoke to the added benefits renewable energy and energy efficiency can provide to national security.

Dr. Aitken testimony concentrated on the practical application of renewable technologies, and its relation to energy security. He also noted the ability of alternative energy sources to provide adequate supply in the absence of more harmful fossil energy.

Member questions focused on the economic viability of renewable energy, and what the role of federal research investments should be if it is viable. Members also touched upon the need to diversify our nation's energy portfolio with renewable sources in order to mitigate the effects of our dependence on foreign sources of oil and the adverse effects of fossil fuels on our environment.

4.2(j)—H.R. 3929, Energy Pipeline Research, Development, and Demonstration Act

March 13, 2002

Hearing Volume No. 107–70

Background

The hearing examined the Committee's proposed legislation, H.R. 3929 designed to advance the science needed to protect the Nation's critical pipeline infrastructure from attack or failure. The Committee's legislation would increase research and development (R&D) efforts to improve surveillance, security, fault detection (including the detection of difficult-to-detect leaks), and pipeline materials and robustness. It would also help reduce repair and recovery times after a pipeline failure.

Witnesses included (1) Mr. Terry Boss, Vice President, Environment, Safety and Operations, Interstate Natural Gas Association of America (INGAA), which represents the major gas pipeline transmission companies; (2) Mr. Tim Felt, President, Explorer Pipeline Corporation on behalf of the Association of Oil Pipe Lines (AOPL), which represents the major oil pipeline transmission companies, and the American Petroleum Institute (API); (3) Dr. Nirmal Chatterjee, Vice President, Environmental, Health and Safety and Corporate Engineering, Air Products and Chemicals, Inc. of Allentown, Pennsylvania, which is an industrial gas company and a manufacturer and distributor of hydrogen and other industrial gases; and (4) Mr. Stan Wise, Commissioner, Georgia Public Service Commission on behalf of the National Association of Regulatory Utility Commissioners (NARUC).

Summary of Hearing

The hearing primarily solicited views on the importance of pipeline safety R&D programs. The committee also investigated means of carrying out that R&D as envisioned in H.R. 3929, which author-

izes a coordinated federal program with $10M annually to DOE and $5M annually each to DOT and NIST.

Mr. Boss testified on the importance of pipeline research and the different funding mechanisms presently employed to finance these efforts. He indicated that new funding mechanisms need to be put in place to make up for the FERC R&D surcharge, which has collected as much as $212 million a year and expires in 2004. He also expressed skepticism about NIST's role in pipeline safety R&D and urged the Committee to give a higher priority to restoring DOE's funding.

Mr. Felt testified that the DOT's Office of Pipeline Safety has the longest experience in pipeline safety R&D and perhaps the best understanding of the needs of the regulated community. He felt that DOE had an important R&D role, since pipeline safety is such an important public and environmental priority, and DOE has access to general revenue funds. He spoke generally about technologies that DOE has developed that may be useful for pipeline operators. Finally, he advised the committee to put one agency in control, otherwise conflicts between the three agencies would hamper research.

Dr. Chatterjee testified that hydrogen pipelines are different from natural gas and products pipelines. He also predicted that most hydrogen production would be local and that there would be no need for extensive hydrogen pipeline system in the next 10–20 years.

Mr. Wise spoke mostly about a NARUC R&D funding resolution that is not a part of H.R. 3929. This mandatory funding scheme would collect approximately $65 million in funding for pipeline and storage R&D programs and has the support of the AGA.

Representative Vernon Ehlers asked Dr. Chatterjee about the size of hydrogen pipelines, how hydrogen is currently produced and what happens to the carbon and other "waste products" produced as a byproduct of reforming natural gas. Dr. Chatterjee responded that a variety of pipe sizes are in use, but that pipes must be specially designed to transport hydrogen. He also stated that most hydrogen today and in the near future is produced from reforming natural gas, and that it is possible to capture the carbon dioxide.

Subcommittee Ranking Minority Member Lynn Woolsey asked the panel about pipeline sitting issues and what could be done to ease the approval of new pipelines, citing a northern California project, which was having difficulty in getting approvals to transport tertiary wastewater. The panel concurred that it was a challenge for the industry, but Mr. Boss felt that better communication between the pipeline engineers and the public could help solve the problem.

Subcommittee Chairman Roscoe Bartlett asked whether the industry preferred research tax credits to direct federal spending on R&D. Members of the panel replied that federally funded programs could aim at industry-wide needs and gain a higher level of trust from the public than company proprietary R&D, regardless of the funding mechanism. The government may also have a longer R&D time horizon than the private sector. Mr. Bartlett asked whether pipelines would have been built differently if we had known about terrorism. The answer was generally "no" except to give greater emphasis to monitoring needs. Mr. Bartlett asked if the panel had

considered putting out an RFP to the engineering and scientific community to develop a new smart pig, a device that monitors the condition of pipelines.

4.2(k)—Fuel Cells: The Key to Energy Independence?

June 24, 2002

Hearing Volume No. 107–83

Background

The hearing examined the potential of hydrogen as an energy source and what needed to be done to fulfill that potential. The hearing focused on developments in hydrogen fuel cell R&D and in the fuel cell business. The hearing provided a broad overview of fuel cells for all applications, rather than a narrow focus on transportation applications.

Witnesses included (1) Dr. Hermann Grunder, Director of Argonne National Laboratory; (2) Mr. Robert Culver, Executive Director of the United States Council for Automotive Research (USCAR); (3) Mr. Stan Borys, Executive Vice President and COO of the Gas Technology Institute (GTI); (4) Mr. Jeff Serfass, President, National Hydrogen Association; (5) Mr. James Uihlein, Fuels Project Manager for BP; and (6) Mr. Elias (Lee) Camara, Vice President of H2Fuels.

Summary of Hearing

Dr. Grunder testified with certainty that hydrogen is the fuel of the future, but he was not sure when it fully develop. He discussed work that Argonne was doing to create a cost-effective fuel processor to convert hydrocarbons to pure hydrogen. The fuel processor was an interim step to allow the use of fuel cells prior to the development of a hydrogen distribution system.

Mr. Uihlein testified that the transition to a hydrogen infrastructure at all U.S. service stations would cost $6.8 billion. He said that BP is beginning to introduce hydrogen into their distribution system

Mr. Culver testified on USCAR's role in the FreedomCAR program. He said there should be thousands of fuel cell vehicles on the road by the end of the decade, but that the availability of hydrogen vehicles needs to be preceded by a fueling infrastructure of some kind.

Mr. Borys spoke about the transition from solid fuels (wood and coal) to liquid fuels (gasoline and diesel) to gaseous (natural gas and hydrogen). He noted that most of the media is focused on hydrogen in transportation applications, but actually stationary applications were in much wider use. Stationary fuel cells are not weight or size constrained, so costs can be lower, and can rely on the existing natural gas infrastructure.

Mr. Serfass testified on the decarbonization of the economy that will happen through the use of hydrogen fuel. He spoke about the important role for government in rolling out hydrogen fuel cells and asked government to increase cost shares, develop codes and standards, a be the first purchaser of fuel cell fleets.

Mr. Camara spoke about his company's process to remove sulfur from hydrogen feedstocks. Pure hydrogen is essential for the success of fuel cells because the alternative, sulfur tolerant fuel cells, are expensive.

Representative Judy Biggert asked about how to overcome the perception that hydrogen gas caused the Hindenburg to burn. She also asked about how water vapor emitted from fuel cells could be prevented from freezing in wintertime conditions, and about alternative sources of hydrogen, including nuclear and ethanol. The panel responded as follows: that the Hindenburg incident was due to a flammable paint used on the dirigible, and that hydrogen is actually safer than gasoline; the freezing problem is being worked on, but for the fuel cells that operate at high temperature it would not be a problem; and alternate sources of hydrogen are definitely viable, but may take longer to develop.

Subcommittee Ranking Minority Member Lynn Woolsey asked whether the existing natural gas distribution system could be used to provide hydrogen to the home; Mr. Borys responded positively. She also asked why the government should trust industry in a partnership when the auto industry refused to enter into a partnership on CAFE. Mr. Culver assured her that the auto industry was interested in the environment, and that the partnership was essential to the development of fuel cells. Finally, she asked why fuel cell technologies developed by NASA hadn't been quickly transferred to the private sector and the consumer, to which the panel responded that mass production of fuel cells presented numerous obstacles.

4.2(l)—FreedomCAR: Getting New Technology into the Marketplace

June 26, 2002

Hearing Volume No. 107–84

Background

The hearing primarily solicited views on the best ways to proceed with automotive research and development (R&D) and how to integrate advanced technologies into production vehicles that can gain customer acceptance. One of the recurring questions was the "chicken and egg" problem with hydrogen fuel cells, i.e., how can you establish an effective hydrogen infrastructure before there are great numbers of fuel cell vehicles?

The Subcommittee heard testimony from: (1) Mr. Amory B. Lovins, Chief Executive Officer (Research), Rocky Mountain Institute; (2) Dr. Byron McCormick, Executive Director, General Motors Fuel Cell Activities; (3) Mr. Doug Rothwell, President and CEO, Michigan Economic Development Corporation; (4) Mr. Roger Saillant, President, Plug Power, Inc.; and (5) Mr. Roger Templin, Director, PAICE Corporation.

Summary of Hearing

The hearing solicited views on the best ways to proceed with automotive research and development (R&D) and how to integrate

advanced technologies into production vehicles that can gain customer acceptance.

Dr. Lovins testified on his 100 mile per gallon concept vehicle called Hypercar. He said that the Hypercar, given appropriate funding, could be available as a demonstration vehicle by 2004 and could go into production by 2007. The auto industry has plenty of R&D resources, according to Dr. Lovins, but lacks the flexibility to change its manufacturing quickly enough to get vehicles like Hypercar to market quickly. He suggested that a fundamental change in manufacturing was required to shorten product cycles and reduce the break-even production level-both of which wed car makers to existing, rather than leapfrog technologies.

Mr. McCormick testified that GM is investing aggressively on hydrogen fuel cell vehicles, including the HydroGEN3, and the Autonomy that will be demonstrated later this year. According to McCormick, hydrogen storage on the vehicle is the greatest challenge GM faces. Dr McCormick brought up the "chicken and egg" problem with hydrogen fuel cells, i.e., how can you establish an effective hydrogen infrastructure before there are great numbers of fuel cell vehicles? He spoke about the critical need to develop fueling infrastructure prior to the introduction of hydrogen vehicles. He also stated that the government must work to develop codes and standards for this fueling infrastructure. He urged the government to refrain from "freezing technologies" with overly prescriptive regulation.

Mr. Rothwell testified on Michigan's NextEnergy program, a public/private consortium designed to promote R&D on alternative fuels. He argued that this effort is critical to provide an incentive for continued production of alternative vehicles in Michigan. He agreed with McCormick that incentives are a better approach than regulation.

Mr. Saillant spoke mostly about Plug Power's vision for fuel cells for residential sized combined heat and power, and potential sources of hydrogen fuel for vehicles. He said that these fuel cells could be deployed fairly rapidly using the existing natural gas distribution infrastructure. He also stated that other countries are doing a better job of encouraging fuel cell manufacturers than the U.S. and argued that the U.S. government should ensure that we don't lose leadership in this area.

Mr. Templin testified on PAICE's Hyperdrive concept, which is a technology designed to improve mileage on internal combustion engine vehicles. Templin stated that this technology could roughly double the mileage of standard gasoline and diesel engines, and provided a technology bridge to hydrogen fuel cells. He said that most of the interest in his technology came from overseas and that it is tougher to sell efficiency in the U.S. than overseas because of our much lower fuel prices.

Subcommittee Ranking Minority Member Lynn Woolsey stated that this country was falling behind other countries in technology and suggested that we need to redouble efforts in science and engineering education. She asked what we could do to make sure we didn't lose the fuel cell technology race with other countries. Dr. McCormick responded by saying that General Motors, as a global company, has a subsidiary that participates in the internal Japa-

nese planning group on hydrogen and fuel cells and that the Japanese are aggressive and formidable in this area. But, he said, the U.S. has the wherewithal and only needs the will and to commit the resources to compete-especially in area beyond basic research, we need to support prototypes and learn to get around the morass of regulatory barriers. He also praised the research at Argonne, Los Alamos and Sandia Livermore in these areas. Mr. Templin said that we should find a way to offer an economic incentive that is comparable with that due to higher fuel costs in Japan and Europe. Dr. Sallant said that we have a science education problem at the secondary and university level where we need to teach systems thinking.

In response to a question from Representative Melissa Hart, on how fast we would see advanced cars, Mr. Templin said he thought his technology, when deployed as an advanced hybrid, would blanket the market within four or five years after they are first introduced. In response to the same question Dr. Lovins said that the car industry is a classic over-mature industry with an unattractive risk-reward profile because it is extremely capital intensive with a very long product cycle time. In contrast, his Hypercar has a low capital intensity, a low fixed cost per model, a higher piece cost, and a comparable total cost per car which means that the break-even volume is low and the product cycle time also can be low. He also said that the hydrogen infrastructure problems (chicken/egg) were real, but readily resolved using miniature gas reformers which would be less capital intensive that the current gasoline fueling infrastructure.

Subcommittee Chairman Roscoe Bartlett stated that at one point he thought it unpatriotic to buy a foreign car, but he now loves his gasoline-electric hybrid Prius. He now believes that it's patriotic to buy foreign vehicles because that is a way to spur innovation through competition in the domestic auto industry. He then asked Dr. Lovins what needs to happen to make the public understand that we have a very uncertain energy future. Dr. Lovins responded that we already have shown that energy and economy can be decoupled. He also criticized H.R. 4 as contrary to market and free trade principles because it distorts prices by suppressing efficient use of oil and by making oil look cheaper than it really is.

Representative Judy Biggert asked how R&D could bring down the cost of fuel cells. She also asked about what the government's role should be. Dr. McCormick replied that on the cost side, it was important to realize that manufacturers are supported by thousands of suppliers, only half of which have the automotive industry as their main customer and so really prescriptive or over targeted approaches will fail. He also said that we need good tax policies so companies make investments in their manufacturing plants. He also said the national laboratories have an important role-especially in new materials.

4.2(m)—Future Direction of the Department of Energy's Office of Science

July 25, 2002

Hearing Volume No. 107–86

Background

The hearing discussions focused on big ideas and societal issues, with an emphasis on the need to provide funding proportionate to the value of the research and educational missions of the Office of Science to the Nation.

The Subcommittee heard testimony from: (1) Dr. Raymond Orbach, Director, Office of Science, U.S. Department of Energy; (2) Dr. Jerome I. Friedman (1990 Nobel Prize in Physics), Department of Physics, Massachusetts Institute of Technology; (3) Dr. Richard E. Smalley (1996 Nobel Prize in Chemistry), Director, Carbon Nanotechnology Laboratory, Rice University; and (4) Ms. Gary Jones, Director, Natural Resources and Environment Issues, U.S. General Accounting Office.

Summary of Hearing

The hearing focused on the role the Office of Science in supporting basic research and education in the fundamental sciences and engineering. Key topics included the impact of flat funding over the past decade, contributions to national economic and technological competitiveness, future plans, programs, and projects, and regulation of worker and environmental safety at Office of Science facilities and laboratories.

Dr. Orbach testified on how the Office of Science contributes to the national scientific research agenda, including supporting graduate education and research at universities, and instrumentation and facilities for DOE and non-DOE scientists and engineers.

Dr. Friedman testified on the serious consequences that flat funding for the Office of Science has had for the Nation's research infrastructure. Funding for the Office of Science has not kept up with inflation and is falling even further behind considering scientific inflation—the increasing costs of scientific equipment and personnel. As a result, there are fewer and smaller research grants to universities. Among the consequences are fewer U.S. citizens pursuing careers and advanced degrees in physical science and engineering.

Dr. Smalley testified that energy is the single most important issue facing mankind. Continued use of fossil fuels is unsustainable and a concerted effort must be made to develop new science and technology to provide safe, clean, affordable energy. Nanotechnology can and will play a central role in this effort and a national commitment to this will invigorate and excite the youth of the Nation to pursue careers in science and engineering.

Ms. Jones updated the Committee on the status of the regulation of nuclear and worker safety at Office of Science laboratories and facilities. The GAO contends that external regulation by the NRC and OSHA is workable and can provide many benefits over the current system of self-regulation by the DOE. The GAO finds a lack

of commitment by the DOE to move forward on this issue, while the NRC, OSHA, laboratory directors, and contractors are all supportive of moving to external regulation.

Subcommittee Chairman Roscoe Bartlett stated that societal values must change if science is going to get the respect and support it deserves and attract young people to careers in science. He expressed his whole-hearted agreement with Dr. Smalley that we need to stop relying on fossil fuels to supply so much of the Nation's energy.

Subcommittee Ranking Minority Member Lynn Woolsey emphasized the need to attract women and minorities to science. She also expressed her concern over nuclear and worker safety at the national laboratories and asked Dr. Orbach if he was committed to pursuing external regulation and what the Office of Science was doing in this regard. Dr. Orbach replied that he and his office were committed to examining external regulation of their facilities and would be performing pilot studies over the next 10 months.

Representative Judy Biggert expressed support for increased funding for the Office of Science and asked how the Office could utilize additional funds.

Representative Nick Lampson observed that people follow money and asked point blank: "Is the current budget sufficient?" Dr. Orbach replied that at present it is. Dr. Friedman asserted that it is not.

Representative Vernon Ehlers expressed his concern that it was socially acceptable to be ignorant of science and encouraged the panel and the scientific community to become more active in educating the public and Congress on the value of science to society.

Representative Dana Rohrabacher expressed his skepticism that throwing money at science would solve the problems discussed here and his concern that "Big Science" was counterproductive to creative thinking. Dr. Friedman responded with examples of how researchers on "Big Science" projects had demonstrated creativity and made contributions to society in important and unexpected ways (e.g., creating the first Web browser).

4.3—SUBCOMMITTEE ON ENVIRONMENT, TECHNOLOGY, AND STANDARDS

4.3(a)—H.R. 64: A Proposal to Strengthen Science at the Environmental Protection Agency

March 29, 2001

Hearing Volume No. 107–4

Background

The purpose of the hearing was to receive testimony on H.R. 64. Introduced by Chairman Ehlers on January 3, 2001, the bill would codify the two primary recommendations of the recently released National Research Council report titled Strengthening Science at the U.S. Environmental Protection Agency.

The legislation would require the President to appoint a Deputy Administrator for Science and Technology of the Environmental Protection Agency (EPA) who would serve as an advocate for and reviewer of science at the most senior levels of the Agency and be responsible for coordinating scientific research among the scientific and regulatory arms of the Agency. Second, the bill would set a six-year term for the Assistant Administrator of the Office of Research and Development (ORD), to serve at the pleasure of the President, and gives that person the additional title of "Chief Scientist of the Environmental Protection Agency."

The Subcommittee heard from: (1) Dr. Ray Loehr, a Professor of Civil Engineering at the University of Texas at Austin, and a member of the National Academy of Sciences' Committee on Research and Peer Review in EPA; (2) Dr. Bill Glaze, a Professor of Environmental Science and Engineering and the Director of the Carolina Environmental Program at the University of North Carolina, and Chairman of the EPA's Science Advisory Board; and (3) Mr. Rick Blum, a Policy Analyst at OMB Watch.

Summary of Hearing

Dr. Loehr testified in support of H.R. 64, which he said would elevate science considerations to parity with legal considerations in EPA decision-making processes. He noted that:

- The bill would provide for better coordination of scientific information within the agency by separating the management of research programs from the management of the use of science and engineering knowledge in the regulatory process.
- Extending the Assistant Administrator for the Office of Research and Development's term to six years would create more stability and strategic leadership for ORD science.

- The National Research Council's report on strengthening science at the EPA outlines the science coordination problems that H.R. 64 would solve.

Dr. Glaze also testified in support of H.R. 64. He said that it would send a "strong signal that we plan to make science a stronger and more integral part of the EPA." He also said that it would help the agency prepare to handle difficult environmental problems of the future and take advantage of new science in new fields. He emphasized that:

- Placing a person of high scientific reputation into the new Deputy Administrator position would positively affect the quality of decisions being made, guide the agency towards a stronger role in setting the environmental and technology agenda of the country, and begin to shift the EPA's culture toward a greater emphasis on using science in decision making.
- Under the structure proposed in H.R. 64, the Assistant Administrator of ORD could better manage the science apparatus, serve as a better liaison with other agencies and other program offices within EPA, and thus promote better science upon which to make decisions.
- These organizational changes would lead the agency to think more carefully about its use of emerging sciences (genomics, proteomics, etc.).

Mr. Blum argued that H.R. 64 could "help overcome shortcomings in EPA's efforts to collect high-quality, timely information." He also mentioned that the new Deputy Administrator position could play a useful role in establishing good data collection practices within the Agency. But he was concerned that:

- There would be significant overlap between the roles of the new Deputy Administrator and the strengthened Assistant Administrator for ORD and those of the recently formed Environmental Information Office (EIO).
- Neither ORD nor EIO would have appropriate authority to ensure that their recommendations are carried out in the program offices.
- The new Deputy Administrator's emphasis on science and technology, rather than information management and public access, might lead the agency to choose inaction if there is any level of uncertainty in the science.

4.3(b)—NOAA's FY 2002 Budget: Predicting Weather and Climate

May 9, 2001

Hearing Volume No. 107–28

Background

The purpose of the hearing was to review the Administration's Fiscal Year 2002 budget request for the National Oceanic Atmospheric Administration (NOAA). The witnesses discussed NOAA's

overall budget and programs, with emphasis on issues relating to weather and climate prediction.

The President's FY 2002 Budget Request for NOAA is $3.15 billion and represents a decrease of $60.8 million, or two percent below FY 2001 Enacted Levels (FY00 Enacted was $2.34 billion). The lower request reflects the elimination of most congressionally mandated earmarks from FY01 and the addition of program increases in such areas as severe weather prediction, coastal conservation, and climate.

The Subcommittee heard testimony from: (1) Mr. Scott Gudes, acting Under Secretary for Oceans and Atmosphere and NOAA Administrator; (2) Dr. Richard E. Hallgren, Executive Director Emeritus, American Meteorological Society and former head of the National Weather Service; (3) Dr. Eric Barron, Distinguished Professor of Geosciences and Director EMS Environmental Institute at Penn State University, chair of the Board on Atmospheric Sciences and Climate of the National Research Council; (4) Dr. Leonard J. Pietrafesa, Director of External Affairs, College of Physical and Mathematical Sciences, North Carolina State University, member of the NOAA Science Board; and (5) Mr. Joe Hoffman, Executive Director, Interstate Commission on the Potomac River Basin, and representative of the Interstate Council on Water Policy.

Summary of Hearing

Mr. Gudes presented the budget request, noting the smaller request than FY 2001, but emphasizing:

- Areas of full funding, such as: the Sea Grant Program, climate and global change research, and weather radar modernization.
- A top priority for NOAA's budget is supporting its workforce and maintaining its infrastructure.
- Education and outreach are important to NOAA, and have been facilitated by improvements in the NOAA website.
- Investments in NOAA programs have produced positive results in recent years, including, for example, improvements in hurricane prediction accuracy and acquisition reform, the latter of which has enabled NOAA to freeze the costs of geostationary satellites.

Dr. Hallgren testified that weather and climate prediction funding is constrained by the size of the overall NOAA budget, though he believes the Administration has done a good job of supporting high priority programs. In particular:

- He noted that the U.S. has more severe weather and flooding than any other nation in the world, and approximately one-quarter of the GNP is affected by weather and climate. Severe weather and flood warnings have improved significantly in recent years because of the Nation's investment in the development of weather and climate services.
- He supports the increased spending on infrastructure improvements and core activities like operating costs and pay increases, that have not received adequate support in recent years.

- Dr. Hallgren highlighted satellite and weather service funding, including increases for: sensors & processing capability, computers in the National Center for Environmental Prediction, the Environmental Modeling Center, the U.S. Weather Research Program, NPOESS, ARGO floats, etc. He expressed strong support for the creation of a joint Data Assimilation Center.

Dr. Barron noted that the ability to make climate predictions on the scale of seasons to centuries enables us to enhance economic vitality, better limit threats to life and property, and improve environmental stewardship. Dr. Barron asserts that in order to have a strong climate program, NOAA requires a robust observing system, commitment to modeling and prediction, and strong interface with decision-makers. He testified that:

- Many different agencies are involved in collecting climate information, yet none of these agencies have climate as a top priority. This problem should be addressed by focusing on improving continuity, addressing overlapping measurements, and promoting free and open access of data. Investing in the efficiency of our observing systems will enable us to fill gaps and address weaknesses in our understanding of climate.
- Because our modeling and prediction capabilities are so successful, we need to focus now on transforming research products into operational products society can use.
- NOAA needs to better involve the user community and decision-makers in its observation and modeling efforts. Dr. Barron believes we need to develop "environmental intelligence centers" in order to make prediction capability and dispersed research more accessible to decision-makers and scientists.

Dr. Pietrafesa addressed three questions asked by Chairman Ehlers: What is the NOAA Science Advisory Board? What are the major challenges facing NOAA in conducting research? What are specific areas that need more attention or coordination?

- The NOAA Science Advisory Board is a 15-member panel, composed of life, physical, and social scientists and policy experts that link NOAA and the university community.
- Major challenges facing NOAA research include: preservation of NOAA's data archive; integration of physical and social sciences; building the agency's strategic plan to include research, development, and technology transfer; investment in climate observation and modeling; ensuring the vitality of NOAA's future science and technology workforce through partnerships with universities; maintaining and upgrading NOAA's observational network and computational facilities; and working with other agencies to ensure that their observational networks are not reduced because of federal budget cuts.
- Specific areas needing more attention or coordination include the study of conditions that pose immediate or long-term health or safety risks to humans, extreme weather events, and the coupling between physical and biological systems.

Mr. Hoffman discussed the importance of the interaction between the National Weather Service and state water management agencies as an example of interagency coordination. The benefits of continuing to fund this sort of work include:

- Increased predictive capability that allows forecasters to issue early flooding alerts, which can help minimize property loss and lives lost.
- The flood warning system in the Susquehanna basin boasts a cost-to-benefit ratio in which every dollar expended on the system prevents $12.50 of flood damage loss.
- In the art of forecasting, ground-truthing with tools like stream gauges is essential to verify and adjust predictions.

4.3(c)—Science and Technology at the Environmental Protection Agency: The FY 2002 Budget Request

May 17, 2001

Hearing Volume No. 107–19

Background

The purpose of the hearing was to examine the Administration's FY 2002 budget request for the Environmental Protection Agency's Office of Research and Development (ORD). The Committee examined whether the budget for ORD, the research arm of the EPA, is adequate to meet the Agency's goal of using science as the foundation of its efforts to protect human health and the environment.

The Subcommittee heard from: (1) Mr. Henry Longest, Acting Assistant Administrator for the Office of Research and Development at EPA; (2) Dr. W. Randall Seeker, Member of the EPA Science Advisory Board's Research Strategies Advisory Committee; and (3) Dr. Ron Hammerschmidt, Vice President of the Environmental Council of the States and Director of the Division of Environment for the Kansas Department of Health and Environment.

Summary of Hearing

Mr. Longest testified that the Office of Research and Development (ORD) continues to be focused on providing the highest quality science in support of the Agency's mission. He pointed out that:

- ORD has developed a research planning process, based on independently peer-reviewed research strategies and plans that outline their direction for the next five to ten years.
- To establish baseline trend data on the condition of coastal estuaries, ORD has sponsored extensive survey programs in the coastal states and Puerto Rico.
- ORD has led efforts to understand how young children are exposed to pesticides and other potentially harmful chemicals.
- The budget request for 2002, $535 million, supports in house research and the extramural Science to Achieve Results program. The FY 2002 budget request builds upon ORD's significant accomplishments, supports the Agency's mission, and provides the science and technical information that is

essential for EPA to achieve its long-term goals. Their resources are directed towards core science issues in environmental media and problem-oriented research.

- In order to compensate for an aging workforce, ORD's Postdoctoral Program provides the Agency with a constant stream of highly qualified, specialized workers.
- ORD is committed to providing a foundation for sound environmental science as well as assuming leadership on a national level in producing cutting-edge research.

Dr. Seeker believes that increasing the Science and Technology budget is necessary if EPA is to continue to make progress incorporating science more effectively into its decision making. He represented the EPA's Science Advisory Board and presented the board's findings regarding EPA's science and technology budget. He noted that:

- The Agency should dedicate resources to develop and maintain an overall science strategy for the Agency that uses a science inventory.
- The Administration should increase the Science and Technology share of the EPA budget from the current level of nine percent to twelve percent by FY 2004 because of the constant pressure on the Agency to make more decisions based on sound science.
- The Science and Technology budget should be balanced between short- and long-term research activities as well as between core and problem-driven research.
- ORD should expand the use of multi-year planning processes, along with the role of the Exploratory Grants Program, to avoid over-emphasizing short-term issues.
- With fifty percent of ORD's workforce over the age of 50, the agency should define future core competencies needed and assemble the next generation of Agency scientists.
- The Advisory Board is continuing with a number of reviews in areas such as the future of multi-year planning, strategic planning processes, and the peer-review process.

Dr. Hammerschmidt explained that states rely heavily on EPA for the scientific information that guides their efforts to protect the public health and environment. He said that:

- States are dependent on EPA to supply them with credible basic science that can be used in their day-to-day operations. Government regulatory programs, whose actions are often questioned by regulated private companies, must use science as a foundation for their actions.
- Some fundamental criteria and standards maintained by EPA in areas such as fecal coliform and E. coli are based on work done during the 1970's and should be reevaluated.
- Identification, characterization, and prioritization of risks associated with air contaminants will become increasingly important.

- The Agency needs to help states determine best management practices to reduce or eliminate urban and rural non-point source pollution.
- The states have a crucial need for the EPA to develop scientific information to guide and support state efforts to protect public health and the environment.

4.3(d)—The Future of the Advanced Technology Program

June 14, 2001

Hearing Volume 107–23

Background

The purpose of the hearing was to discuss the future of the Advanced Technology Program (ATP) at the National Institute of Standards and Technology. The Committee examined both the structure and effectiveness of the program with particular emphasis on the findings of a National Research Council (NRC) review panel.

The Subcommittee heard from: (1) Dr. Michael Borrus, Managing Director of the Petkevich Group LLC and an Adjunct Professor in UC Berkeley's College of Engineering; (2) Dr. Maryann Feldman, Research Professor in the Department of Mathematical Sciences at John Hopkins University; (3) Dr. Lewis Branscomb, Professor Emeritus at the John F. Kennedy School of Government at Harvard University, and past Director of NIST; and (4) Dr. Claude Barfield, Resident Scholar and Director of Science and Technology Policy Studies at the American Enterprise Institute.

Summary of Hearing

Dr. Borrus testified that the ATP is clearly meeting its congressional mandate. He noted that:

- Despite the large number of studies and reviews of the ATP, evidence suggests the program is generally working well. The NRC panel gave the program high marks for its design, its cost-sharing and industry-driven features, its use of peer review for evaluation of technical feasibility and commercial potential, its screening and selection procedures, and its "extraordinarily" thorough assessment process.
- The ATP is an important and necessary complement to private capital. It fills in where there is a public need for technology but a lack of initial private investment. The program, for example, made up for an over-investment in Internet-related technology during the 1990's that drew investment away from biotechnology and energy technology-related fields.
- Capital markets alone cannot be relied upon because of several market imperfections, including "follow-the-leader" or "herd-type" investing, and the need by private investors to liquidate their investments early, often before technology concepts can be fully realized.

- While the ATP operates at a very high standard, that standard can be increased to get further benefits from the program by adopting changes recommended in the NRC report.
- The NRC concluded that the ATP could make effective use of more funding.

Dr. Feldman remarked that the ATP is achieving its goals and is an important part of the Nation's technology policy. She said:

- The ATP is funding broad-based projects with long-term economic benefits and which would have not occurred or advanced at the same rate in the absence of the program.
- Her study of 1998 ATP applicants found that the program awarded grants for projects that were high-risk, potentially high-payoff, and helpful in forming new R&D partnerships. Firms that were awarded funding tended to have extensive linkages to other businesses and to share their research.
- The ATP funds projects that are not likely to be funded otherwise. Her study of 1998 applicants one year after awards were made found that 70 percent of the non-winners had not proceeded with their proposed project, while those who had were working at a much smaller scale.
- By contrast, she found that firms who had won ATP funding often were more successful at attracting funding from other sources. Receiving an ATP award, she said, is apparently perceived by the market to be a certification or legitimacy, helping to attract additional funding in what she called a funding "halo" effect.
- State programs are often the most important source of referral to the ATP. In addition, the majority of ATP funded firms are associated in some way with university programs.

Dr. Branscomb focused his comments on the role that the ATP plays in bridging the "Valley of Death," the gap between a technological invention and its development into a commercial innovation. He said:

- The U.S. R&D enterprise funds about $175 billion worth of science and technology research, while the business enterprise that capitalizes on the fruits of that research is worth over $1 trillion. The gap between the two is the so-called valley of death, or, as he put it, a risky "Darwinian Sea" of ideas.
- The market supplies venture capital that rescues, in Branscomb's analogy, ideas from the Darwinian Sea and carries it to into the business enterprise. In 1998, venture capitol invested roughly $63 billion in this endeavor.
- However, much of that money was spent on technologies that had already been proven and on businesses that were already on a firm footing. Far less was spent on risky ideas. Compared to the total amount of money spent on such risky ventures, funding supplied by the ATP and SBIR programs made up as much as 20 percent.

- The Small Business Administration has proposed major changes to several of their programs, potentially creating programs similar to the ATP.

Dr. Barfield believes there are several areas in which the ATP can do a better job. He said:

- Vanevar Bush's idea of basic research being most beneficial when wholly untargeted was wrong. The U.S. has been successful in conducting largely targeted basic research since the end of the second World War.
- Bush's linear idea of technological development beginning with research and leading to commercial development was wrong, too, since the process has many loops and feedbacks. Nonetheless, government should stick to funding "real research areas" rather than "any kind" of commercial development.
- The government should fund research where it can assure that the public can benefit because the government cannot fund everything and broad-based public benefits should be a government priority.
- Some reports have been skeptical as to whether or not the ATP is producing commercial technologies that would not have been produced in the absence of federal funding.
- If the goal of the ATP is to ensure widespread social benefits, then the Congress should consider preventing participating firms from being granted intellectual property rights or requiring them to agree to license widely and at low cost.

4.3(e)—Standards-Setting and United States Competitiveness

June 28, 2001

Hearing Volume No. 107–21

Background

The purpose of the hearing was to review the impact of standards on the United States economy and the ability of our Nation to compete internationally. The hearing also discussed reforms in the standards-setting process that could make American industries, such as the information technology sector, more globally competitive.

The Subcommittee heard from: (1) Mr. Oliver Smoot, Chairman of the Board of the American National Standards Institute; (2) Mr. Gerald Rittersbusch, Director of Standards and Regulations for Caterpillar, Incorporated.; (3) Mr. Scott Bradner, Senior Technical Consultant with Harvard University; and (4) Mr. Carl Cargill, Director of Standards for Sun Microsystems.

Summary of Hearing

Mr. Smoot noted that both the landscapes of international and domestic standards are changing. To address new challenges, the American National Standards Institute (ANSI) developed a National Standards Strategy. He testified that:

- The central theme of the strategy is that each sector must decide for itself what methods of standards development are the most efficient.
- Standard-setting in the U.S., based on voluntary consensus, has proven effective. However, faster development, coherence, and availability of these voluntary standards is necessary to improve their usefulness.
- Observing the ANSI process for standards development assures U.S. industry and U.S. standards-developing organizations that their standards may be accepted in international markets.
- ANSI endorses the placement of standards attaches in key U.S. embassies.
- The information technology (IT) industry utilizes almost every kind of standardization process, from informal meetings to formal processes that result in an American National Standard.
- The Department of Defense has recently interpreted a 1912 law as meaning that it is illegal for the government to pay an employee's salary, membership dues, or travel costs to participate in a standards organization that bases its activities on individual membership. This could be a major policy obstacle and must be rectified.

Mr. Rittersbusch testified that it is important to make sure that the right standards are being developed for the right uses, whether those standard development processes be formal or informal, consensus- or consortia-based. He suggested that:

- The National Standards Strategy can make a real difference if American businesses work through the 12 key strategies outlined, as well as working with the standards development organizations and the government.
- Harmonized standards are absolutely necessary. American companies lose out when standards at home and abroad differ, since two different products must be built.
- In order to remain a leader in international standards-setting, the U.S. must use its technical expertise to our advantage. Standards experts must be closely in touch with the markets for which they are setting standards.
- The IT industry needs a balance of standards developed through both formal and consortia processes.
- A consortia developed standard is not a consensus standard.

Mr. Bradner focused on the Internet Engineering Task Force (IETF), which is the primary developer of basic standards for the Internet. He believes the IETF has and will continue to have a major part to play in the setting of standards for IT. He noted that:

- The IETF is consensus-based, self-funded, open to all participants, transparent, allows appeals, vendor-neutral, and uses merit-based evaluation. The group also deals with intellectual property rights and other standards development organizations.

- The work of the IETF is done mostly through extensive Internet mailing lists, though the group does meet three times a year at face-to-face meetings.
- IETF standards are voluntary, and the group does not make any attempt to police or mandate the use of the standards.

Mr. Cargill, who also specializes in information technology standards development, added that:

- The IT industry has the ability and willingness to use different methods of standard-setting depending on the situation. Consortia, or groups of like-minded companies, generally get together and produce standards that will benefit the entire market. Over the past five years, consortia have become the dominant standards providers for IT technology.
- These consortia for IT are not part of the ISO–ANSI federation, thus their existence is contingent on whether or not they maintain the support of their members.

For the future of standard-setting, he suggests that:

- The Office of Management and Budget should define what a legitimate consortium is.
- The National Institute of Standards and Technology can play a larger role in organizing IT consortia.
- Our primary concern should not be with who believes in standards, but with those that do not standardize.

4.3(f)—Ocean Exploration and Coastal and Ocean Observing Systems (Joint Hearing of the Subcommittee on Environment, Technology, and Standards and the Subcommittee on Research, Committee on Science, and the Subcommittee on Fisheries Conservation, Wildlife and Oceans, Committee on Resources.)

July 12, 2001

Hearing Volume No. 107–26

Background

The purpose of the hearing was to receive testimony on federal interagency cooperation on ocean research and particularly on the progress of, and plans for, the implementation of an integrated and sustained ocean observing system. This hearing also examined the need to coordinate the rapidly proliferating coastal observing systems and review the Report of the President's Panel on Ocean Exploration and the implementations of that report's recommendations.

The Subcommittees heard from: (1) Mr. Scott B. Gudes, Acting Undersecretary for Oceans and Atmosphere of the Dept. of Commerce; (2) Dr. Rita R. Colwell, Director of the National Science Foundation; (3) Rear Admiral Jay M. Cohen, Chief of the Office of Naval Research of the U.S. Navy; (4) Vice Admiral Conrad Lautenbacher, Jr., President of Consortium for Oceanographic Research & Education; (5) Dr. Marcia McNutt, President and Chief

Executive Officer of Monterey Bay Aquarium Research Institute; (6) Dr. Robert Ballard, President of the Institute for Exploration; (7) Dr. Robert A. Weller, Director of Cooperative Institute for Climate and Ocean Research, Woods Hole Oceanographic Institution; (8) Dr. J. Frederick Grassle, Director of the Institute of Marine and Coastal Sciences, Rutgers University; (9) Dr. Alfred M. Beeton, Senior Science Advisor, National Oceanic and Atmospheric Administration; and (10) Dr. Alexander Malahoff, Director of the Hawaii Undersea Research Laboratory at the University of Hawaii.

Summary of Hearing

Subcommittee Chairman Vernon Ehlers opened the hearing by stating that improved cooperation and coordination among federal agencies, Congressional Committees, and the research community is needed for a more effective ocean research program. Due to limited financial resources, these groups need to agree on specific priorities to achieve goals.

Mr. Gudes testified on ocean exploration, ocean observations, coastal observations, and the role of the National Oceanic and Atmospheric Administration (NOAA). He noted that:

- The President's budget includes $170 million for NOAA to conduct ocean research in fiscal year 2002.
- In 2000, a panel of marine scientists and explorers were convened to review U.S. efforts in ocean exploration. It recommended that the U.S. establish a national program of ocean exploration and discovery.
- He discussed ocean exploration's role in the discovery of new species, our understanding of geological phenomena, etc.
- There are fewer ocean-based measurement systems than there are land-based.
- The National Ocean Partnership Program is an excellent mechanisms for coordinating oceans activities across agencies.
- It is important, especially on the West coast, for tsunami warning devices to be improved.

Dr. Colwell testified that the National Science Foundation (NSF) has a proud history of supporting basic research and education in the ocean sciences. It has a "broad, encompassing role that advances the frontiers of discovery and seeks to engage the public." Dr. Colwell showed footage taken from the submersible ALVIN two miles below sea level, and noted that:

- The NSF accounts for less than four percent of the total federal research and development budget, yet provides about 70 percent of federal funding to academic institutions for ocean research.
- More than 95 percent of the world's oceans remain unexplored.
- The NSF is working with the academic community and federal agencies to provide a new infrastructure to gain access to the oceans and to facilitate the collection of time series

data. This will help improve our understanding of the basic biology, chemistry, geology, and physics of oceans.

Admiral Cohen discussed the importance of ocean exploration, and strongly supports efforts to develop and implement an integrated and sustained national ocean observing system. He noted that:

- Oceans cover 70 percent of the Earth's surface, and are constantly changing.
- Oceans are the Navy's operating environment. The Navy must continually collect and monitor data from all the world's oceans in order to ensure the safety of its fleet.

Admiral Lautenbacher represented the Consortium for Oceanographic Research and Education (CORE), a consortium of 64 premier oceanographic institutions. He noted that:

- Ocean exploration and ocean observing are equally important, and we should emphasize the value we get from each approach to ocean research.
- Now is the time for researchers to work together in a coordinated effort to advance ocean research. The technology available today is such that we can do things that were only dreamed about several years ago.
- Sustained time series data from coastal areas and around the world in addition to the cooperation and coordination of federal agencies are needed to answer pressing questions on environmental management.
- The National Oceanographic Partnership Act successfully established a super-agency mechanism to support and finance ocean exploration and observation.

Dr. McNutt re-emphasized the importance of ocean exploration. She strongly supports further research to learn more about this largely unexplored area. She noted that:

- The ocean is earth's largest living space, containing 80 percent of all phyla. Most photosynthesis occurs there, it keeps earth habitable, and it processes our waste. It also provides an inexpensive source of protein to feed our population.
- The Monterey Bay Aquarium Research Institute is currently considering direct sequestration of carbon dioxide into the ocean 3 kilometers below the surface to mitigate global warming. However, it is having difficulty assessing the potential biological impact of such activity because so little is known about the organisms at that depth.
- In order to know the right scientific questions to ask of ocean models and predictions, the U.S. needs to further explore the ocean.
- Ocean exploration is defined as the systematic observation of all facets of the ocean in the three dimensions of space and the fourth dimension of time. Ocean exploration leads to unpredictable rewards; possibilities include cures for diseases, discovery of untapped mineral, energy, and biological re-

sources, insights into ocean system functions, and beautiful geological and biological vistas.

- Many countries, including Ireland, Japan, France and Russia, are much more advanced in their ocean exploration tools and programs than the U.S.
- Stakeholders such as federal laboratories, businesses, universities, educators, conservationists, students and relevant federal agencies should be involved in ocean exploration. The activities of these groups need to be coordinated through an effective management structure, which could potentially be the National Ocean Partnership Program.
- Ocean exploration programs will be most effective and systematic with built-in mechanisms for educational outreach and information dissemination. Exploration would begin with reconnaissance mapping of the sea floor and water column.
- Detailed exploration should be done by a state-of-the-art flagship equipped with new generation submersible technology and high bandwidth satellite communication to bring real-time discoveries to aquaria, schools, homes and offices over the Internet.

Mr. Ballard testified that oceans are our last unexplored frontier and that we need to develop a blueprint for future exploration. He noted that:

- There is no major ocean exploration program in the U.S.
- Ocean exploration can lead to great discoveries with the help of newer technologies such as autonomous underwater vehicles.
- The future of sea farming will involve a shift from people as hunters and gatherers of the sea to shepherds of the sea.
- The natural beauty and cultural heritage of the oceans need to be preserved for future generations by expanding existing sanctuaries such as The National Marine Sanctuary. Public access is necessary to gain the public support needed for long-term protection.

Dr. Weller gave a brief recount of his time in the Pacific Ocean during the onset of the 1997 El Niño. He noted that:

- Oceanic measuring devices deployed by the National Science Foundation and international partners enabled early detection and warning of the 1997 El Niño, which gave people around the world time to prepare for its effects.
- In 1999 the value of these early El Niño warnings was estimated at $300 million for the agricultural sector, and $1 billion for all U.S. sectors combined. The payoff is huge considering that the U.S. puts only $12 million into the El Niño observing system annually.
- The ocean system across the globe is interconnected; as such, research activities need to be globally focused.

- The tools used to measure oceanic changes, like buoys and moorings, are available. We just need to get more of them out there.

Dr. Grassle focused on the need for a national network of linked and coordinated ocean observing systems, and on recommendations for how such a network should be established. He supports ocean exploration and the census of marine life programs and has suggestions for their advancement. He noted that:

- An integrated national network of coastal ocean observing systems needs to be developed. More than half of Americans live in coastal zones, more than 95 percent of the Nation's foreign trade moves by sea, the fishing industry and other industries rely on ocean, and our understanding of it influences all of these activities.
- A sustained network of linked and coordinated regional ocean observing systems will provide a new way of looking at, working in, and understanding the ocean.
- The growing community of users of ocean information needs a modeling and measurement system that has the ability to continuously map surface current flows and obtain data from satellite observations, buoys, and autonomous gliders.
- Intensive observatory facilities operated by scientists from all disciplines are needed to conduct long-term experiments, sustain long-time series observations, and test new ideas and equipment.
- The National Science Foundation and the Office of Naval Research have played major roles in the development of the LEO observatory, and should continue to play a leading role in the development of intensive observatory technologies.
- The National Ocean Research Leadership Council and National Oceanographic Partnership Program should be responsible for coordinating a national ocean observing system and approving standards and protocols for administering the system.

Dr. Beeton testified on ocean exploration in the context of the Great Lakes. He noted that:

- The Science Advisory Board is the only federal committee whose responsibility it is to advise the Undersecretary of Commerce for Oceans and Atmosphere on long- and short-term strategies for research, education, and application of science to resource management.
- Coastal and ocean observations are necessary to predict events that effect commerce and life and to minimize financial and personal loss.
- Ocean exploration activity should include geophysical surveys to update bathymetric charts for navigation, fisheries, and recreation.
- We need long-term monitoring to detect subtle changes in the Great Lakes ecosystems, make more coherent assessments of long- and short-term impacts, and understand coastal water quality's influence on public health.

Mr. Malahoff stressed that the oceans are an essential resource for the U.S., in addition to being our front line against adversaries. He noted that:

- Oceans provide us with food, energy, and resources for a range of new industries specializing in marine byproducts and their uses.
- NOAA's creation of the Office of Ocean Exploration is a catalyst that will enable the U.S. to lead the development of a holistic understanding of the world's oceans.
- Grass roots partnerships are key to improving ocean exploration.
- Core programs such as NOAA's National Undersea Research Program, along with programs at the Department of Defense, the National Science Foundation, and The Environmental Protection Agency, need to be supported in order to accomplish the objectives of ocean exploration.

4.3(g)—Combating the Invaders: Research on Non-Native Species

July 26, 2001

Hearing Volume No. 107–25

Background

The purpose of the hearing was to receive testimony on federal agencies' research on invasive species and how the National Invasive Species Council coordinates invasive species programs and activities among the various federal agencies. The Subcommittee reviewed the research provisions in the National Invasive Species Act of 1996 and the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 in order to update and improve them.

The Subcommittee heard from: (1) Peter Hoekstra, Congressman from Michigan (2) Dr. David Evans, Assistant Administrator of the Office of Oceanic and Atmospheric Research, National Oceanic and Atmospheric Administration and Co-chair of the Aquatic Nuisance Species Task Force; (3) Ms. Lori Williams, Executive Director of the National Invasive Species Council; (4) Dr. James T. Carlton, Professor of Marine Sciences at Williams College and Director of the Maritime Studies Program of Williams College and Mystic Seaport; (5) Dr. Stephen B. Brandt, Director of the Great Lakes Environmental Research Laboratory; and (6) Mr. Scott Smith from the Washington State Department of Fish and Wildlife.

Summary of Hearing

Mr. Hoekstra expressed interest in working with the Subcommittee to develop legislation to combat non-native species and the ecological and economic damage they cause. He noted that:

- The legislation he introduced earlier this year, H.R. 1680, addresses the introduction of non-native species in the Great Lakes through ballast water exchange. He stressed that this legislation should be considered as only one component of a larger package to solve invasive species problems.

- H.R. 1680 would require the Department of Transportation to institute rules and regulations to control the discharge of ballast water as well as to evaluate best possible practices and technologies to ensure further protection.

Dr. Evans testified that the Aquatic Nuisance Species Task Force, as mandated by the National Invasive Species Act of 1996, has met a significant number of research needs. The role of the task force is to coordinate the federal agencies involved in aquatic nuisance species management. He noted that:

- The Task Force has addressed the problem of zebra mussels, evaluated a range of ballast water technologies, sponsored research on responding to and monitoring non-indigenous species, and created new ways to educate the public regarding the issue.
- The National Invasive Species Act of 1996 charged the task force with prevention, detection, monitoring, and control of aquatic nuisance species.
- The task force conducts joint projects with agencies, provides aquatic nuisance species information to stakeholders, and funds research.
- The National Invasive Species Council has a broader taxonomic scope than the task force, yet the council's work with technologies for non-aquatic environments can inform/guide the task force's work within water environments.
- Control technologies still need to be developed for many taxonomic groups that currently have no known methods of eradication.

Dr. Carlton strongly supports research to prevent, understand, and manage invasive species. He noted that:

- The role of research universities in addressing the threat from invasive species is to define the basic science, theory, and the ecology of invasions and also to partner with government agencies, nonprofit organizations, and industry to develop solutions to invasive species problems.
- What we can expect to get back from research on invasive species is only proportional to what we invest in it, and that investment over the past ten years has been disproportionate to the nature of the problem.
- Creating a national baseline study would allow researchers to better understand the effectiveness of management plans to reduce future invasions.

Ms. Williams stressed the diversity of invasive species and the extent of damage they can inflict on the environment, the economy, and animal and human health. She focused on coordination issues and the role of the National Invasive Species Council. She noted that:

- An effective research response to invasive species problems needs to be coordinated, interdepartmental, and multi-jurisdictional.

- It is the National Invasive Species Council's role to help coordinate research efforts across the 22 federal agencies involved in invasive species.
- The Invasive Species Advisory Committee, which provides input to the council, is a 32-member group of non-federal stakeholders who represent diverse geographic areas, expertise, and interests.
- The Council developed a National Management Plan that outlines broad strategic goals for research and other aspects of invasive species. This is the first comprehensive federal action plan for invasive species. Highlights include: federal cooperation with stakeholders, development of a cross-cutting invasive species budget, research to improve invasive species threat assessment, better baseline data and monitoring, and improved data on economic impacts of invasive species.

Dr. Brandt testified that over the past few decades, rates of invasions have accelerated, especially in larger aquatic environments including the Great Lakes. He noted that:

- The Great Lakes Environmental Research Laboratory (GLERL) is the leading institution for aquatic species invasion research within NOAA. GLERL has a strong history of collaboration and partnerships in support of high-quality research, and has recently taken the lead to develop strategic plans on invasive species for NOAA.
- Current research is focused on preventing introductions and understanding ecological impacts.
- Prevention and control of ballast water introductions are critical research priorities. Ballast water is responsible for nine of the twelve recent invasive introductions in the Great Lakes.
- More emphasis should be placed on implementation of planning efforts, ideally at the regional level.

Mr. Smith used a variety of slides depicting invasive species to illustrate how some non-native species invade aquatic environments. He offered a state and regional perspective and noted that:

- The aquaculture industry in Washington State has been very concerned about the impact that spartina, zebra mussels, and green crabs have on the environment and the economy.
- The National Invasive Species Council coordinates both terrestrial and aquatic species, while the Aquatic Nuisance Species Task Force focuses on federal coordination of aquatic species efforts.
- The weakest link is at the state level; state aquatic nuisance species committees, an aquatic nuisance species coordinator in each state, and state plans are needed.
- Ballast water treatment research funds should be available to more than just Great Lakes states.
- We should improve the use of aquatic nuisance species regional panels, and encourage states that are not affiliated with a panel to join.

- With regard to zebra mussels, funds should be focused on areas that do not have zebra mussels for education and inspection programs to prevent introduction. Ballast water treatment research and technology development should be promoted.

4.3(h)—Arsenic in Drinking Water: An Update on the Science, Benefits, and Cost

October 4, 2001

Hearing Volume No. 107–32

Background

The purpose of the hearing was to receive testimony on three reports recently submitted to the Environmental Protection Agency (EPA) that update the state of knowledge on the science, benefits, and cost of regulating arsenic in drinking water. The Subcommittee was especially interested in the latest findings that will inform EPA as it sets the maximum contaminant level for arsenic in drinking water, due to be published in February 2002.

The Subcommittee heard from: (1) Dr. Robert Goyer, Chairman of the National Research Council Subcommittee to update the 1999 Arsenic in Drinking Water Report, Committee on Toxicology; (2) Dr. Maureen Cropper, Chair of the EPA Science Advisory Board, Arsenic Rule Benefits Review Panel; Lead Economist, The World Bank; Professor of Economics at the University of Maryland; (3) John Scheltens, National Drinking Water Advisory Council, Arsenic Cost Working Group; City Engineer, Public Works Director, Hot Springs, South Dakota; (4) Barbara Beck, Ph.D., Principal, Gradient Corporation representing the Environmental Arsenic Council, the National Wood Preservers Institute, and the National Rural Water Association; (5) Scott Rubin, Attorney & Consultant presenting research on water system affordability that he conducted for the National Rural Water Association; and (6) Erik Olson, Senior Attorney, Natural Resources Defense Council.

Summary of Hearing

Subcommittee Chairman Vernon Ehlers opened the hearing by pointing out the controversy surrounding the appropriate standard for arsenic in drinking water. He pointed out that the Committee's review evaluating the science of the risk of arsenic in drinking water is important, relevant and timely, not only because arsenic has received so much public attention, but also because it highlights the importance of using science as the basis of important public health and environmental decisions.

Dr. Goyer testified on the National Research Council's September 2001 report, "Arsenic in Drinking Water: 2001 Update". He noted that:

- On January 22, 2001, EPA issued a proposed standard for arsenic in drinking water of 10 micrograms per liter. This proposed standard is based primarily on response models and extrapolation from cancer studies of the Taiwanese pop-

ulation exposed to high concentrations of arsenic in its drinking water.

- On March 23, 2001, EPA published a notice that delayed the effective date of the arsenic rule pending further study.
- To incorporate the most recent scientific research into the EPA's decision on a standard, the EPA's Office of Water requested that the National Research Council independently review studies on the health effects of arsenic published since the NRC published its 1999 Arsenic in Drinking Water Report.
- The NRC assigned the project to the Committee on Toxicology, which prepared the updated report. The report also evaluated the analysis conducted by the EPA in support of its regulatory decision-making for arsenic in drinking water.
- The Subcommittee did not address economic questions, cost benefit assessment, control technology, exposure assessment in the U.S. population, or regulatory decision-making.
- The Subcommittee concluded that there is a sound database on the carcinogenic effect of arsenic in humans that is adequate for the purpose of risk assessment, and that arsenic causes cancer in humans at doses that are close to the drinking water concentrations that might occur in the United States.
- The new report suggests that the risks for bladder and lung cancer are greater than the risk estimates on which the EPA based its January 2001 pending rule. Reasons for the increased risk estimate include the use of a different biostatistical model that provides a better fit to the available data, the use of an external, rather than internal, comparison population, improved assumptions for determining arsenic exposures, and relating the risks to the Taiwanese population to the U.S. cancer rate, which is higher than the Taiwanese rate.
- Estimates of risk from low-level arsenic exposures were based on a Poisson linear extrapolation from observed data. Available data does not provide evidence for a threshold or non-linear dose response.
- Studies have also shown that arsenic is linked to cardiovascular diseases such as hypertension, diabetes mellitus, as well as reproductive disorders. Age, sex, and simultaneous exposure to other carcinogens may influence risk estimates.
- More research needs to be conducted to reduce uncertainties relevant to risk assessment and to gain knowledge of other effects of arsenic on the human body.

Dr. Cropper testified on the soundness of the benefit-cost analysis that was done in support of the arsenic rule, as evaluated in the report "Arsenic Rule Benefits Analysis: A Science Advisory Board Review." She focused on the economics of this and the economics of measuring the benefits and comparing them to the costs. She noted that:

- The ratio of benefits to cost is much lower in small drinking water systems. Although, the Safe Drinking Water Act calls for a uniform drinking water standard throughout the country, from an efficiency perspective, consideration should be given to the idea of allowing standards to vary by community.
- Avoided cases of illness and mortality should be broken down by age.
- Attention should be focused on the number of cases of premature mortality or fatal and non-fatal cancers expected to be reduced every year after the new drinking water standard is implemented for people who want to adopt their own discount rates or dollar value of a life.
- Other health endpoints besides lung and bladder cancers need to be quantified in order to be considered in an effective benefit-cost analysis.
- The timing of health benefits needs to be considered in cost-benefit analyses. More research is needed to assess the risk after exposure has stopped.
- The methodology used by the EPA to assess the valuation of benefits was sound.

Mr. Scheltens testified on the three major recommendations of the "Report on the Arsenic Cost Working Group to the National Drinking Water Advisory Committee." He noted that:

- The methodology the EPA used to produce a cost estimate for implementing the rule may not be sufficiently detailed to be able to fully understand the impact of the rule, particularly on small systems.
- 95 percent of the water systems affected by the arsenic rule are small systems, which are less able to absorb the costs (in terms of user rates) than the large systems.
- The working group proposed recommendations for improving future cost projections.
- Many additional contaminants will be regulated in the future, which expands the scope of this issue to the affordability of all drinking water regulations. A national panel of experts needs to be formed to deal with the affordability issue, and a "sustainability" fund needs to be set up by the Federal Government.
- The funds to update arsenic treatment facilities in small towns are important, but only solve a portion of the problem for small communities that can't afford the higher operation and maintenance costs.

Dr. Beck provided comments on several of the recent evaluations of arsenic toxicity and risk, especially the NRC 2001 report and the Science Advisory Board benefits review. She noted that:

- There is no evidence of arsenic-related diseases at typical U.S. exposure levels.

- The lower levels of arsenic that are typical of the U.S. situation are relatively low risk or perhaps no risk, which is consistent with a non-linear or sublinear dose response model.
- The key conclusions in the NRC Report, especially as reflected in the Executive Summary, are not well supported by scientific evidence, and in some cases, are inconsistent with the body of the text.
- Four main lines of evidence support a nonlinear response model: (1) other models such as the Weibel model and a paper by Morales cited in the NRC 2001 report; (2) arsenic doesn't interact directly with DNA; (3) there are qualitative differences between what happens at low doses versus high doses of arsenic in cells; (4) epidemiology studies do not find any consistent or convincing effects of arsenic at levels less than 100 micrograms per liter.
- The non-cancer effects of arsenic in drinking water are not quantified and could be less serious than the NRC report leads one to believe.
- Other nonlinear dose response models for the relationship between arsenic and health effects need to be explored. The Utah study of arsenic in drinking water offers a good opportunity for further evaluation of the data from that study to determine whether its results are consistent or inconsistent with the risk estimates in the NRC report.

Mr. Rubin testified that the Arsenic Cost Working group recognized that there might be small water systems that will not be able to afford to comply with the arsenic rule, but that it understates the problem and fails to discuss its consequences. He noted that:

- The EPA assumes small communities can afford a quadrupling of their water bills to $800. There are four significant problems with the EPA's assumptions: (1) the EPA focuses on median income rather than a more accurate measure of economic need, such as poverty; (2) EPA's assumption that 2.5 percent of income is affordable is inconsistent with the experience of other utility services; (3) The EPA's use of national averages and medians does not accurately measure the people who will have to pay for arsenic compliance; (4) existing water bills in many parts of the country are significantly higher than the EPA assumed.
- Several studies show that most low-income families will pay their utility bills and cut back on food or medical care. We need to evaluate not only the health impacts of reducing arsenic levels, but also the offsetting health impacts of reduced spending on other necessities.
- The Arsenic Workgroup recommends that Congress should authorize additional funding to help small water systems that face serious economic problems meeting the standard.
- The EPA must change the way it evaluates whether small water systems will be able to afford a new regulation, set a reasonable and realistic threshold for affordability, and evaluate the public health consequences of tradeoffs that

low-income households will be required to make in order to pay higher water bills.

Mr. Olson testified on the history of the arsenic rule and called for a new arsenic standard of three parts per billion (ppb). He noted that:

- The original standard was set in 1942, and recommendations to lower the standard to 10 ppb have been suggested since 1962. The current range of acceptable arsenic levels is as low as 3 ppb.
- The National Academy of Sciences affirms that even at 3 ppb, arsenic levels are ten times more carcinogenic than the EPA says is acceptable. It also holds that there is not sufficient evidence to show that there is a nonlinear dose response.
- The EPA estimates that 36 million Americans drink water everyday that contains over 3 ppb of arsenic.
- The EPA has produced credible estimates of the cost of arsenic compliance, given the constraints of the present rulemaking, data-gathering, and cost models.
- The benefits of lowering the standard to 3 ppb are much more than the EPA initially thought. The costs would be about $3 per household for 90 percent of the people that are affected.
- Public water systems in small communities need to be targeted for the $1.7 billion in federal money designated for public water systems.

4.3(i)—Weatherproofing the U.S.: Are We Prepared for Severe Storms?

October 11, 2001

Hearing Volume No. 107–31

Background

The purpose of the hearing was to receive testimony about research efforts into the prediction of severe storms, with emphasis on hurricanes, flooding, and wind-related damage. The hearing addressed the needs of emergency management officials to ensure the public is adequately warned about storms and their effects. In addition, the hearing examined three related legislative issues: H.R. 2486, the Tropical Cyclone Inland Forecasting Improvement and Warning System Development Act, introduced by Representative Etheridge; draft legislation by Representative Moore on research related to severe wind damage and its amelioration; and reauthorization of the U.S. Weather Research Program.

The Subcommittee heard testimony from: (1) Dr. Chris Landsea, Hurricane Research Division, Atlantic Oceanographic and Meteorological Laboratory, National Oceanic and Atmospheric Administration (NOAA): (2) Dr. Len Pietrafesa, Director of External Affairs, College of Mathematical Sciences, N.C. State University; (3) Dr. Steven L. McCabe, Professor and Department Chair, Department of Civil and Environmental Engineering, University of Kansas; (4)

Mr. John L. Hayes, Director, Office of Science and Technology, National Weather Service; Co-chair, U.S. Weather Research Program; (5) Mr. Doug Hill, Chief Meteorologist, WJLA—Channel 7 News, Washington, D.C.; and (6) Mr. Robert Shea, Acting Administrator for Federal Insurance and Mitigation, Federal Emergency Management Agency (FEMA).

Summary of Hearing

Dr. Landsea presented his research regarding hurricanes and the likelihood of increased hurricane activity in the coming decades. He noted that:

- The formation of hurricanes requires a specific combination of environmental factors.
- Hurricane activity seems to be cyclical with the 1940's—1960's being quite active, and the 1970's-early 1990's relatively quiet.
- It appears the Atlantic is beginning to enter another active period, with much more dangerous consequences because of increased population and economic develop along the East Coast.

Dr. Pietrafesa discussed the need for an interdisciplinary approach to severe storms through research and management. He emphasized that:

- The roots of the problem lie in the interactions between the environmental physical system, which are not well understood and changing, and those interactions with the human system, with its social and demographic characteristics. This is especially true in the loss of life and destruction due to floods.
- In North Carolina, Category 2 Hurricanes (as opposed to those much stronger) are responsible for 42 percent of all damage because of their high moisture content and the hidden nature of estuarian, coastal, and inland flooding.
- Proper funding of the U.S. Weather Research Program will increase our ability to handle severe storm events.
- He supports the legislation put forth by Congressman Etheridge to develop a new flood warning index.

Dr. McCabe discussed the issue of windstorms and their effects on the citizens and economy of the United States. He noted that:

- Property damage, personal injuries, and death from wind storms is a national problem, resulting in an average economic loss in the United States on the order of several billion dollars.
- The Federal Government needs to do more toward preventing or minimizing the impact of windstorms.
- Legislation developed by Congressman Moore and the Science Committee staff would better coordinate federal wind hazard reduction efforts and research, and provide sufficient funds to accomplish its goals.

- One area where this legislation would help is roof system testing procedures and new devices for wind resistance.

Dr. Hayes discussed the importance of the U.S. Weather Research Program. He emphasized that:

- Hazardous weather, such as tornadoes, hurricanes, and winter storms each year cause thousands of fatalities, far more injuries, and tens of billions of dollars in property damage.
- The U.S. Weather Research Program (USWRP) can improve warning and forecast accuracies and lead times by more fully exploiting our advanced technologies and improving the scientific basis for weather prediction.
- The USWRP is a $9 million multi-agency collaborative effort of operation and research communities, and academia and government. The current participants include NOAA, the National Science Foundation, NASA, and the Department of Defense.

Mr. Hill presented his perspective as a television meteorologist about communicating information on severe storms to the public. He noted that:

- Most people have become desensitized to emergency weather warnings, especially while riding in automobiles.
- We need to find a way to make it mandatory that radio stations issue severe weather warnings.
- Many times the people providing local weather information in smaller areas are not specifically qualified or certified.
- Television meteorologists and the staff with the national weather service forecasting offices must have a good working relationship.

Mr. Shea discussed the need to ensure that research into natural hazards is translated into effective practice for emergency managers and the public. He emphasized that:

- The Federal Emergency Management Agency (FEMA) has been developing a multi-hazard risk assessment and loss estimation tool called HAZUS or Hazards U.S. The first one was for earthquake issues, the next one due is for flooding and there is a prototype of one concerning wind issues.
- The HAZUS tools are designed to provide federal, state and local people with information to understand the risks involved with specific natural hazards, and then how to deal with it.
- Congressman Etheridge's legislation to create a new flood warning system, which would also educate local officials and the public about the new system, would help to save lives.
- FEMA and the National Weather Service are working together to develop enhanced flood maps and flood modeling capabilities, but more collaboration is needed.

4.3(j)—Sea Grant: Review and Reauthorization

February 28, 2002

Hearing Volume No. 107–47

Background

The purpose of the hearing was to evaluate the President's fiscal year 2003 Budget proposal to transfer the Sea Grant College Program from the National Oceanic and Atmospheric Administration (NOAA) to the National Science Foundation (NSF). The hearing also explored H.R. 3389, a bill that would reauthorize the Sea Grant College Program within NOAA.

The Subcommittee heard from: (1) Vice Admiral Conrad C. Lautenbacher, Jr., Under Secretary of Commerce for Oceans and Atmosphere, National Oceanic and Atmospheric Administration; (2) Dr. Russell Moll, Director, California Sea Grant College Program, University of California San Diego; (3) Ms. Mary Hope Katsouros, Senior Fellow and Senior Vice President, The H. John Heinz III Center for Science, Economics, and the Environment; (4) Dr. Nancy Rabalais, Professor, Louisiana Universities Marine Consortium; and (5) Mr. Michael Donahue, President/Chief Executive Officer, Great Lakes Commission

Summary of Hearing

Admiral Lautenbacher deferred to his written testimony, which reiterates the justification put forward by the Office of Management and Budget and the Department of Commerce for the President's FY 2003 budget request. With regard to the proposal to move Sea Grant to the NSF, he commented that the Administration believes that NSF would better manage Sea Grant's research, which would maximize the benefit received from each dollar invested. Admiral Lautenbacher supports Sea Grant and noted that, under NOAA, he intends to manage the program for the remainder of FY 2002 in accordance with the intent of the President and Congress, as stated in the current authorizations.

Dr. Moll described Sea Grant as a broad-based, priority-driven program that balances research, extension, and education. It matches federal funding with local support to build partnerships to investigate issues such as aquaculture, marine biotechnology, and non-indigenous species. He argued that:

- Sea Grant's local, State, and national programs use a strong peer review process for evaluating potential research projects. And, every four years each Sea Grant program undergoes an external review.
- Whether the Sea Grant program remains at NOAA or is transferred to NSF, the program's strengths (partnerships, research interwoven with outreach, and coastal focus) should be maintained.
- Since Sea Grant is already authorized for several more years within NOAA, the Administration should wait for the President's Commission on Ocean Policy to finish their review of the structure of federal maritime programs before moving Sea Grant.

- There should be no change in the mission, structure, or function of Sea Grant until the Commission's report is released.
- NSF is not particularly well vested in outreach activities nor is NSF likely to support Sea Grant's matching provision; both are elements of the program's current strengths.
- If the Coastal Ocean Program is merged with Sea Grant, the integrity of both programs should be maintained.

Ms. Katsouros noted that Sea Grant creates partnerships involving 300 institutions and 3,000 scientists each year. "It helps people," she said in regard to the program's role in federal research. She testified that:

- Sea Grant should not be moved from NOAA to NSF because Sea Grant currently funds applied research, responds to local, State, regional, and national goals, is supported by matching funds, and conducts extension activities—all elements that would be lost under NSF administration.
- Congress should reconsider implementing a 1994 National Academy of Sciences recommendation to elevate Sea Grant to the Office of the NOAA Administrator.
- Since 1994, the Sea Grant peer-review process has improved.
- The Coastal Ocean Program supports long-term, multidisciplinary research, whereas the Sea Grant program is focused on single investigator, State and national priority research.

Dr. Rabalais is a scientist who has been doing marine coastal research for twenty years. She has received grant money from Sea Grant, The Coastal Ocean Program, and NSF, and has had proposals rejected by each organization as well. She testified that:

- These programs serve different constituencies, do different kinds of research, and address different needs.
- The fear among the marine science community is that moving Sea Grant or the Coastal Ocean Program would jeopardize the purpose and integrity of each program.
- The NSF budget needs to be increased on its own; not by moving other programs into it.
- The U.S. Ocean Commission review and Vice Admiral Lautenbacher's bottom-up review of NOAA's programs should be completed before research dollars and programs are moved around.

Dr. Donahue discussed Sea Grant and the Coastal Ocean Program from a Great Lakes perspective. He testified that:

- The Great Lakes Commission and member states rely fundamentally on the research and extension services Sea Grant provides.
- The Great Lakes Commission opposes the proposed transfer of the program from NOAA to NSF; attention should be directed towards strengthening the program within NOAA and working towards reauthorization.
- If the Federal Government provides less or no funding for Sea Grant's activities, the ability of the states to perform their mandated functions would be severely compromised

and could cause the outright elimination of entire research, education, and outreach programs. The implications of which might include loss of local economic development opportunities, a less informed public, a compromised decision-support system for state legislators, and in some areas increased exposure to environmental contaminants.

- Several Sea Grant issues merit evaluation: the program's stature and base funding need to be elevated for it to realize its potential; Sea Grant's outreach needs have increased because of the downsizing of government but its budget for extensions has not; Sea Grant's focus on regional, in addition to state-level, issues should be expanded.
- Sea Grant needs to be reauthorized, appropriated not less than $100 million, and its profile within NOAA should be elevated over time.

4.3(k)—Technology Administration: Review and Reauthorization

March 14, 2002

Hearing Volume No. 107–54

Background

The purpose of the hearing was to evaluate the President's Fiscal Year 2003 Budget request for the Technology Administration and the National Institute of Standards and Technology. In addition, the Subcommittee reviewed the Administration's proposed reforms for the Advanced Technology Program.

The Subcommittee heard from: (1) Mr. Philip J. Bond, Undersecretary of Commerce for Technology and Chief of Staff to the Secretary of Commerce; (2) Dr. Arden L. Bement, Director, National Institute of Standards and Technology (NIST); (3) Mr. Michael Wojcicki, President, The Modernization Forum; (4) Ms. Birgit M. Klohs, President, The Right Place Program; and (5) Dr. Christopher T. Hill, Vice Provost for Research and Professor of Public Policy and Technology, George Mason University.

Summary of Hearing

Mr. Bond testified that the Department of Commerce and the Technology Administration (TA) are carrying out their respective missions by focusing resources on the following goals: fostering job creation, assisting homeland security initiatives within the Administration, and helping to fight the war on terrorism.

He testified that technology will play a significant role in meeting these goals. He outlined the different roles the Federal Government and the private sector can play in developing technology. He argued that the private sector must assume the lead in technology development; however, the Office of Technology Policy (which is part of the Technology Administration) is developing and advocating national policies that use technology to build America's economic strength. To that end, he explained that the office seeks to encourage research, development, and commercialization of new technologies, such as nanotechnology and biotechnology. At the

same time, the TA has been working to encourage students to pursue high tech careers.

Lastly, he recognized the Administration's proposed reforms to the Advanced Technology Program (ATP) and requested funding level for the Manufacturing Extension Partnership (MEP) (both programs are run by NIST) are controversial. Specifically, he noted that the Department of Commerce recognizes the value of the ATP program, and that the Administration felt the proposed reforms would help the program in the long run. In regards to MEP, he testified that the current budget climate led to the proposed cuts in MEP. He argued that because the program is successful, large and small manufacturers would have an incentive to supplement the loss of federal funding for the centers that carry out MEP's mission.

Dr. Bement discussed the President's budget request for NIST for Fiscal Year 2003 and its recent work in responding to the terrorist attacks of September 11. He testified that NIST had many examples of meeting the Nation's security, research, and commercial needs in the wake of that event. Among the activities that NIST undertook in response were: assessing structural damage to, and building standards for, the World Trade Center buildings and the Pentagon; testing and establishing dose standards for irradiated mail to ensure the destruction of anthrax spores and other pathogens; and providing research support through 75 different ongoing projects for sensors, biometrics, information security, and support for emergency services and law enforcement.

He outlined NIST's funding needs within the context of the President's budget request. Specifically, he called attention to the $35 million request instruments for the soon-to-be-completed Advanced Measurement Laboratory (AML), the $54.5 million request for construction and maintenance of NIST's facilities (which would allow for upgrades and new facilities in NIST Boulder, Colorado labs and equip the AML), and the $396.4 million request for laboratories (which would help strengthen NIST's core mission in several key areas including: health care, nanotechnology, measurement science, cyber security, Homeland Security, and neutron research). He added that demand for the use of NIST's neutron facility has increased dramatically, since it is now the only such facility in the U.S. The Administration's funding request would go toward meeting this demand.

Finally, Dr. Bement echoed Mr. Bond's comments regarding the Administration's funding requests for ATP and MEP, by arguing that the current budget climate led to the Administration's request for funding cuts in the ATP and MEP programs. He added that NIST's headquarters would continue to coordinate the state MEP centers, even with a substantial decrease in funding.

Mr. Wojcicki testified to the importance of the Federal Government's role in the Manufacturing Extension Partnership, as both a leader in the partnership and as a major source of funding. He indicated that State funding for the Manufacturing Extension centers is either explicitly or implicitly contingent on federal funding in two-thirds of participating State governments. Mr. Wojcicki concluded that if federal funding is not allocated, a majority of the

MEP centers would be threatened, as state budgets would be redirected to receive federal matching grants.

Mr. Wojcicki asserted that centers continuing to operate in the absence of federal funding, would need to increase their hourly fees, focus on larger projects, and decrease the use of private consultants. He believes that each of these changes would affect the accessibility of the program to smaller manufacturers and would favor a shift towards larger manufacturers that would be capable of paying higher fees and taking on larger projects. He added that, without federal funding to serve as a catalyst, the MEP centers will not be able to carry out their original mandate to help small manufacturers become more competitive and productive. For MEP projects in Fiscal Year 2000, client firms reported $2.3 billion in increased sales and more than 25,000 jobs created or retained. Mr. Wojcicki reported that a conservative estimate indicates that the Federal Government receives $4 in federal tax revenue for every $1 invested in the program.

Ms. Klohs discussed the Right Place Program's work to attract, retain and grow businesses in Grand Rapids. She explained that because a large part of the local economy is based in manufacturing, a lot of her work is focused on helping small to medium manufacturers through the West Michigan MMTC Center. She reported that independent analysis has shown that in Western Michigan, manufacturing jobs account for 26 percent of employment and 42 cents of every dollar earned is a manufacturing dollar.

Ms. Klohs reported that federal funding for MEP is matched by state funding and is used to support outreach activity, informational events, program development and industry benchmarking assessments. The MEP network links Michigan's programs to resources nationwide. MMTC serves as a catalyst for reducing waste in business practices for small manufacturers such as lean enterprise user groups and helps them cut lead time. Citing independent research Ms. Klohs asserted that by continuing to support smaller manufacturers in Western Michigan, the MEP program has helped boost manufacturing employment 60 percent with the help of State and federal funding.

Dr. Hill focused his testimony on evaluating four proposals in the Department of Commerce's report for reforming the Advanced Technology Program (ATP). The first recommended change would allow institutions of higher education to lead ATP joint ventures with private industry, including the authority to organize proposals. He believes this would be an effective use of funds because new proposals would still require educational institutions to work with industry, rather than use ATP funding as another university funding source.

The second reform would amend the ATP statute to permit universities and other nonprofit members of ATP to establish joint ventures to negotiate intellectual property rights. Dr. Hill supported this reform, however, he believes the disposition of future property rights should be agreed to before the award is made, avoiding difficult negotiations afterward.

The third recommendation would limit large companies from participating in ATP ventures. Dr. Hill did not support this proposal and argued for the continued inclusion of all sizes of firms, since,

as Dr. Hill reports, the research funded by ATP does not take into account the size of the firm, and the purpose of the research is to encourage basic research that would be overlooked by either large or small firms in the private sector. The fourth major reform would require ATP grant recipients to make a royalty payment of five percent of gross sales to be paid on ATP investments and profitable ventures up to 500 percent of the original award. Dr. Hill did not support this reform and argued that it would be difficult to administer and would impose a usurious rate of interest. In addition, he argued that this reform would produce a number of counterproductive incentives that would undermine the original intent of the program.

4.3(l)—Science and Technology Programs at the Environmental Protection Agency: The FY 2003 Budget Request

April 23, 2002

Hearing Volume No. 107–53

Background

This purpose of the hearing was to review the Environmental Protection Agency's (EPA's) FY 2003 budget request for Science and Technology programs. The Subcommittee planned to examine the strategic directions in the Agency's R&D budget and whether the resources available to EPA's Office of Research and Development (ORD) are adequate for producing the science necessary to protect public health and the environment.

The Subcommittee heard testimony from: (1) Dr. Paul Gilman, Assistant Administrator, ORD, EPA; (2) Dr. Genevieve Matanoski, Professor, Department of Epidemiology, Johns Hopkins University; Member, Science Advisory Board (SAB) and Research Strategies Advisory Committee (RSAC), EPA; and (3) Dr. Eli Pearce, President, American Chemical Society.

Summary of Hearing

Subcommittee Chairman Vernon Ehlers opened the hearing by describing the purpose of the hearing to examine the budget request for both ORD and the Agency's overall Science and Technology (S&T) budget. He raised several concerns about the Agency's budget proposal. First, he indicated concern about the absence of a rationale for eliminating funding for the highly successful Science to Achieve Results (STAR) graduate fellowship program. He questioned the size of the proposed transfer of $75M from the Superfund Trust Account to the S&T account for the detection and cleaning of buildings contaminated with biological or chemical agents. Finally, he raised a longstanding concern about the rapid growth in federal investment in life sciences research relative to the relatively flat levels of investment in the physical sciences, including EPA's science and technology budget.

Dr. Gilman provided an overview of EPA's FY 2003 budget request. He pointed out that:

- Of the $627 million total request, $514M would come from the Science and Technology appropriation. It would represent 75 percent of the Agency's S&T account.
- ORD expects to continue critical environmental research programs in such areas as children's health, drinking water, and particulate matter research. The agency is also proposing budget initiatives in homeland security, computational toxicology, biotechnology, and the Central Basin Integrated Assessment.
- ORD is proud of several recent scientific accomplishments. For example, Microarrays or gene chips are being developed and used in rapid testing of drinking water for harmful pathogens and chemicals and detecting environmentally induced male infertility. ORD scientists are also developing new technologies to better measure the distribution and the control of contaminants in areas such as absorptive membrane systems that can effectively eliminate heavy metal impurities from moving water sources. ORD is also developing methods, data, and models for evaluating children's aggregate exposure to pesticides.
- The methodology in ORD's Environmental Monitoring and Assessment Program (EMAP) promises to improve assessments of ecosystem conditions and that many states are now using it as an efficient way to monitor coastal conditions.

Dr. Matanoski summarized the findings of the SAB's review of EPA's budget request by pointing out that:

- EPA should continue to strengthen the link between R&D and the Agency's strategic plan, and to improve recruitment that will help maintain core scientific competencies within the Agency's R&D programs.
- Many of the environmental problems that we face are not explicitly identified in statute, and that the Agency needs to maintain a forward-looking research program to identify future problems which will support non-regulatory approaches.
- The Agency needs to maintain and augment research and development in emerging and under-funded avenues. She agreed with the other witnesses about the need to provide sufficient resources for exploring the next generation of environmental problems.

Dr. Pierce highlighted that:

- This year's budget request for the EPA Science and Technology account continues a trend that diminishes support for science programs, which are critical for sound regulatory decisions, and in new areas such as nano and biotechnology.
- Core programs, such as the STAR program, which build the talent pool for the environmental sciences, should not be cut.
- EPA's need for structural management reform in its science programs is becoming more pressing.
- EPA needs to improve recruitment in response to the pending wave of retirements in EPA's scientific ranks.

In addition to the testimony of the witnesses, a consortium of graduate students and faculty submitted testimony concerning proposed cut to the STAR Fellowship program. The consortium called for restoring STAR funding.

4.3(m)—Homeland Security: The Federal and Regional Response

June 10, 2002

Hearing Volume No. 107–76

Background

The hearing examined the federal and the National Capital area regional responses to the threat of terrorism. Topics included computer security, biodefense, regional coordination, public and private research and development, and first responder needs. The Subcommittee was especially interested in how the various agencies work with private entities and entrepreneurs to maximize both speed and efficiency in dealing with new terrorist threats.

The Subcommittee heard from: (1) Dr. Elias Zerhouni, Director, National Institutes of Health; (2) Dr. Arden L. Bement, Jr., Director, National Institute of Standards and Technology; (3) Dr. Anthony S. Fauci, Director, National Institute of Allergy and Infectious Diseases, National Institutes of Health; (4) Major Julie Pavlin, Chief, Department of Field Studies, Walter Reed Army Institute of Research; (5) Mr. Edward J. McCallum, Director, Combating Terrorism Technology Support Office, Department of Defense; and (6) Mr. Robert A. Malson, President, DC Hospital Association, and Chairman, Washington Metropolitan Council of Governments' Bioterrorism Task Force.

Summary of Hearing

Dr. Zerhouni discussed the role of the National Institutes of Health (NIH) in biodefense and in coordinating medical response preparedness with public and private partners.

- Much of NIH's biodefense work will fall under the authority of the new Department of Homeland Security, which will unify our defenses against human, animal, and plant diseases that could be used as terrorist weapons, as well as sponsor extramural research.
- NIH biodefense research began long before the anthrax cases of fall 2001.
- Collaboration with the private sector has never been more important as progress will depend on the ability to assemble multidisciplinary teams of scientists, cost-cutting initiatives, and public-private partnerships.

Dr. Bement testified on the recent activities of the National Institute of Standards and Technology (NIST).

- NIST reacted almost immediately to the 9/11 attacks and the anthrax bioterrorism, coordinating responses with a number of federal agencies.

- Besides NIST's traditional responsibilities for developing standards and guidelines to protect sensitive information in non-classified federal computer systems, post-9/11 laws have mandated NIST's assistance in the development of a national biometric identification system, which will be used to identify people entering the U.S. who are applying for visas.
- NIST is also preparing for the future of cyber security through its program in quantum computing.

Dr. Fauci discussed NIH's biodefense research efforts.

- NIH's responsibility is not biowarfare (it is the military's); rather, it is biodefense, which is more complex because it is responsible for the protection of the entire civilian population.
- Smallpox, anthrax, plague, botulism, tularemia, and hemorrhagic fevers are all threats for which NIH has to prepare.
- Under the Department of Homeland Security, NIH would work closely with the Departments of Health and Human Services, Agriculture, Defense, Energy, the Centers for Disease Control, and its industrial partners.
- In conjunction with CDC, the NIH has been working to develop and stockpile vaccines for smallpox, anthrax, and Ebola.

Major Pavlin discussed disease surveillance and response capabilities, particularly at the Department of Defense.

- Surveillance is the fundamental building block in detecting biological threats, whether they are naturally occurring or deliberately introduced. Unfortunately, most surveillance systems are passive and rely on people to report outbreaks; they are not sufficiently sensitive or timely for this type of threat.
- A number of universities and agencies have developed systems, including the University of Pittsburgh, which created a real-time system for disease surveillance that monitors outpatient visits. This system was successfully deployed at the Winter Olympics in Salt Lake City.
- Recent increases in Dept. of Health and Human Services funding for improving public health capacity could be used to develop surveillance capabilities in regions that lack them.
- There is no national surveillance system, although the CDC is working to enhance existing surveillance systems. State and local governments are the ones that determine relationships with local authorities and public health responders.

Mr. McCallum explained the activities of the Technical Support Working Group (TSWG).

- Created in 1982, TSWG is tasked with conducting a national interagency R&D program for combating terrorism. It also influences long-term R&D requirements through the coordination of the basic science organizations.
- Recently, TSWG formed bilateral R&D efforts with several key allies, including the UK, Canada, and Israel.

- A number of agencies in TSWG, primarily non-medical ones, will be included in the Department of Homeland Security.
- The business process of TSWG involves bringing together sponsors and experts from academia from the labs and Federal Government with users to ensure that the real requirements are analyzed.

Mr. Malson discussed the Washington, DC Hospital Association's (DCHA) Bioterrorism Task Force.

- The focus is on developing a consensus approach that would promote inter-jurisdictional coordination while preserving the unique characteristics and operating procedures of each member jurisdiction.
- In the wake of the anthrax attacks last fall, the DCHA established daily conference calls for all of the local hospitals in order to allow communication with researches and medical responders. At the same time, two committees were created: the Infectious Disease and Infection Control Committee and the Stress Response and Research Committee.
- The need for regional coordination cannot be overstated when planning for bioterrorism. In the National Capital Region, it is especially challenging because of the abundance of federal, State, and local agencies—all with defined jurisdictions and all within close proximity of each other. Also, healthcare first responders are primarily in the private sector and traditionally have not been included in emergency planning activities.

4.3(n)—Research Priorities for Aquatic Invasive Species

June 20, 2002

Hearing Volume No. 107–72

Background

The hearing examined research priorities to support the National Invasive Species Act (NISA). NISA establishes a federal program to control the spread of aquatic nuisance species and the brown tree snake. The hearing examined gaps in our understanding of how invasive species are introduced and spread, and what research is required to enable state and federal officials to better manage aquatic invasive species.

The hearing explored several questions, including:

- What research is needed to assess the relative risk of different invasion pathways?
- What types of monitoring (for example, ecological surveys and pathway surveys) would support early detection of, and rapid response to, the introduction of an invasive species?
- What research is required to enable more accurate characterization of the likelihood of a species invading once it is introduced?

- What research is required to support the development of standards for ballast water and "whole ship" treatment?
- What research programs should we pursue to develop new technologies to control the introduction of invasive species by ships entering or moving about U.S. waters?

The witnesses included: Panel 1: The Honorable Robert A. Underwood, Member of Congress. Panel 2: (1) Dr. David Lodge, Professor of Biological Sciences, University of Notre Dame; (2) Dr. L. David Smith, Assistant Professor of Biological Science, Smith College; (3) Dr. Gregory Ruiz, Senior Scientist, Smithsonian Environmental Research Center; (4) Ms. Allegra Cangelosi, Senior Policy Analyst, Northeast-Midwest Institute; and (5) Ms. Maurya Falkner, Staff Environmental Scientist, Marine Facilities Division of the California State Lands Commission and Program Manager, Ballast Water Management and Control Program.

Summary of Hearing

Delegate Underwood testified on the significant environmental and economic damage caused on Guam by the non-native brown tree snake. The snake was accidentally introduced following WWII and is responsible for the extinction of 10 to 13 native bird species, two of three bat species and half of the 12 native lizard species. Controlling the spread of the snake, and preventing it from interfering with high voltage wires and electrical transformers, has had very high costs for Guam. Del. Underwood noted that the bulk of research monies have been directed at prevention, basic biological research, trapping and barrier technologies, while he would like to see the passage of legislation that would include research focusing on actively reducing snake populations.

Dr. Lodge outlined the universal process of species invasions, the current invasive species research portfolio and the ideal invasive species research portfolio.

- The current research portfolio does not dedicate enough resources to prevention.
- Research should focus on distinguishing which possible invasive species pose the greatest threat to ecosystems and on pathway analysis.

Dr. Smith testified that shipping is the primary vector for aquatic invasions, however, prevention efforts should also focus on other invasive pathways.

- Other pathways include fisheries, the pet aquarium industry, research and educational organizations and restoration projects. Basic research is needed to understand how these pathways operate.
- Findings from pathway studies should be incorporated into Invasive Species Management Plans and industry management practices.

Dr. Ruiz identified gaps in current knowledge of marine and aquatic ecosystem invasions and emphasized the importance of tracking invasion patterns.

- Strategies to prevent new invasions can be directed at key transfer mechanisms or vectors.
- Field measurement is necessary to measure the relationship between the number of organisms released by a vector and the rate of invasion.

Ms. Cangelosi addressed what she believes needs to be included in a federal research program to prevent the introduction of additional aquatic invasive species.

- While ballast water exchange is currently required under the National Invasive Species Act (NISA), an interim, biologically-based standard of treatment is needed until R&D can identify a final "whole-ship" standard.
- An integrated shore-based and shipboard approach between the EPA and Coast Guard would afford economic and ecological research efficiencies and assure that methods developed would be environmentally sound.

Ms. Faulkner testified that:

- Development of new technologies for ballast water treatment has been hindered by the fact that alternatives to ballast water exchange have not been encouraged, an interim and final treatment standard has not been identified, and research funding is inadequate.
- A test program for treatment technologies also needs to focus on developing verification and certification programs, which can only exist when standards are identified.

4.3(o)—Environmental Contributors to Breast Cancer: What Does the Science Say?

June 22, 2002

Hearing Volume No. 107–74

Background

The hearing examined what is known about environmental factors that may cause breast cancer and how these factors may be linked to the unusually high rate of breast cancer observed in Port Jefferson, New York and surrounding communities.

The New York Department of Health has mapped cancer rates across the state and discovered higher than expected rates of breast cancer in seven ZIP codes west of the township of Brookhaven, New York, an area that encompasses Coram, Port Jefferson Station, Setauket, Miller Place, Mount Sinai, Port Jefferson, and Sound Beach. Researchers involved in developing the state cancer map have noted that the population in the affected area does not appear to have unusual genetic characteristics that could account for the high breast cancer rates, suggesting instead that environmental factors may play a significant role. The Department of Health is investigating the feasibility of conducting a full environmental study of the area. In the past, however, state officials, backed by some experts, have resisted in-depth studies of cancer clusters, arguing that they have limited scientific value because

relatively little is known about the connection between exposure to environmental toxins and subsequent incidences of cancer.

In the meantime, the School of Medicine at the State University of New York at Stony Brook has established the Long Island Cancer Center to conduct scientific research into Long Island's high incidence of cancer. The Center is developing a clinical database of breast and prostate cancer patients from the Long Island region that will allow researchers to characterize the nature and possible causes of these cancers.

The hearing consisted of two panels of witnesses. The first panel included: (1) Dr. John Kovach, Director, Long Island Cancer Center, State University of New York at Stony Brook; (2) Dr. Roger Grimson, Principal Research Scientist, Department of Preventive Medicine, State University of New York at Stony Brook; (3) Mr. Peter Levine, President and CEO, Correlogic Systems, Inc.; and (4) Dr. Nancy Kim, Director, Division of Environmental Health Assessment, New York Department of Health. The Second Panel included: (1) Ms. Gail Frankel, Field Coordinator and Advocate, National Breast Cancer Coalition; (2) Ms. Elsa Ford, President, Brentwood/Bay Shore Breast Cancer Coalition; and (3) Ms. Lorraine Pace, a breast cancer educator and Founder of the Breast Cancer Mapping Project.

Summary of Hearing

The first three witnesses on the first panel, two researchers from the Long Island Cancer Center and the director of the New York State Health Dept. Division of Environmental Assessment delivered essentially the same testimony: there is higher incidence of breast cancer on Long Island compared with the average for both New York State and for the Nation; environmental factors are suspect but there is no evidence to point to any particular causative agent; a full environmental survey may be warranted but is not likely to yield answers; instead, all three witnesses spoke of the need to create a comprehensive longitudinal database—like the Framingham heart study—to track a representative population over an extended period of time; all three panelists testified that the success of activists in raising awareness is helpful because it increases the likelihood of finding willing participants—including healthy subjects—for a long-term study, should one be established.

- Mr. Levine spoke of his company's proprietary technology to analyze the protein composition of blood serum and, through pattern recognition algorithms, identify correlations with the presence of cancer. He recently published data indicating a very high success rate in diagnosing ovarian cancer. His company has embarked on a similar effort to identify markers for breast cancer.
- The panel was asked whether the Federal Government should be funding cancer mapping projects. Drs. Kovach and Grimson answered that cancer maps are useful but remapping of the Long Island region would not add any new information—there is no data on exposure to environmental toxins, for example. U.S. breast cancer rates are extraordinarily high—3 or 4 times the rates typical of most countries (only

Canada and a few of the Northern European countries have breast cancer rates as high as those found in the U.S.); hot spots or clusters where rates are 20–50 percent higher than the national average may not be as significant when overlaid on the much larger disparity between the U.S. and the rest of the world.

- The panel asked what federal resources were needed to address the problem. Mr. Levine said the biggest problem was getting healthy woman—who are needed as a control group—to participate in long-term medical studies. Drs. Kovach and Grimson reiterated the need for a population-based database and suggested that this ought to be a nationwide effort; they both referred to the national medical and genetic database that has been created in Iceland as a model.
- The panel of three breast cancer survivors and activists related their own experiences in dealing with the disease and the path that led them to activism.
- Once the second panel's testimony was delivered, the hearing was opened to comments from the audience. Several audience members related their own stories about their personal experience with breast cancer and their involvement in public education about the issue.

4.3(p)—Workforce Training in a Time of Technological Change

June 24, 2002

Hearing Volume No. 107–78

Background

The purpose of the hearing was to examine ways in which workers' skill requirements have changed as a result of technological innovations in the workforce, and to assess various training programs aimed at providing workers with the requisite skills for success in today's high-tech work environment.

The Subcommittee heard from: (1) The Honorable Bruce Mehlman, Assistant Secretary, U.S. Department of Commerce; (2) Ms. Cindy Ballard, Directory of Policy, Strategic Initiatives, Michigan Economic Development Corporation; (3) Mr. Tim N. Clark, Director, Center for Manufacturing Improvement, Michigan Manufacturing Technology Center-Northeast, Saginaw Valley State University; and (4) Mr. Robert Worthington, Sr., President, Globe Fire Sprinkler Corporation.

Summary of Hearing

Secretary Mehlman testified that unlike previous eras in which economic strength was measured in terms of natural resource abundance and manufacturing robustness, today's economy hinges on technological innovation and the ability to train and retain a highly skilled workforce. Specifically, he noted that the field of Information Technology (IT) is a substantial component of the Nation's economy (while accounting for only seven percent of busi-

nesses in the U.S. economy it generated 28 percent of economic growth between 1996 and 2000), but at the same time poses serious challenges in the realm of worker training.

- IT is a dynamic field of rapid change, creating challenges for workers and employers alike.
- Worker training is not always economical or even possible for small and midsize companies that cannot afford the high cost and/or the requisite time away from profit-generating work for training programs.
- Specific skill requirements change rapidly casting doubt on the long-term benefit to employers, and employees, of worker-training programs.

Ms. Ballard commented to the Committee on the workforce challenges facing the State of Michigan. She noted:

- The study released by the Michigan Economic Development Corporation, Workforce and Career-Development: Building Upon Key Michigan Strengths, found that a shortage of skilled workers posed a long-term threat to the State's economic competitiveness.
- The primary focus of the State in addressing its skilled-worker shortage situation should be the recruitment and retention of a highly-skilled workforce which is plagued by both a low birth rate and limited migration from other states.
- Michigan Works Agencies, the Michigan Department of Career Development, and the State's community colleges have been successful in implementing programs (such as M–TEC) that provide the technical training vital to Michigan's workforce.
- Surveys of high school students reflect a belief among them that computer-related professions offer the greatest opportunity, but also show a lack of desire among students to enter those fields.
- Increased involvement by the Federal Government via scholarships, grants, etc., could prove highly effective in attracting the Nation's youth to high-tech fields.

The challenges faced by employers in creating and maintaining a well-trained workforce were addressed by Mr. Clark:

- The workforce training problem for employers is two-fold: the initial recruitment of employees, and the ongoing task of ensuring current workers posses the skills they require to properly perform their job functions.
- For small companies, specifically, the two biggest issues are the time and monetary costs of training programs.
- Receiving funding from the Federal Government via NIST's Manufacturing Extension Partnership, and the State Government via the Michigan Economic Development Corporation, the Michigan Manufacturing Technology Center (MMTC) works to provide training resources to Michigan's

manufacturers with fewer than 500 employees. (Mr. Clark described a few such programs to the Committee.)

As President of Globe Fire Sprinkler, Mr. Worthington provided the Committee with an assessment of worker-training challenges from an employer's perspective. He noted:

- Recruitment of highly skilled workers is easier for employers during periods of limited economic growth and more difficult when the economy is performing well.
- The greatest problem he generally faces is a lack of basic reading, writing, and math skills in his employees.
- A lack of sufficient remedy to the worker-training issue could severely limit the ability of Michigan, or the United States as a whole, to remain competitive in this age of technological innovation.
- As more and more manufacturing jobs are of the Computerized Numeric Control (C.N.C.) type, basic skills in computers and mathematics are becoming essential.
- Proximity of education centers and tuition costs pose the greatest barrier to workforce training.
- Tax incentives to small and medium sized companies for worker training would greatly help in addressing the lack of skilled workers.

4.3(q)—Satellite Data Management at NOAA

July 24, 2002

Hearing Volume No. 107–80

Background

The hearing examined satellite data management at the National Oceanic and Atmospheric Administration (NOAA). NOAA, through its line office, the National Environmental Satellite, Data and Information Service (NESDIS), procures and operates the Nation's environmental monitoring satellites, which provide raw data and processed data products to the National Weather Service and the Department of Defense for weather forecasting and prediction. NESDIS is also primarily responsible for the long-term archiving and managing of environmental satellite data from all NOAA satellites and for many of the research satellites flown by the National Aeronautical and Space Administration (NASA) for use by researchers and others.

The hearing focused on three major concerns: (1) NESDIS is not delivering all the weather satellite data products requested by the National Weather Service and the Department of Defense in a timely manner; (2) NESDIS is having great difficulty in maintaining, archiving, and distributing satellite data and data products for researchers primarily because of the tremendous increase in both the volume of data produced by currently deployed satellites and the demand for archived data during the past few years; and (3) NOAA is in the final planning stages for the new National Polar Orbiting Environmental Satellite System (NPOESS), which will cost $6.5 billion and produce hundreds of times more data and sub-

sequent information than today's satellites. The $6.5 billion NPOESS budget plan does not include funding or specific upgrades of NESDIS' satellite data management capabilities either for producing products used in real-time weather operations or for long-term archiving of data for retrieval by researchers.

Witnesses Included: (1) Vice Admiral Conrad C. Lautenbacher, Jr., Under Secretary for Oceans and Atmosphere, NOAA, Department of Commerce; (2) Ms. Linda D. Koontz, Director, Information Management Issues, General Accounting Office; and (3) Dr. Mark Abbott, Dean, College of Oceanic and Atmospheric Sciences, Oregon State University, and Chair, Committee on Earth Studies, National Research Council.

Summary of Hearing

Admiral Lautenbacher agreed with the assessment and concerns by Members of the Committee that there were significant problems with satellite data management that needed to be addressed.

- NOAA has asked Congress for budget increases in several satellite data management areas. However, Congress has not provided the modest increases, which has hampered attempts to deal with current problems.
- NPOESS is critical to the National Weather Service and the Department of Defense for weather prediction. This new satellite system will save the government money by having two satellites in orbit rather than the current four.
- NOAA is working hard to ensure that satellite data from NPOESS can be used starting on the first day of operation.

Ms. Koontz stated that her written testimony discusses the current NOAA polar satellite system, plans for the new system, and the key challenges that are faced by the four satellite data processing centers in managing the vast amounts of data that are going to be generated by the new system.

- The new polar satellite system will produce about ten times the data as the current system. The data processing centers must increase computing power, upgrade communication systems, and increase data storage capacity.
- The data centers cannot plan too far in the future because of the unforeseeable likely rapid changes in technology.
- The data centers had different opinions of what was specifically needed to plan for NPOESS. They had not yet examined how each center uses the data, or identified opportunities to leverage the expertise of the various centers.
- More should be done to better coordinate the activities of the centers to prepare for the NPOESS.

Dr. Abbott discussed the importance of satellite data to climate change research, and that it was critical for the NPOESS data to be managed in a way that fulfilled the needs of researchers.

- NPOESS will have more capable instruments and stable Earth orbits, which will provide a significant opportunity to advance climate research. However, data products that are

useful for weather prediction (operational needs), generally do not meet the needs of climate researchers.

- NOAA must appreciate and understand the differences and be willing to work with the research community to ensure the maximum use of NPOESS for climate research.
- NOAA must provide new services and functions that go beyond its current capabilities. And it must develop these new capabilities against the backdrop of significant increases in data volume.
- Interactions between NOAA and the climate research community up to this point have indicated that NOAA does not recognize the scope of the problem aside from the technical issues of storage, network bandwith, and computational requirements.

4.3(r)—H.R. 5395, Aquatic Invasive Species Research Act, and H.R. 5396, National Aquatic Invasive Species Act of 2002. (Joint hearing of the Subcommittee on Environment, Technology, and Standards, Committee on Science; and the Subcommittee on Fisheries Conservation, Wildlife, and Oceans, Committee on Resources.)

November 14, 2002

Hearing Volume No. 107–81

Background

The purpose of the joint hearing was to receive testimony on H.R. 5395, the *Aquatic Invasive Species Research Act,* introduced by Representative Vernon Ehlers, and H.R. 5396, the *National Aquatic Invasive Species Act of 2002,* introduced by Representative Wayne Gilchrest.

Witnesses included: Panel 1: (1) Mr. Steve Williams, Director, U.S. Fish and Wildlife Service; (2) Mr. Timothy R.E. Keeney, Deputy Assistant Secretary for Oceans and Atmosphere, National Oceanic and Atmospheric Administration and Co-chair of the Aquatic Nuisance Species Task Force; (3) Captain Michael W. Brown, Chief Office of Operating and Environmental Standards, U.S. Coast Guard; and (4) Dr. Gregory M. Ruiz, Senior Scientist, Smithsonian Environmental Research Center. Panel 2 witnesses included: (1) Dr. Gabriela Chavarria, Policy Director for Wildlife Management, National Wildlife Federation; (2) Ms. Allegra Cangelosi, Senior Policy Analyst, Northeast-Midwest Institute; (3) Dr. Roger Mann, Professor, Virginia Institute for Marine Science; and (4) Dr. Phyllis Windle, Senior Scientist, Union of Concerned Scientists.

Summary of Hearing

Mr. Williams began by stating that the introduction of invasive species has had a significant impact on our environment and that the Department of Interior supported the overall direction of the two bills.

Mr. Williams had some general comments about both pieces of legislation. He pointed out that the Fish and Wildlife Service was

concerned over some of the proposed deadlines in H.R. 5396 and also wanted to work with the Congressional staff on what he sees as regulatory gaps between the Lacey Act and some of the provisions of the proposed legislation. Mr. Williams reported that the Department of Interior was encouraged to see some emphasis on aquatic pathways other than ballast water contamination. He added that education and outreach continue to be critical elements in invasive species control efforts. He also testified in support of the research provisions of H.R. 5395, noting that efforts to deal with invasive species must be informed by research.

Mr. Keeney believes the two bills address gaps in the existing programs. He added that there is a need to develop an early detection and response mechanism and a need to systematically assess eradication technologies. Mr. Keeney was pleased that the bills did include education and research elements.

Mr. Keeney stated that some provisions of the bills, like those relating to ballast water technology development, are duplicative and overlap each other. He also agreed with Mr. Williams' testimony that the chronology for some of the activities in the legislation are inconsistent and that the 36 deadlines identified may prove problematic in their current form.

Finally, Mr. Keeney identified some of NOAA's concerns with the ballast water management and treatment requirements. He stated that voluntary guidelines with regional standards are burdensome to the shipping industry without a nationwide, mandatory standard.

Captain Brown began his testimony by supporting the reauthorization and amendment of the existing invasive species legislation, but expressed concerns similar to those of the Department of Interior and NOAA, specifically with regard to guidelines. He stated that the Coast Guard, with lead responsibility for protecting the marine environment, supports establishing a mandatory ballast water management regime.

Captain Brown added that the Coast Guard is currently working on trying to set up a scientifically supportable set of standards for ballast water discharge and wants to facilitate development of the testing and evaluation of experimental treatment programs. However, during the question and answer period he could not give a definitive time line of when the Coast Guard would actually implement the standards. He also noted that each of these efforts is being undertaken while working to have consistency with an international regulatory approach.

Dr. Ruiz began his testimony by outlining the difficulty in developing management strategies without more complete information about invasion ecology. He stated that there are gaps in the scientific data on dose-response relationships and that the gaps limit the predictive capability for both intentional and unintentional introductions. Dr. Ruiz emphasized the need for research to measure changes in species transfer and invasion patterns to understand and predict the most serious threats for invasive introductions, both intentional and unintentional.

Dr. Ruiz advocates two measures for addressing these problems. He sees the need for the development of an early detection system that would include a list of 'target' species that have the potential

for causing the most harm. What he believes would be more important, however, would be establishing a framework, consistent among geographical regions, which evaluates and approves intentional introductions.

Dr. Chavarria expressed National Wildlife Federation's support for the legislation and cited the organization's recent position statement on non-native species, which called for additional Federal and State legislation requiring the treatment of ballast water in ships entering the Great Lakes. She indicated that the proposed legislation will close some loopholes the NWF has identified in the existing regulations.

Dr. Chavarria continues to advocate prevention as the most environmentally sound and cost-effective management approach and sees rapid response contingency strategies, contained in the legislation, to be key in this effort. Dr. Chavarria's concerns with this legislation are that the Congress appropriate adequate funds and that programs to control non-native species be implemented in such a manner so that they are not harmful to natural ecosystems.

Ms. Cangelosi believes the most important part of the introduced legislation is the regulation of pathways through ballast water regulation. She thinks that an interim mandatory standard is important for establishing an effective final standard. Ms. Cangelosi addressed two concerns over using a 95 percent inactivation or removal of different species. The first concern is that 95 percent is not an effective measure, but she argued that this is more effective than the current ballast water exchange program and therefore suitable for an interim measure. Her second defense of the interim standard addressed the concern that a percent efficiency would be harder to enforce than a standard concentration or size cut-off. Ms. Cangelosi indicated that those concerns are valid and could be addressed during the interim period while still requiring a more enforceable size-based standard for purposes of regulation rather than statute.

Ms. Cangelosi pointed out that the use of interim and final standards with enforceable deadlines is similar to the methods used to implement air and water pollution control standards. She indicated the strength of this regulation is the establishment of a final standard based on best available technology based on periodic review that is economically achievable.

Dr. Mann testified about his experience as a federally-funded researcher and commented on the proposed modifications to ballast water management. He believes that the ultimate approach to ballast water final standards is not to establish percentage reductions, but to focus on developing technologies in the private sector that would be effective at eliminating invasive species from the ballast water. Dr. Mann also provided two suggestions for the proposed legislation: size ranges should be included for definitions of phytoplankton and algae and interim standards should be considered in reduction of absolute numbers of organisms within given size ranges.

Dr. Windle testified that the Union of Concerned Scientists (UCS) is encouraged to see this legislation for coordinating Federal and State responses to invasive species and supports the legislation's expanded authority. Dr. Windle indicated that Interagency

National Management Plan and other efforts by federal agencies are important, but that this legislation adds the necessary authority for enforcement that the concerned agencies need. She also cited GAO documentation and Union observations that certain federal agencies, such as the Coast Guard, have not responded to concerns in a timely manner.

Dr. Windle provided some additional thoughts on how the legislation could be enhanced. The UCS believes that eventually all introduced species will need to be screened and support this trend, believing that few exceptions should be made. Dr. Windle also supports replacing ballast water exchange with ballast water treatment as quickly as possible. Finally, the Union supports ongoing independent peer review analysis of government-funded research protocols and contracts.

4.4—SUBCOMMITTEE ON RESEARCH

4.4(a)—Life in the Subduction Zone: The Recent Nisqually Quake and Federal Efforts to Reduce Earthquake Hazards

March 21, 2001

Hearing Volume No. 107–2

Background

The purpose of the hearing was to examine the impact of the Nisqually earthquake that struck the Seattle area on February 28, 2001, and to discuss federal research efforts to mitigate the damage caused by earthquakes. Witnesses before the Committee included representatives from the U.S. Geological Survey (USGS) and the National Science Foundation (NSF)—two of the four participating agencies in the National Earthquake Hazards Reduction Program (NEHRP)—and two university researchers involved in seismic research. The witnesses were asked to address the following questions in their testimony: How significant were the effects of the Nisqually earthquake on the Puget Sound Region? How were these effects assessed? To what extent did buildings and land behave differently than expected in this earthquake? To what extent should codes, earthquake preparations and the research agenda be altered as a result? And, what is the current depth of our understanding about earthquakes in the Pacific Northwest and elsewhere, and where should we focus future research efforts?

The Subcommittee heard testimony from (1) Dr. John Filson, Coordinator of Earthquake Programs at USGS; (2) Dr. Priscilla Nelson, Director, Division of Civil and Mechanical Systems at NSF; (3) Dr. Steve Palmer, Washington Department of Natural Resources, Geology and Earth Resources Division; and (4) Dr. M. Meghan Miller, Professor of Geology, Central Washington University.

Summary of Hearing

Chairman Smith opened this hearing by welcoming members—both new and old—to the first Research Subcommittee hearing of the 107th Congress. He discussed some of his goals for the upcoming session, including reauthorization of the National Science Foundation.

Chairman Smith then described the details of the February 2001 Nisqually Earthquake, stating that it resulted in 410 injuries and $2 billion in damages. He gave an overview and history of the National Earthquake Hazards Reduction Program since its inception in 1977, and discussed how the hearing would attempt to uncover how NEHRP programs had an impact before, during, and after the Nisqually Earthquake. The Chairman noted that he was particu-

larly interested in learning about the new technologies—including more sensitive ground-based equipment and satellite-based sensors for monitoring fault movements—as well as efforts to provide real-time warnings or more accurate predictions of earthquakes.

Dr. Filson discussed the work that the Geological Survey carries out regarding earthquake monitoring, notification, and hazards assessment and presented data regarding seismic activity and shaking related to the Nisqually earthquake. Dr. Filson explained that:

- The Nisqually earthquake was the result of tectonic movement between the Juan de Fuca and North American plates in the Pacific Northwest. The Juan de Fuca plate extends from the Pacific Northwest coastline to an ocean ridge approximately 500 miles offshore and moves northeast at about 1.5 inches per year. As it moves, the Juan de Fuca plate collides with, and is overridden by, the North American Plate and the Juan de Fuca plate sinks into the Earth's mantle.
- This process of tectonic movement results in enormous strain, which is released during an earthquake event. The three types of earthquakes that could occur in the Pacific Northwest region include: 1) type 1—large earthquakes that occur at the contact between the two plates, the subduction zone; 2) type 2—deep earthquakes that occur internally within the plate as it bends and deforms while sinking into the mantle; 3) type 3—shallow earthquakes that occur along the North American plate as it overrides the Juan de Fuco plate during convergence.
- NEHRP has developed a predictive model of ground shaking during an earthquake for the entire U.S. and compares this model with data of actual shaking during earthquake events. Levels of shaking from the Nisqually earthquake—a 6.7 magnitude, type 2 event—did not exceed those predicted by the National assessment. The 33-mile depth of the earthquake reduced shaking at the Earth's surface and, therefore, caused less structural damage than superficial earthquakes of similar magnitude (such as the Northridge earthquake).
- The USGS has been studying the seismic potential of the Pacific Northwest for more than 20 years and has installed a seismic detection network to monitor events such as the Nisqually earthquake. Further, USGS has worked closely with the City of Seattle to identify earthquake and landslide hazards and to implement measures, including public awareness, to lessen their impacts. Building retrofitting in the Pacific Northwest may have diminished the damages caused by the Nisqually earthquake.

Dr. Nelson explained that earthquake events provide a wealth of knowledge relative to earthquake hazard mitigation and stated that:

- The National Science Foundation supports a number of individual researchers, consortia, and research centers that participate in earthquake reconnaissance activities and post-earthquake research, five of which were involved in the Nisqually response effort along with FEMA (Federal Emer-

gency Management Agency) and USGS (United States Geological Survey).

- Nonstructural damage was the major impact of the Nisqually earthquake, with only unreinforced masonry buildings on poor soils suffering significant structural damage.
- Data collected during and following the Nisqually event will allow scientists to evaluate the impact of soil type on performance during an earthquake.
- NSF is supporting work in the area of performance-based earthquake engineering to study pre-collapse performance of buildings and to correlate performance expectations with investment in building construction or retrofitting.

Dr. Palmer highlighted the findings of previous liquefaction hazard studies in the Puget Sound and presented some of the early findings regarding soil liquefaction during the Nisqually earthquake, noting that:

- The Nisqually earthquake was very near the location of the 1949 Olympia quake—a 7.1 magnitude, type 2 event—so a comparative study of damages is informative.
- During the Nisqually event, the greatest damages occurred in Olympia and Seattle, primarily in areas where liquefaction (the process by which water-saturated soils experience increased particle movement during an earthquake) resulted in reduced soil strength and stiffness. These damages were consistent with past performance during the 1949 earthquake and with predicted liquefaction hazard areas reported by NEHRP.
- Liquefaction was most severe along Deshutes Parkway and at the north end of the runway at Boeing Field, a designated high-hazard area. Damage in the port area of Seattle was widespread, but minimized because of geotechnical engineering of new construction projects completed in the last few decades.
- There were surprises with this earthquake, namely the significant damage at SeaTac Airport where peak ground acceleration was well below the limits of current structural design code in western Washington. Another surprise was the lack of liquefaction in the Payallup Valley where numerous occurrences were observed during the 1949 earthquake. Both of these areas are the site of further investigation and research.
- Damages could have been much greater if the ground shaking had been stronger, lasted longer, or occurred when the ground was much more saturated.

Dr. Miller testified about advanced seismic monitoring, risk assessment and planning in Puget Sound and stated that:

- The co-seismic deformation (the change in the position of the ground after the earthquake fault has split) following the Nisqually earthquake was observed using continuous Global Positioning System (GPS) geodesy. This data, and that collected following other seismic events, will help scientists bet-

ter understand the physics of earthquakes and how the earth responds to seismic events.

- GPS geodesy has shown that approximately 5 mm of shortening occurs each year across the Olympic Mountains and Puget Sound. This movement will ultimately be released through earthquakes and related processes and could result in the rupture of the east-west Seattle fault in an earthquake larger than a magnitude 7.5 event. Such an earthquake, because of its proximity to an urban corridor, could rival or exceed the Northridge earthquake in terms of damage and casualties.
- A denser distribution of GPS stations in the Puget Lowlands will help researchers determine which faults pose seismic hazard and could positively impact zoning and building code development, mitigation strategies, community preparedness, and response planning. Central Washington University is currently contributing toward the GPS monitoring in Puget Lowlands as a result of NSF support and partnership with USGS, Southern California Earthquake Center and the University NAVSTAR Consortium.
- The Earthscope Initiative, a project currently approved by the National Science Board and waiting congressional support, would expand the capacity of GPS observations and systematic accounting of seismic hazard in the U.S. This Initiative involves a number of federal agencies including NSF, NASA, USGS, DOE, and also has international partnerships with Canada and Mexico.

4.4(b)—Improving Math and Science Education So That No Child Is Left Behind

May 2, 2001

Hearing Volume No. 107–27

Background

In his plan for reforming K–12 education in the United States, *No Child Left Behind,* President Bush laid out a comprehensive agenda for improving the Nation's K–12 schools. Included in his package of proposed reforms was a call for partnerships between institutions of higher education and K–12 schools aimed at strengthening the quality of math and science instruction in elementary and secondary schools. Types of partnership activities addressed in *No Child Left Behind* include: making math and science curricula more rigorous, improving teacher professional development in math and science, attracting more math and science majors to teaching, and aligning high school math and science standards to college performance expectations. In the President's initial budget request, *A Blueprint for New Beginnings,* President Bush charged the National Science Foundation with the responsibility for undertaking this initiative.

The Subcommittee heard testimony from (1) Dr. Phil Sadler, Director of the Science Education Department at the Harvard-Smithsonian Center for Astrophysics; (2) Mr. David Garner, Executive

Administrator of the Urban Systemic Program, Oklahoma City Public Schools; (3) Dr. Carlo Parravano, Director, Merck Institute for Science Education; and (4) Dr. Eugene Shaffer, Chair of the Education Department at the University of Maryland Baltimore County.

Summary of Hearing

Chairman Smith opened this hearing by noting that many of our efforts at improving K–12 math and science education have been ineffective, and that U.S. students generally fall in the middle of the pack compared with students of other countries. The President's plan to improve education, No Child Left Behind, and certainly the math and science partnership initiative, highlights the importance of partnerships between K through 12 schools and institutions of higher education in leading the math and science education reform effort. As part of that plan the President charged the National Science Foundation with the responsibility of implementing and managing a Math and Science Partnership Initiative.

Chairman Smith stated that the hearing would serve to examine the role of various kinds of partnerships in education reform by hearing from those that have experience in this area and can be of great help as we try to formulate how we best move ahead in this venture to improve math and science education. He noted that he hoped the discussion would provide details and directions regarding some of the key elements pivotal to the successes, as well as danger spots that we might encounter. Through our exploration in these efforts perhaps we will better understand what works and how best to make it more broadly applicable across the United States.

Dr. Sadler talked about the projects that the Harvard-Smithsonian Center for Astrophysics is working on and noted that:

- The Harvard-Smithsonian Center for Astrophysics supports a 45-member Science Education Department that has been described as a model for partnership activities between teachers and scientists. The Center brings together scientists and teachers to produce curricular materials based on discovery activities, and to develop new kinds of standardized tests for students in grades 4–12.
- The key components of a successful educational program at a large research institution include: institutional leadership dedicated to improving K–12 science education; high standards and activities subjected to rigorous evaluation; and the involvement of expert scientists and engineers, teachers, world-class researchers, graduate students, and post-doctoral fellows.
- There are significant barriers for scientists and mathematicians who wish to be engaged in K–12 outreach, namely, the lack of consideration of K–12 work as part of the university professor's professional contribution, the disparity between university concerns and the practical problems of society, a tenure system that is not focused on solving practical problems, and the fact that teaching is seen as an art.

- Schools of education have strongly resisted the move to National standards, National assessment and accountability. Well-controlled educational studies using quantitative measures appeal to scientists and engineers who can help guide this work because controlled research studies are "at home" in a scientific research center.
- NASA funding has helped to engage some research scientists in educational activities and has helped researchers find a path to combine their science activities with educational outreach.

Dr. Schaffer discussed the University of Maryland Baltimore County and some of its program attributes, including:

- There are no undergraduate education majors at UMBC. Rather, UMBC requires all teacher education graduates to obtain a degree in the subject area to be taught in addition to taking post-baccalaureate courses in education and participating in on-going field experiences.
- In order to recruit more people to careers in teaching, UMBC has an active outreach program to high schools and community colleges that allows students at these institutions to move rapidly and easily through joint admission programs and course transfer options.
- UMBC has created partnerships between the university and local K–12 schools that serve teachers in training, provide professional development opportunities for current teachers and administrators, and provide a forum for on-going research activities.
- There is also an Urban Teacher Education Program at UMBC that focuses on recruitment and training of individuals dedicated to teaching in urban settings. This post-baccalaureate program provides future teachers with training in content as well as the use of integrated materials in the classroom. Students in this program receive tuition, salary or stipends in addition to free books and computers—this financial "package" helps working adults transition to careers in teaching.
- It is imperative to provide mentoring support for new teachers in the area of content delivery; therefore, schools should provide content experts to serve as mentors for new teachers, especially those in their second and third year of teaching when they are more comfortable with classroom management and become more focused on content delivery issues.
- Although collaborations are costly, time-consuming, and difficult to manage, they are very worthwhile and the sum value of a collaborative effort is greater than that of the parts for both teachers and children.

Mr. Garner stated that teacher preparation programs must be analyzed and reformed and noted that:

- The Oklahoma City Public Schools have benefited from participation in the NSF-funded Oklahoma Teacher Education Collaborative (OTEC) that has developed innovative recruit-

ment strategies, reformed undergraduate curriculum for teacher preparation, and increased support of new teachers during their initial years in the classroom.

- The OTEC program has had a positive impact on coursework offered through the School of Math and Science at the University of Central Oklahoma (UCO) in that teacher's are now provided with a more content-rich undergraduate experience.
- However, the OTEC program has not had an impact on the School of Education at UCO which continues to graduate teachers unprepared for the demands of teaching in an urban setting.
- The greatest barrier to effective partnerships between K–12 teachers and their university colleagues is the lack of time. For reform to be comprehensive and effective, teacher training programs must provide significantly more field experience and teachers must be given ample opportunities and time to pursue continuing professional development. Inadequate support and non-systemic reform efforts are the norm in public education.

Dr. Parravano noted that the Merck Institution for Science Education has been successful in leading systemic reform in four New Jersey public school districts and one Pennsylvania district. Merck recommends the following steps for developing effective business-to-school partnerships, including:

- Partner with districts that are willing to use a systemic approach to make science an instructional priority.
- Develop high-quality instructional materials and then provide them at considerable scale engaging high proportions of teachers to participate.
- Involve a critical mass of teachers at each institution and the changing practices of these teachers will have a positive impact on all teachers at the institution.
- Be cautious about using team leaders to stimulate instructional change within a school—this model has had mixed success and is highly dependent on the support of the principal and careful selection of leader teachers.
- Use the corporate assessment model to measure results continuously and modify the program according to those results.

4.4(c)—Classrooms as Laboratories: The Science of Learning Meets the Practice of Teaching

May 10, 2001

Hearing Volume No. 107–7

Background

The purpose of the hearing was to examine the gap that currently exists between what is known about how people learn and the methods and materials educators use to teach. The fields of cognitive science and neuroscience have grown markedly due to an expanding repertoire of tools that enable researchers to understand

how humans process, store and utilize information, yet educational materials and practices are rarely aligned to this knowledge. The Subcommittee considered recent reports from the National Academy of Sciences, including *How People Learn: Bridging Research and Practice and Improving Student Learning,* to better understand the recommendations for incorporating research into classroom practice. The hearing helped the Subcommittee refine ideas that are likely to be part of education legislation later this month.

Testifying at this hearing were: (1) Dr. Diane Halpern, Professor of Psychology, California State University at San Bernardino; (2) Dr. Jose Mestre, Professor of Theoretical Nuclear Physics and Cognitive Science, University of Massachusetts at Amherst; (3) Dr. Nancy Songer, Professor of Education, University of Michigan; and (4) Dr. Chirs Dede, Professor of Learning Technologies and Education, Harvard University.

Summary of Hearing

Dr. Halpern discussed cognitive science and noted the following:

- There is considerable knowledge about powerful learning strategies that can be used to promote long-term retention and transfer that is not being applied in classrooms.
- The understanding of scientific principles among the general public is very low.
- It is important to redesign education to teach for transfer and long-term retention and to help students handle challenging courses and subject matter.
- There is a critical need for research on instructional programs that can be scaled up to include large student samples at multiple sites.

Dr. Mestre discussed how the science of learning can be applied to improve students' learning and noted the following:

- Little is known about the following aspects of learning: knowledge transfer, pedagogical content knowledge, and assessment.
- Current practices for training pre-service and in-service teachers are in need of major revision to eliminate the mismatch between how teachers are taught and how we expect them to teach.
- Science Ph.D.s should be taught about learners' cognitive development or pedagogy so that they can more effectively teach science to others.
- To solve the problems in education today, we need to draw on the expertise and research methodologies of several disciplines and increase funding for further research.

Dr. Songer suggested four necessary steps to facilitate the impact of learning research in the classroom:

- Form very specific kinds of long-term partnerships to implement the education reform agenda.
- Develop more educational programs that are based on learning research.

- Solicit long-term commitment from school administrators, educational researchers, teachers, and funding agencies because effective reform requires effort for longer duration than the typical funding cycle.
- Assess pedagogical models for impact on a variety of children and in an array of educational settings to determine which practices are best for children based on factors such as learning style and learning environment.

Dr. Dede discussed learning technologies research and noted the following:

- In a knowledge-based economy, all students need to master higher-order cognitive, affective and social skills, including rapid decision-making, troubleshooting, the ability to collaborate, and the ability to find relevant information within a sea of quasi-accurate information.
- Centers should be created to perform research in real-world implementation of information technology to education. These Centers should be problem-focused such that research findings can be easily translated to educational practice.
- Learning technologies are worth the time, effort and resources required for widespread implementation only when they are used appropriately. "Technology is not a vitamin whose mere presence in schools and teacher preparation programs catalyzes better educational outcomes."

4.4(d)—NSF FY02 Request: Research and Related Activities

June 6, 2001

Hearing Volume No. 107–16

Background

This hearing was on the National Science Foundation's Fiscal Year 2002 Research and Related Activities Budget Request. In addition to the budget overview, the Subcommittee heard testimony on the process by which NSF establishes programmatic and budget priorities as exemplified by the Plant Genome Research Program (PGR) and Project 2010, two plant biology programs funded out of NSF's Biology Directorate. Testifying before the Committee was a representative of NSF and two research scientists who are principal investigators of Plant Genome research projects and who also serve on various oversight and advisory committees for the Biology Directorate.

The Subcommittee heard from: (1) Dr. Joseph Bordogna, Deputy Director of the National Science Foundation; (2) Dr. Mary Clutter, Assistant Director of Biological Sciences, NSF; (3) Dr. Vickie Chandler, Professor of Plant Sciences and Molecular and Cellular Biology at the University of Arizona and currently a co-Principal Investigator on an NSF-funded Plant Genome Research Virtual Center project; and (4) Dr. Daphne Preuss, Assistant Professor of Molecular Genetics and Cell Biology at the University of Chicago, and

former Chair of the NSF–DOE–USDA Arabadopsis Genome Oversight Committee.

Summary of Hearing

Dr. Bordogna discussed NSF's process for setting agency investment priorities and noted that:

- A number of factors are considered when setting research priorities including: scientific readiness, technical feasibility, response to National needs, affordability, performance goals and results, international benchmarks, and balance with existing programs of NSF and other agencies.
- NSF staff and management personnel and the National Science Board work together to determine final research priorities.
- There are two major integrative strategies in implementing NSF's budget: strengthening core activities and emphasizing areas of intellectual capital.
- NSF seeks to maintain an integrated portfolio that makes the wisest investments in the most promising fields.

Dr. Clutter provided an overview of the Plant Genome Research Program and Project 2010 as case-study examples of the budgeting process.

- The Plant Genome Research Program supports research in an area of science unique to the NSF by proving funding for research that is not supported by any other agencies.
- The Plant Genome Research Program, initiated in 1998, allowed for the accelerated sequencing of the genome of *Arabidopsis,* a model plant. The sequencing of *Arabidopsis,* in many ways, is as important as the Human Genome Project because it provides a starting point for better understanding the genetic make-up of plants.
- Project 2010 builds upon the Plant Genome program because Project 2010 will allow scientists to determine the function of all of the *Arabidopsis* genes identified through the sequencing project.

Dr. Chandler stated the following concerning NSF funding:

- NSF determines its research priorities by extensive consultation with scientists through its Advisory Boards, special workshops, and scientific meetings. The impetus for new programs and initiatives most often comes from the scientific community.
- Through its continued investment in core research and education activities and through its special priorities, NSF has been a leader in helping to create the exciting research environment we are experiencing today. Core research grants provided by NSF to individual researchers are the foundation for conducting scientific research in our country and are a major reason that the U.S. has a competitive edge in many research areas.
- The NSF-sponsored Plant Genome Program has opened up the world of plant genomics and has led to significant ad-

vances in the way plant research is conducted. Unlocking the mystery of plant genomes will advance research related to food production, pharmaceuticals, energy production, and the environment.

Dr. Preuss stated the following concerning NSF funding and plant biotechnology research:

- NSF's support for basic science has had an enormously positive impact on science.
- NSF played a leading role in the international *Arabidopsis* Genome Sequencing Project, setting the early standards for technical methods and public data release, providing 51 percent of the funding for this effort, and facilitating the early completion of this project.
- NSF's continued investment in basic science is enormously important in that leading researchers are trained by these funds, cutting edge science has been supported, and innovative programs have been established that drive science forward.
- Without micromanaging, NSF staff inspire, motivate and enable scientists to do great work.

4.4(e)—Reinventing the Internet: Promoting Innovation in IT

June 26, 2001

Hearing Volume No. 107–38

Background

The hearing addressed the role of the Federal Government in promoting innovation in information technology. The hearing focused on:

- The need for federal investments in fundamental research in IT;
- The effects of those investments on the Nation's economy, workforce, and scientific enterprise;
- The state of current federal programs in IT research and development (R&D), as established by past legislation, including the High-Performance Computing Act of 1991 and the Next Generation Internet Research Act of 1998; and
- The need for congressional action to update the authorization legislation of the current and future coordinated activities of federal agencies in IT R&D.

The Subcommittee heard from: (1) Dr. Eric Benhamou, Chairman and CEO, 3Com Corporation, and member of the President's Information Technology Advisory Committee (PITAC); (2) Dr. Anita Jones, Professor of Engineering and Applied Science, Department of Computer Science, University of Virginia; (3) Mr. Alfred R. Berkeley, III, Vice Chairman of the Board of Directors and former President, The Nasdaq Stock Market, Inc.; and (4) Ms. Cita M. Furlani, Director, National Coordination Office for Information Technology Research and Development.

Summary of Hearing

Chairman Smith opened this hearing by noting that IT is an integral part of our daily lives and a driving force in the global economy. Fast, capable computers and far-reaching networks enable instantaneous communications worldwide, access to unimaginable volumes of information, and enough computational power to make American business and industry more efficient and productive. He noted that Alan Greenspan, Chairman of the Federal Reserve, has said that he believes that the remarkable performance of the U.S. economy is due to "the resurgence of productivity growth" which he credits to the revolution in information technology.

He described the history of federal support for IT research and development dating back to the World War II era when the first digital electronic computer was developed and the Federal Government's overall investment in computing was less than $20 million a year. Since then, the Federal Government's investment in computing and the underlying disciplines—mathematics, engineering, physics—has been significant. Today, multi-agency programs such as the President's Information Technology Advisory Committee (PITAC) have been developed to coordinate the federal effort in this area. Chairman Smith also stated that he hoped the witness would provide recommendations for authorization levels and broad policy guidance for a multi-agency IT R&D program, including what specific areas of research should be given high priority.

Dr. Jones discussed the importance of government funded information technology research and noted:

- Today's favorable economy is to a great extent enabled by research in information technology.
- NSF has not been able to acquire the most capable high-end computers for research, which limits university research.
- The annual government competition for high-end computing is inefficient.
- Computer science departments are having difficulties maintaining their current faculty size due to insufficient funding for research.

Mr. Benhamou discussed the following concerning the IT industry and federal funding for R&D:

- Several key sectors of the IT industry owe their existence to basic research funded by the Federal Government in the 1960's and 70's.
- The natural rewards and incentives that shape the IT industry has made it very short-term focused.
- Long-term IT research is necessary to continue the flow of ideas that have fueled the information revolution.
- There are four specific areas that need increases in funding: software, scaleable information infrastructures, high-end computing, and the related socioeconomic impacts.

Mr. Berkeley discussed the following concerning the IT industry and federal funding for IT R&D:

- Venture capital partnerships do not have the time to conduct long-term, basic research that leads to commercial products.
- With deregulation and globalization, corporations are forced to seek short-term returns and are not able to conduct long-term research.
- Only government can take a longer-term perspective, but federal investment is slowing and needs to be increased.
- Better education in math and science is needed.
- Strong intellectual property laws are needed to protect and promote innovation.
- Easing technology transfer from government-funded research to commercial application is necessary.

Ms. Furlani discussed the Networking and Information Technology Research and Development effort (NITRD) and made the following points:

- Federal support for IT R&D helped to launch the IT revolution some 50 years ago.
- Congress's original framework for IT R&D has evolved into a very productive research enterprise.
- The NITRD effort does not suffer from structural weaknesses.
- NITRD faces the problems of undertaking the necessary R&D to tackle IT problems at scale and working with other federal agencies on their IT problems.

4.4(f)—Ocean Exploration and Coastal and Ocean Observing Systems. (Joint Hearing of the Subcommittee on Research, the Subcommittee on Environment, Technology, and Standards, Committee on Science; and the Subcommittee on Fisheries Conservation, Wildlife and Oceans, Committee on Resources.)

July 12, 2001

Hearing Volume No. 107–26

Background

The purpose of the joint hearing was to receive testimony on federal interagency cooperation on ocean research and particularly on the progress of, and plans for, the implementation of an integrated and sustained ocean observing system. This hearing also examined the need to coordinate the rapidly proliferating coastal observing systems and review the Report of the President's Panel on Ocean Exploration and the implementations of that report's recommendations.

The Committees heard from: (1) Mr. Scott B. Gudes, Acting Undersecretary for Oceans and Atmosphere of the Dept. of Commerce; (2) Dr. Rita R. Colwell, Director of the National Science Foundation; (3) Rear Admiral Jay M. Cohen, Chief of the Office of Naval Research of the U.S. Navy; (4) Vice Admiral Conrad Lautenbacher, Jr., President of Consortium for Oceanographic Research & Edu-

cation; (5) Dr. Marcia McNutt, President and Chief Executive Officer of Monterey Bay Aquarium Research Institute; (6) Dr. Robert Ballard, President of the Institute for Exploration; (7) Dr. Robert A. Weller, Director of Cooperative Institute for Climate and Ocean Research, Woods Hole Oceanographic Institution; (8) Dr. J. Frederick Grassle, Director of the Institute of Marine and Coastal Sciences, Rutgers University; (9) Dr. Alfred M. Beeton, Senior Science Advisor, National Oceanic and Atmospheric Administration; and (10) Dr. Alexander Malahoff, Director of the Hawaii Undersea Research Laboratory at the University of Hawaii.

Summary of Hearing

Environment, Technology, and Standards Subcommittee Chairman Vernon Ehlers opened the hearing by stating that improved cooperation and coordination among federal agencies, Congressional Committees, and the research community is needed for a more effective ocean research program. Due to limited financial resources, these groups need to agree on specific priorities to achieve goals.

Mr. Gudes testified on ocean exploration, ocean observations, coastal observations, and the role of the National Oceanic and Atmospheric Administration (NOAA). He noted that:

- The President's budget includes $170 million for NOAA to conduct ocean research in fiscal year 2002.
- In 2000, a panel of marine scientists and explorers were convened to review U.S. efforts in ocean exploration. It recommended that the U.S. establish a national program of ocean exploration and discovery.
- He discussed ocean exploration's role in the discovery of new species, our understanding of geological phenomena, etc.
- There are fewer ocean-based measurement systems than there are land-based.
- The National Ocean Partnership Program is an excellent mechanism for coordinating oceans activities across agencies.
- It is important, especially on the West Coast, for tsunami warning devices to be improved.

Dr. Colwell testified that the National Science Foundation (NSF) has a proud history of supporting basic research and education in the ocean sciences. It has a "broad, encompassing role that advances the frontiers of discovery and seeks to engage the public." Dr. Colwell showed footage taken from the submersible ALVIN two miles below sea level, and noted that:

- The NSF accounts for less than four percent of the total federal research and development budget, yet provides about 70 percent of federal funding to academic institutions for ocean research.
- More than 95 percent of the world's oceans remain unexplored.
- The NSF is working with the academic community and federal agencies to provide a new infrastructure to gain access to the oceans and to facilitate the collection of time series

data. This will help improve our understanding of the basic biology, chemistry, geology, and physics of oceans.

Admiral Cohen discussed the importance of ocean exploration, and strongly supports efforts to develop and implement an integrated and sustained national ocean observing system. He noted that:

- Oceans cover 70 percent of the Earth's surface, and are constantly changing.
- Oceans are the Navy's operating environment. The Navy must continually collect and monitor data from all the world's oceans in order to ensure the safety of its fleet.

Admiral Lautenbacher represented the Consortium for Oceanographic Research and Education (CORE), a consortium of 64 premier oceanographic institutions. He noted that:

- Ocean exploration and ocean observing are equally important, and we should emphasize the value we get from each approach to ocean research.
- Now is the time for researchers to work together in a coordinated effort to advance ocean research. The technology available today is such that we can do things that were only dreamed about several years ago.
- Sustained time series data from coastal areas and around the world in addition to the cooperation and coordination of federal agencies are needed to answer pressing questions on environmental management.
- The National Oceanographic Partnership Act successfully established a super-agency mechanism to support and finance ocean exploration and observation.

Dr. McNutt re-emphasized the importance of ocean exploration. She strongly supports further research to learn more about this largely unexplored area. She noted that:

- The ocean is earth's largest living space, containing 80 percent of all phyla. Most photosynthesis occurs there, it keeps earth habitable, and it processes our waste. It also provides an inexpensive source of protein to feed our population.
- The Monterey Bay Aquarium Research Institute is currently considering direct sequestration of carbon dioxide into the ocean 3 kilometers below the surface to mitigate global warming. However, it is having difficulty assessing the potential biological impact of such activity because so little is known about the organisms at that depth.
- In order to know the right scientific questions to ask of ocean models and predictions, the U.S. needs to further explore the ocean.
- Ocean exploration is defined as the systematic observation of all facets of the ocean in the three dimensions of space and the fourth dimension of time. Ocean exploration leads to unpredictable rewards; possibilities include cures for diseases, discovery of untapped mineral, energy, and biological re-

sources, insights into ocean system functions, and beautiful geological and biological vistas.

- Many countries, including Ireland, Japan, France and Russia, are much more advanced in their ocean exploration tools and programs than the U.S.
- Stakeholders such as federal laboratories, businesses, universities, educators, conservationists, students and relevant federal agencies should be involved in ocean exploration. The activities of these groups need to be coordinated through an effective management structure, which could potentially be the National Ocean Partnership Program.
- Ocean exploration programs will be most effective and systematic with built-in mechanisms for educational outreach and information dissemination. Exploration would begin with reconnaissance mapping of the sea floor and water column.
- Detailed exploration should be done by a state of the art flagship equipped with new generation submersible technology and high bandwidth satellite communication to bring real-time discoveries to aquaria, schools, homes and offices over the Internet.

Mr. Ballard believes that oceans are our last unexplored frontier and that we need to develop a blueprint for future exploration. He noted that:

- There is no major ocean exploration program in the U.S.
- Ocean exploration can lead to great discoveries with the help of newer technologies such as autonomous underwater vehicles.
- The future of sea farming will involve a shift from people as hunters and gatherers of the sea to shepherds of the sea.
- The natural beauty and cultural heritage of the oceans need to be preserved for future generations by expanding existing sanctuaries such as The National Marine Sanctuary. Public access is necessary to gain the public support needed for long-term protection.

Dr. Weller gave a brief recount of his time in the Pacific Ocean during the onset of the 1997 El Niño. He noted that:

- Oceanic measuring devises deployed by the National Science Foundation and international partners enabled early detection and warning of the 1997 El Niño, which gave people around the world time to prepare for its effects.
- In 1999 the value of these early El Niño warnings was estimated at $300 million for the agricultural sector, and $1 billion for all U.S. sectors combined. The payoff is huge considering that the U.S. puts only $12 million into the El Niño observing system annually.
- The ocean system across the globe is interconnected; as such, research activities need to be globally focused.

- The tools used to measure oceanic changes, like buoys and moorings, are available. We just need to get more of them out there.

Dr. Grassle focused on the need for a national network of linked and coordinated ocean observing systems, and on recommendations for how such a network should be established. He supports ocean exploration and the census of marine life programs and has suggestions for their advancement. He noted that:

- An integrated national network of coastal ocean observing systems needs to be developed. More than half of Americans live in coastal zones, more than 95 percent of the Nation's foreign trade moves by sea, the fishing industry and other industries rely on ocean, and our understanding of it influences all of these activities.
- A sustained network of linked and coordinated regional ocean observing systems will provide a new way of looking at, working in, and understanding the ocean.
- The growing community of users of ocean information needs a modeling and measurement system that has the ability to continuously map surface current flows and obtain data from satellite observations, buoys, and autonomous gliders.
- Intensive observatory facilities operated by scientists from all disciplines are needed to conduct long-term experiments, sustain long time series observations, and test new ideas and equipment.
- The National Science Foundation and the Office of Naval Research have played major roles in the development of the LEO observatory, and should continue to play a leading role in the development of intensive observatory technologies.
- The National Ocean Research Leadership Council and National Oceanographic Partnership Program should be responsible for coordinating a national ocean observing system and approving standards and protocols for administering the system.

Dr. Beeton testified on ocean exploration in the context of the Great Lakes. He noted that:

- The Science Advisory Board is the only federal committee whose responsibility it is to advise the Undersecretary of Commerce for Oceans and Atmosphere on long- and short-term strategies for research, education, and application of science to resource management.
- Coastal and ocean observations are necessary to predict events that effect commerce and life and to minimize financial and personal loss.
- Ocean exploration activity should include geophysical surveys to update bathymetric charts for navigation, fisheries, and recreation.
- We need long-term monitoring to detect subtle changes in the Great Lakes ecosystems, make more coherent assessments of long- and short-term impacts, and understand coastal water quality's influence on public health.

Mr. Malahoff stressed that the oceans are an essential resource for the U.S., in addition to being our frontline against adversaries. He noted that:

- Oceans provide us with food, energy, and resources for a range of new industries specializing in marine byproducts and their uses.
- NOAA's creation of the Office of Ocean Exploration is a catalyst that will enable the U.S. to lead the development of a holistic understanding of the world's oceans.
- Grass roots partnerships are key to improving ocean exploration.
- Core programs such as NOAA's National Undersea Research Program, along with programs at the Department of Defense, the National Science Foundation, and The Environmental Protection Agency, need to be supported in order to accomplish the objectives of ocean exploration.

4.4(g)—Innovation in Information Technology: Beyond Faster Computers and Higher Bandwidth

July 31, 2001

Hearing Volume No. 107–18

Background

The hearing examined the impact federal investment has had on promoting innovation in information technology and fostering a variety of sophisticated applications that infuse information technology into areas such as education, scientific research, and delivery of public services. The hearing also examined the limits of current technology and highlighted research questions and technological applications that require additional investment.

The Subcommittee heard from: (1) Dr. Ruzena Bajcsy, Chair of the Interagency Working Group and Assistant Director, NSF, Computer and Information Science and Engineering; (2) Dr. Hans-Werner Braun, a Research Scientist at the San Diego Supercomputing Center; (3) Dr. Helen Berman, Director of the Protein Data Bank and Board of Governors Professor of Chemistry at Rutgers, The State University of New Jersey; (4) Ms. Carol Wideman, CEO and founder of Vcom3D; and (5) Mr. Bill Blake, Vice-President for High-Performance Technical Computing at Compaq Computer Corporation.

Summary of Hearing

Chairman Smith opened this hearing by noting that this was the second hearing on information technology that the Research Subcommittee has held, and that while the first hearing examined the federal information technology oversight structure, the second hearing would focus more on the National Science Foundation's role in helping prioritize federal IT R&D efforts.

Chairman Smith went on to describe the Information Technology Research Program (ITR) and how it works to coordinate funding across disciplines and agencies to achieve the best use of taxpayer money. He discussed how new research in wireless, high-quality

Internet connections is allowing children in the most remote rural locations of our country to have real-time access to today's leading research and how IT is enabling communities struck by disaster to coordinate relief efforts when phone and fiberoptic networks are down. He stated that he hoped the witness testimony and discussion would help members to analyze past mistakes government has made in politicizing support of IT research.

Dr. Bajcsy discussed the National Science Foundation's Information Technology Research (ITR) program and noted that:

- In order to respond to the need for continuing rapid advancements in Information Technology (IT), and in response to the 1999 recommendations of the President's Information Technology Advisory Committee (PITAC), NSF took the lead in the Federal IT R&D Initiative and established the ITR program. The ITR program supports research in a variety of IT-related areas and also facilitates the acquisition of high-end equipment such as terascale computers.
- Through the ITR program—a cross-cutting agency-wide program—NSF encourages proposals for basic, long-term, high-end, risky projects. These proposals are evaluated by a coordinating committee of NSF program officers from the Computer and Information Science and Engineering Directorate as well as other NSF directorates.
- The NSF hopes that much of the targeted research it supports will have an eventual trickle-down effect, resulting in useful technologies for the general public. In the short-term, however, NSF is now facing the problem of monitoring and evaluating the progress and success of these long-term projects.
- In the future, ITR will focus on enhancing cyber infrastructure such as high-performance computers and broadband connectivity and on advancing interdisciplinary IT-enabled research such as computer modeling and simulation, sensory networks, and improved user interfaces.

Mr. Braun discussed his High-Performance Wireless Research and Education Network (HPWREN) and noted that:

- Government support for Information Technology projects was key for driving the Internet evolution. The NSF supported NSFNET provided an Internet backbone at the threshold between the original government communications network and the commercialized Internet.
- Access to high-performance Internet systems is not ubiquitous, especially in rural areas. The Federal Government has an obligation to support a national network that meets demanding performance requirements even in less populated areas.
- HPWREN is a project that aims to demonstrate ways in which a high-performance network can be created and used for network applications in remote communities. This network is utilized by a number of people and organizations including emergency crisis management and first responder professionals.

- Schools in remote communities also need access to high-performance networks; HPWREN has linked to several rural American and Native American schools to facilitate enhanced instruction and communication between practicing scientists and children who attend schools in remote locations.

Dr. Berman discussed the Protein Data Bank (PDB) and the Nucleic Acid Database she directs and noted that:

- The PDB was started in 1971 at Brookhaven National Laboratory with distributions sites in Cambridge, England. At that time there were less than a dozen protein structures in the database, which now holds over 1600 structures.
- The growth in both number and complexity of information contained in the PDB is the result of tremendous advances in protein chemistry research, crystallization techniques, robotics, imaging, and high-performance computing.
- Every day 100,000 structure files are downloaded and used by scientists in academia, government and industry to plan new experiments, analyze results, and even discover new drugs.
- PDB is managed by a consortium of three institutions: Rutgers, The State University of New Jersey; San Diego Supercomputer Center, University of California, San Diego; and the National Institute of Standards and Technology. Three agencies fund the PDB including the NSF, the National Institutes of Health (NIH) and the Department of Energy. For the PDB to continue as a successful international resource, a more streamlined and reliable funding mechanism must be implemented.

Ms. Wideman discussed the importance of the Federal Government's investment in information technology research and its value to the United States Economy and noted that:

- While fast computers and high bandwidth connections are of great importance, it is the development of software technologies and online applications that make these computers and Internet connections valuable to American citizens.
- Because deaf and hard-of-hearing children experience delayed acquisition of language skills, these children suffer from many missed opportunities in their early development of key communication, collaboration, and knowledge-building skills. The SigningAvatar software developed by Ms. Wideman's company converts English text to real-time, 3–D graphic representations of sign language so that deaf children learn to communicate earlier.
- The SigningAvatar technology is revolutionary in that it is available over the Internet, can be used to link words in complete sentences, and allows new signs for specialty terms to be developed and entered into a user's computer sign vocabulary.
- Beyond the hearing-impaired community, the basic technology of SigningAvatar will also serve the broad educational

community by providing life-like computer-generated characters who motivate learners by engaging them in goal oriented behaviors, role-playing simulations, and mentoring opportunities.

Dr. Blake discussed trends in supercomputing over the past ten to twenty years and noted that:

- In the early days of supercomputing, the focus was on taking a single processor and making it process information as fast as possible. A later approach was to take hundreds of thousands of processors and build a supercomputer out of a massive parallel array. Cluster computers now facilitate performance at the TeraFLOPS level.
- High-Performance Technical Computing (HPTC) will impact scientific research by enabling powerful simulations that, in addition to traditional theoretical work and experimentation, will serve as a key method of discovery. Beyond that, HPTC will impact manufacturing by enabling virtual testing of components and design processes as well as optimization of performance, quality, and manufacturability. To maintain an edge in manufacturing, the U.S. must utilize cost-effective HPTC to optimize manufacturing and design processes.
- The NSF-funded Pittsburgh Supercomputing Center is working with Compaq to deliver the first Terascale computing system that will deliver 12 times the computational power and 40 times the memory to users at over 800 nodes.

4.4(h)—National Science Foundation's Major Research Facilities: Planning and Management Issues

September 6, 2001

Hearing Volume No. 107–48

Background

Recently, a number of organizations, including the National Academy of Sciences, the NSF Office of the Inspector General, Congress, the Office of Management and Budget, and the scientific community, have raised concerns over the adequacy of NSF's planning and management of large research facilities. These large facilities include astronomical observatories, supercomputer centers, the South Pole Station, and earthquake simulators, among others. Witness testimony described the process by which these projects are selected for funding as well as agency oversight during implementation and operation of these facilities.

The Subcommittee heard from (1) Dr. Rita Colwell, Director, National Science Foundation; (2) Dr. Anita Jones, Vice Chair, National Science Board; and (3) Dr. Christine Boesz, Inspector General, National Science Foundation.

Summary of Hearing

Chairman Smith opened this hearing by noting that the NSF, which is primarily known for funding small-scale scientific re-

search, has recently become more involved in funding large-scale research projects, facilities, and equipment. With these increasingly large and complex projects have come ever-growing management challenges. Also, recognizing that the scientific community's new facilities wish list will always outstrip the resources available for funding these projects, prioritization of the projects is critical. This prioritization should not be left for OMB or Congress to decide, but needs input from the scientific community as to which projects should go first.

Chairman Smith stated that the hearing would also address the issue of oversight and operation of these facilities aimed at ensuring that taxpayer dollars are spent as effectively and efficiently as possible. On large projects, even proportionately small cost overruns can add up to big money. For example, the Space Station overruns are greater than NSF's entire 2002 budget. Mr. Smith noted that he appreciated the Inspector General's input and interest into assuring how these goals can best be accomplished and that he looked forward to hearing about NSF's new Large Facility Project Management and Oversight Plan.

Dr. Colwell discussed the National Science Foundation's management and oversight of large facilities and noted that:

- NSF's approach to facilities management differs from the other federal research and development agencies because NSF does not directly construct or operate the facilities that it supports.
- NSF makes awards to universities or nonprofit organizations that undertake the construction, management and operation of facilities.
- Major Research Equipment (MRE) and large facility construction proposals undergo very rigorous evaluation and merit review including that provided by a committee of NSF leaders and by the National Science Board who must approve the design and merit of each MRE project before it can be funded.
- After a project is funded, NSF tries to ensure that the MRE project or the large research facility is constructed on time and within cost estimates.

Dr. Jones focused on the National Science Board's (NSB) role as the governing body of the Foundation and said that:

- With respect to the MRE account, the NSB functions in both an approval and oversight role in that all MRE proposals must earn NSB approval before they can be included in a budget request, and MRE cost over-runs of greater than 20 percent or $10 million of the approved project budget must be approved by the NSB.
- Typically, the Director selects MRE candidates for the NSB to review and, if the project is meritorious and planning is adequate, the NSB will approve it for future funding (though the NSB does not rank order or prioritize programs that receive NSB approval). In determining if a project is meritorious, the Board will evaluate it for intellectual merit, societal impacts, importance to science and engineering, balance

across disciplines, readiness to be implemented, and cost-benefit and risk analyses.

- The NSB assumes that all approved MRE projects are of unquestioned excellence and worthy of Foundation support, which it reaffirms in approving the Foundation's budget submission to the Office of Management and Budget. The Director, however, makes the final decision regarding which NSB-approved MRE projects will be included in the budget request.
- The NSB has grown increasingly concerned about the management and oversight responsibility of the Foundation related to the growing number and size of MRE projects. Therefore, in 1999, the NSB had been working with the NSF to develop a Large Facility Projects Management and Oversight Plan.

Dr. Boesz discussed the results of her recent MRE audit and made the following suggestions regarding improved management and oversight of the MRE account:

- Overseeing the construction and management of large facility projects and programs, while still being sensitive to the scientific endeavor, requires much more diligence than simply allowing for research independence and freedom. It requires a disciplined project management approach including meeting deadlines and budgets, and working hand-in-hand with scientists, engineers, project managers, and financial analysts.
- NSF should develop strong policies and procedures for managing all aspects of large facility projects, including improved oversight, financial management and enhanced training of staff.
- The Large Facility Projects Management Plan represents progress, but key areas of implementation still need to be addressed. In particular, the plan should clarify who will have ultimate project accountability and should provide guidelines for a more comprehensive pre-award review process.
- The Inspector General's office will conduct a follow-up review to ensure that the audit recommendations have been fully implemented.

4.4(i)—Strengthening NSF Sponsored Agricultural Biotechnology Research: H.R. 2051 and H.R. 2912

September 25, 2001

Hearing Volume No. 107–36

Background

The purpose of the hearing was to receive testimony regarding legislation that aims to expand the National Science Foundation's investment in research related to plant genomics. Witnesses discussed current advances and concerns, as well as future needs, in plant genomics and related research and commented on the role

that the National Science Foundation (NSF) should play in plant biotechnology research.

Witnesses included: (1) Dr. Mary Clutter, Assistant Director, National Science Foundation; Biological Sciences Directorate; (2) Dr. Catherine Ives, Director, Agricultural Biotechnology Support Program, Michigan State University; (3) Dr. Charles Arntzen, Distinguished Professor of Plant Biology, Arizona State University and an expert in the field of plant-based pharmaceutical and vaccine production; and (4) Dr. Robert Paarlburg, Professor of Political Science, Wellesley College, and an expert in the socioeconomic and policy implications of agricultural biotechnology in the developing world.

Summary of Hearing

Chairman Smith opened this hearing by noting that the issue of biotechnology has been of great interest to the Research Subcommittee in the past, with the Subcommittee holding a series of hearings and briefings during the 106th Congress that led to a Chairman's Report on the issue entitled *"Seeds of Opportunity: An Assessment of the Benefits, Safety, and Oversight of Plant Genomics and Agricultural Biotechnology."* That report noted biotechnology's incredible potential to enhance nutrition, feed a growing world population, open up new markets for farmers, and reduce environmental impacts of farming.

Chairman Smith went on to state that the potential benefits of biotechnology are limited only by the imagination and resourcefulness of our scientists, and that H.R. 2051 and H.R. 2912 both attempt to unleash some of that imagination and resourcefulness. H.R. 2051 would bring together some of the best researchers in the field to combine efforts and use the latest in technology, greatly increasing our ability to tackle fundamental genomics problems. Ranking Member Johnson's bill, H.R. 2912, would attempt to bring together similar expertise and resources, but with a focus on the farming systems of the developing world.

Dr. Clutter discussed NSF's support of fundamental research and noted that:

- NSF's Plant Genome Research Program supports projects that make significant contributions to our understanding of plant genome structure, organization and function. Emphasis is placed on plants of economic importance, as well as plant processes of potential economic value.
- Project 2010 will enable scientists to better understand the function of the 25,000 genes found in the small mustard plant, Arabidopsis, that were identified as a result of the genome sequencing effort.
- To be effective in transferring genomics technology to the developing world, sustained research collaborations are essential.
- Virtual Centers, like those supported through the Plant Genome Program, enable a number of scientists—including students—to participate in world-class research that was traditionally limited to Research I institutions.

- Both H.R. 2051 and H.R. 2912 are consistent with the activities currently funded by NSF.

Dr. Ives discussed why the U.S. should invest in programs to elucidate fundamental mechanisms of plant production and noted that:

- More public funding needs to be spent on creating new partnerships among public institutions, the private sector, and other nonprofit organizations. The U.S. needs to improve communication infrastructure and networking, and increase the number of trained scientists through research partnerships. Both H.R. 2051 and H.R. 2912 would address this challenge.
- The programs outlined by the legislation would fill an important gap in the current research environment, which neglects basic research on plants of importance to the developing world. Currently, the United States Department of Agriculture (USDA) funds basic research on crops of National interest and the U.S. Agency for International Development (USAID) provides technical assistance to developing countries, but does not fund basic research.
- For NSF's work to result in improved technologies that are available to the poor in developing countries, it will be important for the agency to develop strong linkages with USAID and USDA's Foreign Agricultural Service.
- A fundamental knowledge and understanding of plants and cooperative research strategies are the foundation for addressing food production and nutrition problems in the developing world.

Dr. Arntzen discussed his interests in biotechnology-derived products, including plant-derived pharmaceuticals, and stated that:

- Early use of DNA transfer techniques focused on developing insect-resistant seeds and crops tolerant to herbicides with the ultimate goal of reducing pesticide use mitigating the impact of cropland degradation and erosion.
- A fifteen-year lag time is expected for the development of seeds improved for food, fiber or feed crops. Improvements in production traits (insect, herbicide, disease, and drought tolerance) will be available over the next decade.
- Of major importance to the developing world is the production of vaccines in a convenient form for universal use. Plants such as potatoes and bananas may prove to be safe and effective "vehicles" for manufacturing and delivering vaccines if research can address issues such as uniform dose delivery and product quality.
- Private companies may be hesitant to develop plant-based vaccines for a number of reasons, including the lack of crucial information about plant cell biology and the inability to estimate the project cost of developing plant-based vaccine candidates. Federal funding will be required to drive advances in plant-based pharmaceutical technologies.

- NSF could play a valuable role in advancing research to enable plant-based production of new health care projects because of the agency's experience in facilitating multidisciplinary research centers, in identifying sound science, and in supporting educational programs that are essential for the success of emerging technologies.

Dr. Paarlberg discussed why the planting of genetically modified (GM) crops has not yet spread in any significant way to the developing world and noted that:

- GM crops have been grown widely and successfully for the last five or six years in the U.S., Argentina, and Canada, but consumer resistance has impeded wide-scale use of GM crops, even in countries that initially approved GM crops on both food safety and biosafety grounds.
- No countries in Africa, except South Africa, allow the planting of any GM crops; China and Indonesia are the only Asian countries that allow GM crops to be grown.
- Crop technologies that are created in the private sector and sold through private multinational seed companies are often difficult for poor countries to accept on political grounds. For this reason, academic research will be vital to the successful implementation of GM techniques in food production.
- Some developing countries have refrained from utilizing GM crops, despite years of promising field trials, because of intense opposition from local and European-based NGOs, anti-GM activist groups, and the fear that export commodities would be devalued if found to be GM varieties.
- A rebalance of agribiotechnology research away from the private sector and back into the public sector will be important if we hope to get modern applications of biotechnology to poor farmers in the developing world.

4.4(j)—Meeting the Demands of the Knowledge-Based Economy: Strengthening Undergraduate Science, Mathematics, and Engineering Education

March 7, 2002

Hearing Volume No. 107–52

Background

The hearing examined the challenges in undergraduate science, mathematics and engineering education at a variety of institutional types; explore examples of undergraduate science, mathematics and engineering programs that address the relevant problems; discuss federal programs that could be developed in the future to fill current gaps or stimulate additional change; and to consider how H.R. 3130, Improving Undergraduate Science, Mathematics, and Engineering Education will address the needs of the undergraduate mathematics and science education community.

The Subcommittee heard testimony from (1) Dr. Carl Wieman, Distinguished Professor of Physics, recipient of the 2001 Nobel Prize in Physics, University of Colorado, Boulder; (2) Dr. Kathleen

P. Howard, Assistant Professor of Chemistry, Swarthmore College; (3) Dr. Daniel Wubah, Professor of Biology, James Madison University; (4) Dr. Steven Lee Johnson, Provost and Chief Operating Officer, Sinclair Community College; and (5) Dr. Narl Davidson, Professor of Mechanical Engineering and Interim Dean of Engineering, Georgia Institute of Technology.

Summary of Hearing

Chairman Smith opened this hearing by stating that if we want to maintain our competitive edge in the world, we have to do a better job of providing students with the ability to function and contribute in today's highly technological world. This of course, means better preparing our students for careers in science, and mathematics, and engineering, and technology. Thinking about the war situation we are in today, it is going to be our research efforts that are not only going to develop the new smart weapons, but it is also going to be these science and math students that are going to develop the tools, and the new computers, and the new technologies that are going to assist us improving our national security.

If these challenges are to be met, we must improve our science and math education programs. Chairman Smith noted that much of the math and science education problems that we are facing take root in a K through 12 school system that has inadequately excited individuals toward pursuing math and science careers. Last year, the House has passed H.R. 1858, a bill authorizing NSF to build partnerships for improved cooperation between high schools and universities so that students are better prepared for college math and science curriculum. Consistent with those initiatives, we are now beginning to examine how we can improve undergraduate math and science education. Chairman Smith stated that today's hearing was intended to first help us to determine exactly where the problems lie, and consider potential solutions to those problems.

Dr. Wieman discussed the lecture-based teaching methods he has developed and used to actively engage students, including non-majors in his physics classes. Dr Wieman also discussed the difficulties faculty face in implementing novel pedagogical strategies because of student resistance to techniques with which they are unfamiliar and administrator's wishes to keep students happy. Dr. Wieman addressed the importance of making instruction relevant to the daily lives of students and the need to make courses more attractive to students while maintaining their vigor and content delivery. He explained that:

- New methods of teaching undergraduate science, mathematics, and engineering education may be very effective but the academic traditions and structures that have developed over the last 500 years makes implementing new techniques very difficult.
- H.R. 3130 focuses on key issues and is an excellent start but it will be important to get widespread support within college departments and among administrators to result in full-scale reform.

- Effective undergraduate education reform requires top-down demand for department-wide reform rather than a lone faculty hero who works to change the educational program one course at a time. In addition, faculty needs to realize that without dramatic improvements in instruction, science courses will suffer from continuing declining enrollment and departments will suffer from cutbacks.

Dr. Howard discussed the challenges that new faculty members face in trying to juggle the demands of research and teaching as well as how to engage undergraduate students in research classes and laboratories. She stated that:

- Honors degrees awarded to students based on oral and written exams prepared and administered by outside experts on performance challenge students and reward excellence. Faculty receives a great benefit from the honors degrees program in that it provides an external evaluation of the quality of the undergraduate program.
- Having students involved in research during the year and throughout the summer is beneficial to both students and faculty.
- H.R. 3130 is important because it invests in programs that encourage undergraduate research. Participating in research is the best way for students to learn what it means to be a scientist.
- NSF should expand its current programs that help undergraduate institutions purchase state of the art instrumentation so that students can participate in high-quality research experiences.

Dr. Wubah highlighted the importance of mentoring and recruiting talented students to comprehensive undergraduate institutions through the NSF supported Research Experiences for Undergraduates programs. He also discussed the need for additional or targeted programs within NSF's Division of Undergraduate Education and the Division of Graduate Education to recognize the unique opportunities and challenges of comprehensive undergraduate institutions and the students enrolled at those institutions. He testified that:

- Our country's continuing global leadership depends on a strong, well-trained work force and citizens who are equipped to function in a complex technological world. Current concerns about our future ability to prepare a scientifically literate citizenry require a change in the distribution of resources for science and technology education.
- It is very important to integrate research and education but this can be very difficult especially at the comprehensive colleges and universities where resources are most lacking.
- It is important to link the student's research experience to something relevant in their everyday life. So they begin to make connections between courses and the real world of scientific research.

- Mentorship is very important in recruiting students to and retaining students in undergraduate science programs and encouraging students to pursue graduate education.

Dr. Johnson addressed problems community colleges face in securing funding for their core academic and transfer programs, in facilitating faculty development in a non-research intensive environment, and in finding support for the dissemination of good models and practices across the Nation. He testified that:

- Given the high percentage of minority students who attend community colleges, these institutions are key entry points for minority students who may want to be scientists, mathematicians, or engineers.
- Funding from the National Science Foundation Advanced Technological Education Program has been very important in supporting the development and expansion of technician training programs at colleges. However, the program needs to be expanded to include support for core mathematics and science courses that all students, and not just technicians-in-training, take at community colleges.
- Community colleges are not as competitive at securing federal funding as 4-year colleges and universities in part because agencies and grant reviewers are used to considering an institution's research program rather than its instructional program when awarding funding.
- Innovation and outreach is accelerated by federal support, State Government support, as well as foundation, private foundation, support. Public community colleges across the country are delivering on their promise of providing solid and accessible higher education and they need to be supported by federal programs and legislation similar to H.R. 3130.

Dr. Davidson addressed the importance of cultivating talent among those students who express an interest in engineering as opposed to weeding out interested students in hope of finding better talent elsewhere. He testified that:

- Nothing creates enthusiasm for learning like participating in meaningful research projects. One of the most effective undergraduate programs has been the Research Experience for Undergraduates program through which research faculty can receive supplemental funds to include undergraduate students in laboratory research.
- Effective student retention invariably requires an institutional cultural change, and all change at academic institutions academics moves slowly. Georgia Tech has been successful in increasing student enrollment and retention by proving students with additional research opportunities early in the undergraduate experience and by providing student mentoring and peer support opportunities.
- The problem of declining undergraduate enrollment must be attacked from all sides by encouraging pre-college initiatives for K–12 students and their teachers, enhancing the univer-

sity and college experiences for undergraduate and graduate students, and increasing the diversity of academic faculties in science and engineering.

- NSF should provide small grants for experimental programs and should also support greater exchange among universities with respect to effective recruitment and retention strategies. H.R. 3130 would allow NSF to implement most of the recommendations listed above and then engineering education community strongly supports this bill.

4.4(k)—The NSF Budget: How Should We Determine Future Levels?

March 13, 2002

Hearing Volume No. 107–62

Background

The Subcommittee held the hearing to receive guidance and advice from the external community on how to determine appropriate NSF funding levels as the Committee crafts authorization legislation for the agency. The hearing explored criteria that should be used in setting NSF budget levels, in establishing priorities within the budget, and in restoring balance to the federal research portfolio. The hearing also examined the impact of current NSF funding on academic and private sector research and on the economy in general.

The Subcommittee heard testimony from (1) Dr. Stephen Director, Professor, Electrical Engineering & Computer Science; Robert J. Vlasic Dean of Engineering, University of Michigan; (2) Mr. Scott Donnelly, Senior Vice President, Corporate Research and Development, General Electric Company; (3) Dr. Irwin Feller, Professor of Economics, Pennsylvania State University; and (4) Dr. Karen S. Harpp, Assistant Professor, Department of Geology, Colgate University.

Summary of Hearing

Chairman Smith opened this hearing by noting that the Science Committee has been very supportive of NSF and it's strong record of leadership and success funding competitive, peer-reviewed research, and is interested in our witnesses' ideas to improve NSF and their research efforts. NSF's unique focus on fundamental scientific research that is not undertaken by the private sector is a very important aspect of our federal R&D funding. While it is very difficult to quantify the return on federal investments in basic research, its footprints are unmistakably part of the world around us. Knowledge from NSF-funded research resulting in modern industries such as genomics, information technologies, and communications has clearly made our lives better. These technological developments have also been one of the major drivers of growth in our economy, and are likely to remain so.

Chairman Smith went on to discuss the NSF fiscal year 2003 budget request, noting that, after accounting for the proposed transfer of three programs from other agencies to NSF, its increase

was just a modest 3.4 percent. He stated that he understood the difficulties that accompany wartime budgets, and believed that President Bush should be commended for developing a budget that makes some difficult choices. However, Mr. Smith noted that he had hoped a model federal agency such as NSF would have received a stronger increase. He also remarked on the disparity between funding increases for NSF and the National Institutes of Health, noting that just a slightly smaller increase for NIH, if added to NSF, would result in an equivalent 14.7 percent increase for NSF.

Dr. Director addressed the impact of NSF funding on research and education programs at institutions such as the University of Michigan. In addition, he discussed the need to achieve balance among scientific disciplines and between core research programs and priority areas within. He testified that:

- NSF funded research in the areas of information security, detection of airborne hazards, and structural studies to improve building safety are likely to be key in the war on terrorism and will continue to play an important role in national security for years to come.
- While NSF is the lifeblood for thousands of researchers across the Nation, there are many outstanding researchers who are unable to obtain NSF funding due to budget limitations. Last year nearly 70 percent of the almost 33,000 NSF grant proposals were not funded, including thousands that were rated as being very good or excellent during the rigorous peer review. With so few excellent proposals being funded our nation runs the risk of losing out on a number of break-throughs or innovations.
- There is almost no increase in the number of American students pursuing science or engineering studies despite the growing demand for technologically trained individuals.
- Congress should provide ample funding to increase the number, size, and duration of NSF grants so that researchers can spend more time doing their research and less time applying for funds. The number of grants also needs to be increased so that all proposals receiving a rating of very good and above are funded.
- Increased funding for NSF will insure that the United States remains the leader in scientific innovation that United States research universities are prepared to meet the needs of the 21st century.

Mr. Donnelly addressed the impact of federally funded basic research, such as that funded by NSF, on industry and the economy. He also discussed scientific and technical workforce issues and recommended various criteria that could be used to appropriate funding levels for NSF. He testified that:

- Advanced technologies such as those supported by NIH funding, are possible only when basic research in physics, engineering and information technology provides tools and technologies that can be transferred into clinical applications.

- Academic research findings need to be translated into advanced applications by industry scientist who develop products and services that feed into the economy.
- There are a number of vibrant programs at and talented students graduating from top medical schools. We need that same vibrancy and talent coming out of our university physics and engineering departments and we must continue to translate basic research into value-added products and services.
- Increased funding for the NSF insures vibrant university research programs and terrific students prepared to deliver the next generation of technologies through their work at academic and industrial laboratories.

Dr. Feller addressed the impact of basic research on the economy and also discussed the role economic research can play in optimizing the balance between different types of research (such as basic research versus applied, or research in the physical versus the biomedical sciences). He testified that:

- There is a great concern that the small size of the average NSF award is causing faculty to divert their research programs away from basic research and toward those research areas supported by other federal agencies and may be dissuading students from pursuing careers in research.
- The average award is so small in many cases that the historic coupling of research and education is under strain. This forces faculty to adjust their research agendas to the amount of funding they think is realistic rather than the amount required to realize the full potential of their research.
- Another detrimental affect of under-funding is that students view the lives of their mentors as being too focused on chasing after limited money and, as a result, students often opt out of careers in research.
- Unfortunately, NSF program officers and senior officials are often in a situation of having to trade off funding of individual investigators to support larger research centers and interdisciplinary programs making it even more difficult for faculty to get the money they need to run their independent research laboratories and programs. Adequate funding is needed for support both core programs and priority areas.
- The best investment of federal funds at NSF and other science agencies is through the competitive peer-review process.

Dr. Harpp discussed the major challenges faced by students and faculty who are engaged in undergraduate science, mathematics, or engineering education and research. In addition, she addressed the criteria that should be used to determine the level of NSF funding for education and research activities at primarily undergraduate-serving institutions. She testified that:

- Major research instrumentation programs are invaluable in enabling faculty at undergraduate institutions to establish state-of-the-art facilities for undergraduate research train-

ing. These instruments expose students to the types of equipment they will encounter ultimately in the work force or in graduate school and this is critical.

- Students benefit from participating in authentic research projects through which they are exposed to the entire research process with all of its challenges and rewards. Students emerge generally energized by having discovered something new about the world and excited about making a difference because of their actual original scientific work.
- The demand and desire to build a research-rich environment for students has become overwhelming for faculty at primarily undergraduate institutions. In an undergraduate setting, it takes longer to accomplish research goals than at focused research institutions because of limited resources available for building and maintaining laboratory facilities, limited time with each research student, and extensive faculty teaching responsibilities.
- Allocation of funds should be governed by high quality proposals for innovative ideas with the potential to advance the frontiers of science and science education. NSF must take into account that research in undergraduate settings does not progress at the same rate or along the same path as it does at large research universities, but that the research at undergraduate institutions is equally important and valuable because undergraduate institutions provide the essential link between research and education.

4.4(l)—Preparing a 21st Century Workforce: Strengthening and Improving K–12 and Undergraduate Science, Math, and Engineering Education

April 22, 2002

Hearing Volume No. 107–59

Background

The field hearing, held in Dallas, Texas, evaluated the state of K–12 undergraduate science technology, engineering, and mathematics (STEM) education and to discuss how federal programs such as NSF's Urban Systemic Initiative (USI) program have impacted K–12 education in Dallas. Additionally, the hearing explored educational programs that could be developed or expanded to fill current gaps and stimulate STEM, education reform efforts and train a scientifically literate workforce.

The Subcommittee heard testimony from (1) Ms. Narvella West, Executive Director, Science for Dallas Public Schools; (2) Dr. Geoffrey C. Orsak, Director, Infinity Project, Southern Methodist University; (3) Dr. Neal Smatresk, Dean of Science, University of Texas at Arlington; (4) Dr. Sebetha Jenkins, President, Jarvis Christian College; (5) Mr. Erza C. Penermon, Manager, workforce development, Texas Instruments; (6) Ms. Elissa P. Sterry, deputy manager of public affairs, ExxonMobil Corporation; and (7) Mr. Norman Robbins, community relations manager, Lockheed Martin.

Summary of Hearing

Chairman Smith opened this field hearing by remarking that we have understood the need to improve math and science education in America for some time now. How to best go about it, however, has been a more difficult undertaking to resolve. What is clear, though, is that if we want to maintain our competitive edge in the world, we have to do a better job of preparing our students for careers in science, mathematics, engineering, and technology.

Mr. Smith noted that the hearing's witnesses would provide a diverse array of expertise representing high schools, universities, and the private sector. He also stated that the witnesses would be discussing some examples of unique programs that Texas has undertaken in education reform efforts, as well as reviewing their experiences with the National Science Foundation-sponsored programs.

Ms. West discussed the need for better math and science education programs, stating that:

- There has been a lack of accountability in science education.
- There is inadequate infrastructure in the classroom to meet the technology requirements of today.
- College students majoring in math and science are not taught how to teach urban students.
- Adults need to understand why it is important to accelerate learning in math and science, especially for to ensure the future safety and security of this country.

Dr. Orsak discussed the importance of H.R. 3130, Improving Undergraduate Science, Mathematics, Engineering and Technology education, noting that:

- The bill emphasizes the importance of science, mathematics, and engineering education in preparing the country and the workforce to meet the challenge of the 21st century.
- Only two percent of all high school graduates will actually receive an engineering or technical degree and even fewer women and minorities will receive degrees in those areas. The number is much lower for women and minorities.
- If science and engineering enrollment trends are not reversed, the U.S. will struggle in the future to maintain its standing in the global market place.
- It is important that the bill has methods to identify high-performance programs, and has ways to aid these programs.
- There should be a method to increase the help of the corporate community to address workforce needs.

Dr. Smatresk addressed problems associated with recruiting good undergraduate mathematics and science students, commenting that:

- The number of students across the country entering undergraduate math and science programs is dropping nationwide.
- When students are struggling through introductory science and math courses, they are often times unaware of the multitude of career choices that will be available to them if they persist in the science and engineering majors.

- There are not enough well trained K–12 science and math teachers in the U.S. to adequately prepare students for undergraduate science and math courses.
- Half of all science and engineering students drop out of the program in the first two years.
- Programs are needed that bring schools, teachers and business together.

Dr. Jenkins commented on the role of Historically Black Colleges and Universities (HBCU) and the Federal Government, noting:

- The most important partner for HBCU is the Federal Government.
- There is a significant under-representation of minorities in the fields of mathematics and science, showing that HBCU are not being well utilized.
- An Experimental Program to Stimulate Competitive Research (EPSCoR)-like program is needed to provide additional support to minority serving institutions.
- HBCUs need to be supported by the Congress and NSF to improve K–12 mathematics and science education for minority students. This would help increase the number of engineers and scientist in the country, and promote a more diverse workforce.

Mr. Penermon explained the current needs of the semi-conductor industry and Texas Instruments (TI) and their plan to help meet those needs, stating that:

- Industry is struggling with a shortage of qualified workers and the downward trend of enrollment at universities and colleges in engineering and technical programs only exacerbates this problem.
- The biggest problem in attracting qualified persons is making people aware of the opportunities available in the private sector.
- Currently TI has 50 students in a work/study arrangement that allows them to gain work experience and complete their studies.
- It is important that universities utilize industry-approved curricula that will prepare students for the workforce. TI is involved in many programs to help improve K–12 and undergraduate education.

Ms. Sterry discussed the importance of U.S. students having an improved K–12 and undergraduate mathematics and science education, and noted that:

- It is critical for ExxonMobil to have a skilled and educated workforce, but there has been a long-term decline in undergraduate engineering enrollment.
- Intern and Co-operative work-study opportunities are the best way for students to learn about opportunities in industry.

- In addition to having research experiences, students must be taught fundamentals and gain basic skills through the university engineering curriculum.
- Minorities and women are still a small portion of the engineering workforce.
- ExxonMobil encourages employees and retirees to help in educational programs through volunteering and matching gift programs.
- American citizens need more math and science skills to compete in today's world.

Mr. Robbins discussed the level of engineering education and the current engineering job market, stating:

- Lockheed Martin contributes in a number of ways to help improve mathematics, science, and engineering education.
- The job market for engineers is expected to double, while the number of engineers continues to decrease.
- In grades 4, 8, and 12, less than $\frac{1}{3}$ of U.S. students performed at proficient levels in math and science according to the National Assessment of Educational Progress.

4.4(m)—Preparing First Responders: A Review of the U.S. Fire Administration Assistance to Firefighters Grant Program and Post-9/11 Challenges for Firefighters and Emergency Responders

May 6, 2002

Hearing Volume No. 107–65

Background

The hearing reviewed a number of issues related to United States Fire Administration programs. The goal of this hearing was to: provide an overview of U.S. Fire Administration (USFA) programs and issues; review implementation and budget challenges facing Assistance to Firefighters grant program, and examine counter terrorism-related challenges facing firefighters and first responders.

The Subcommittee heard testimony from (1) Mr. Charles E. Cribley, Chief Windsor Township Emergency Services; (2) Mr. Larry J. Hausman, Fire Chief, Battle Creek, Michigan Fire Department; and (3) Mr. Edward G. Buikema, Director, Federal Emergency Management Agency, Region Five. Also submitting written testimony but unable to attend the hearing was Mr. R. David Paulison, Administrator, U.S. Fire Administration.

Summary of Hearing

Chairman Smith opened this field hearing by remarking that our first responders come to our rescue whenever we need them, during natural disasters including tornadoes and hurricanes, during car crashes and school shootings, and many, many other situations, not the least of which is certainly fires. He noted that while the events of 9/11 brought a new focus to fire and emergency services, it is all too easy for us to forget that they were not just there for us that

day, they are there for us every day. Fire and emergency services respond to over 16 million calls annually, without reservation and with little regard for their personal safety. Since September 11th, over 30 first responders have died in the line of duty.

He stated that there is a considerable likelihood of future attacks on American soil that could happen in any number of forms—bombs, fires, weapons of mass destruction, attacks on our infrastructure, and others—are all conceivable and demand a new level of readiness. It is the job of Congress and state and local governments to ensure we honor the commitment of first responders who protect us day-in and day-out by providing them the resources that they need.

Mr. Cribley testified on the role of the fire and emergency crews in local communities, and how to better prepare them for the future. Specifically, he described the challenges his fire department faces as it transitions from a rural to suburban community. Mr. Cribley noted that:

- Windsor Township created a new "emergency services" department that merged the ambulance and fire departments, to create a more effective operation.
- All mail sent to the state of Michigan is sorted in the secondary complex within his departments jurisdiction. While personnel is now trained to assess the threat of anthrax, the local service would need help in dealing with the threat if an incident would occur.
- Small community fire departments, while still having a role as an important source of pride and identity for communities, simply cannot effectively handle critical administrative, specialized response, and inter-agency coordination.
- Grants should be given to departments that serve multi-community response districts.
- The FEMA first responder grant program is critical for support in dealing with terrorism, but the role of fire fighters should not be merged with that of one fighting terrorism.

Mr. Hausman described the state of the Battle Creek Fire Department, and how the government has aided, and can continue to aid, local fire departments. He explained that:

- The department faces challenges related to equipment acquisition, training, fire prevention, arson, meeting national standards, and recruitment.
- Compliance with National Fire Protection Association standards is becoming more complicated, and has been fragmenting the fire departments of the fire service; an increase in national funding is needed.
- The Battle Creek Fire Department used its USFA grant to install smoke detectors in approximately 17,000 dwellings.
- Funding to the USFA for the grant program needs to be increased by 10 fold, and the matching amount should not fluctuate between 10 and 30 percent.
- The assistance program should not be tied in with Homeland defense.

Mr. Buikema discussed the role of FEMA in responding to natural disasters and terrorism, and the post-9/11 challenges presented by the reality of a wide range of terrorist threats. He testified that:

- FEMA has internally restructured to establish at the headquarters and regional level, the Office of National Preparedness, to be ready for and respond to terrorist acts.
- FEMA's primary responsibility is to enhance first responder capabilities concerning planning, equipment, training, and exercises.
- FEMA is the lead government agency in dealing with the response to terrorist attacks.
- Centralization of the preparedness efforts under FEMA, as outlined in the President's budget, will help address the needs in Homeland defense.

4.4(n)—H.R. 4664, The National Science Foundation Reauthorization Act of 2002

May 9, 2002

Hearing Volume No. 107–63

Background

The hearing examined H.R. 4664, "The National Science Foundation Authorization Act of 2002," which was introduced by Representatives Nick Smith, Eddie Bernice Johnson, Sherwood Boehlert, and Ralph Hall. The National Science Foundation (NSF) currently funds research and education activities at more than 2,000 universities, colleges, K–12 schools, businesses, and other research institutions throughout the United States. Virtually all of this support is provided through competitive, peer-reviewed grants and cooperative agreements. NSF provides approximately 25 percent of the federal support for basic research conducted at academic institutions.

The Subcommittee heard testimony from (1) Dr. Daniel Mote, President, University of Maryland, College Park; (2) Dr. Ioannis Miaoulis, Professor, Mechanical Engineering; Dean, School of Engineering, and Associate Provost, Tufts University; and (3) Dr. Jerome Friedman, Institute Professor, Massachusetts Institute of Technology.

Summary of Hearing

Chairman Smith opened this hearing by noting that it would serve to review H.R. 4664, the National Science Foundation Authorization Act of 2002, and would immediately be followed by a Subcommittee markup of the legislation. He stated that while this was the second hearing of the year on NSF, the Subcommittee has also held numerous oversight hearings on NSF since the last authorization for the agency expired at the end of fiscal year 2000.

Mr. Smith went on to describe the details of H.R. 4664, noting that the legislation provides 15 percent annual increases for NSF, placing the agency on track to double over five years. He remarked that, while he maintains a philosophy of limited government and

intended to continue to push for increased private investment in research, continued government support for basic research forms the building blocks for the applied research that keeps our security, health, and economy strong. He stated that understanding the importance of continuing this record of success is one of the primary reasons he advocates the 15 percent increase, but there are numerous other reasons, including increasing the size and duration of NSF grants, increasing graduate student stipends, providing support for new initiatives in education, cyber security, information technology, and nanotechnology, and addressing the problem of backlogged major research equipment projects that have been waiting for funding.

Dr. Mote discussed the important role of NSF funding and suggested ways in which NSF programs and funding would be improved, testifying that:

- Research is the underpinning of the future in commerce, health, and defense.
- There will be a shortage of working scientists and engineers in the near future. We need to be thinking about the long-term implications cultivating a talented workforce that can support the future science and engineering.
- Since fewer agencies are supporting basic research, NSF needs to increase funding for basic research.
- NSF grants need to be larger, and for a longer period of time.
- NSF support is vital to helping young students that are beginning in science and engineering.

Dr. Miaoulis testified about the current downward trends in engineering enrollment and how Tufts has been working to reverse the trends. He also commented on the need to improve K–12 education stating that:

- Most major engineering schools across the country have problems attracting and retaining students, especially minorities and women.
- The number of students enrolling in engineering programs has fallen 15 percent over the last 8 years, and most schools see a 30–50 percent dropout rate from the engineering program.
- NSF funding allowed Tufts to change its engineering curriculum, and as a result, Tufts has seen an increase in the enrollment and graduation rates of all engineering students, including women and minorities.
- All students need to be exposed to engineering applications early in their undergraduate education so that they are technologically literate and understand how technologies work.

Dr. Friedman discussed the changing role of the government in funding basic research, and the future of the NSF and noted:

- In the 1960's two-thirds of all American research activity was government supported, but today two-thirds of research and development is done by industry.

- Most industry research and development is for short-term economic gain, not basic scientific research.
- NSF is beginning to fund large, collaborate research projects and faculties, but the Major Research Equipment and Facilities Construction (MREFC) account that funds these efforts has some significant problems.
- NSF should submit a list of approved MREFC projects, in a prioritized order so that legislators and scientists understand NSF's funding plans and priorities.
- NSF's annual budget should contain facilities, construction and operation costs for all MREFC projects as projected for a 5-year period.

4.5—SUBCOMMITTEE ON SPACE AND AERONAUTICS

4.5(a)—Vision 2001: Future Space

April 3, 2001

Hearing Volume No. 107–1

Background

The hearing explored visionary concepts of America's future in space exploration, commercialization, and utilization.

Witnesses included: (1) Dr. Buzz Aldrin, President, Starcraft Enterprises; (2) Dr. Lawrence M. Krauss, Chairman of the Department of Physics, Case Western Reserve University; (3) Dr. Wesley T. Huntress, Director of the Carnegie Institution's Geophysical Laboratory; and (4) Mr. Allen Steele, Science Fiction Author.

Summary of Hearing

Dr. Aldrin discussed the risk and long-term vision and commitment necessary for space exploration, commercialization, and utilization to prosper. His five recommendations included developing lower cost launch systems, eliminating hampering regulations and procedures, charging NASA with investigating lower cost transportation systems, and focusing NASA and the private sector on the near-term objective of flying "people" in space. Dr. Aldrin provided a video that would, in his opinion, make the launching of boosters and replacement of orbiters viable.

Dr. Krauss spoke of how to find a balance between far-term vision and near-term practicality in pursuing space exploration, human space exploration, and science.

Dr. Huntress outlined his vision for America's future space program in a systematic, logical, science-driven manner. He ultimately envisions a meshing of robotics and human space flight for a productive and cost effective mission from planet Earth, as well as the creation of a progressive infrastructure necessary for future missions.

Mr. Steele advocated the establishment of a permanent spacefaring civilization. He testified that private industry rather than NASA is best suited for the commercialization of space. He believes our space program should have an element of private purpose, as well as public, and should establish a Federal Space Agency that would focus entirely upon private space development. He proposed three major space objectives that can be accomplished by private industry: development of a second-generation space shuttle, construction of solar-powered satellites, and a return mission to the Moon to establish a permanent base.

4.5(b)—NASA Posture

May 2, 2001

Hearing Volume No. 107–15

Background

The hearing addressed NASA's scientific priorities as reflected in the budget request, NASA's technology development and demonstration activities, and options NASA is evaluating for proceeding with the International Space Station. NASA Administrator Daniel S. Goldin was the only witness.

Summary of Hearing

Mr. Goldin provided testimony on NASA's FY02 budget request. He highlighted NASA's major accomplishments and technical successes over the past year and identified specific management challenges and new priorities for NASA. The biggest challenge that NASA must address was the significant cost overrun ($4 billion) with the Space Station program.

The President's FY02 budget request proposed to offset a large portion of the cost growth by redirecting funding for the Crew Return Vehicle (CRV), the Habitation Module, and the U.S. Propulsion Module. In addition, funding for U.S. research equipment and associated support will be aligned with the new assembly schedule that will result from NASA's ongoing bottoms-up analysis. NASA estimates that research funding will be reduced by 40 percent. The budget request also stated that U.S. development would be complete once the Space Station is ready to accept the hardware elements of the international partners. This milestone, referred to as "U.S. Core Complete," will be reached following the successful integration of Node 2, currently planned for November 2003. The President's budget further committed that any additional cost growth would be offset by efficiencies found within the human space flight programs and would not affect NASA's other research programs. He stated that NASA would be examining privatization of the Space Shuttle in order to save funds to offset cost growth on the Space Station.

Mr. Goldin also testified regarding the status and issues for each of NASA's enterprises: Human Exploration and Development of Space, Space Science, Earth Science, Biological and Physical Research, and Aerospace Technology.

4.5(c)—A Review of Vertical Takeoff and Landing Technology in the National Airspace System

May 9, 2001

Hearing Volume No. 107–9

Background

The hearing examined VTOL technology, how VTOL could mitigate airport congestion, and federal and industry efforts to more fully integrate VTOL into the National Airspace System. The hear-

ing also focused on a developmental VTOL aircraft concept, known as the DP–2.

Witnesses were (1) Mr. Anthony A. duPont, founder and President of duPont Aerospace Company; (2) Mr. William H. Wallace, National Resource Specialist for Rotorcraft Operations, Federal Aviation Administration; (3) Dr. John Zuk, Chief of the Advanced Tiltrotor Technology Office, NASA Ames Research Center; and (4) Dr. Thomas D. Taylor, Chief Scientist and Program Manager of Naval Expeditionary Warfare Science and Technology, Office of Naval Research.

Summary of Hearing

Mr. Wallace testified that use of helicopters and civil tiltrotor aircraft hold promise to add capacity to the Nation's commercial aviation system by providing new opportunities for moving passengers into—and out of—crowded airports. He cautioned, though, that new arrival and departure routes, and procedures to integrate vertical-flight aircraft into the traffic flows at busy airports have not yet been developed. He stated that FAA continues to investigate operational and regulatory standards for civil tiltrotor aircraft, including pilot certification issues.

Dr. Zuk provided testimony on research conducted by NASA on the traffic effects of substituting vertical-lift aircraft for short-haul commuter flights at congested airports. Research findings indicated that operational capacity increases of up ten-percent were possible. In addition, Dr. Zuk testified that the introduction of these aircraft into small communities and general aviation airports would greatly expand accessibility of the national airspace system to underserved communities. Dr. Zuk also outlined NASA-sponsored research designed to reduce the noise footprint of vertical-lift aircraft.

Mr. duPont spoke about predicted flying characteristics of the DP–2, a developmental vertical take-off and landing aircraft that relies on vectored thrust produced by turbojet engines. His company is attempting to build the first-ever vertical-takeoff jet designed for commercial and military markets. He stated that considerable research, design, and engineering work must be completed before it could be ready for its first flight.

Dr. Taylor gave a general assessment of the DP–2 aircraft. ONR is sponsoring the developmental work of the DP–2. He testified that no known obstacles were encountered for the DP–2, but that the thrust-vectoring design required intensive research, and captive flight tests would be required before the aircraft would be approved for manned flight.

4.5(d)—The Aerospace Industrial Base

May 15, 2001

Hearing Volume No. 107–10

Background

The hearing focused on the ability of U.S. industry to maintain its leadership against primarily European competition.

Witnesses included: (1) Mr. John Douglass, President, Aerospace Industries Association; (2) Mr. Tom Moorman, Partner, Booz, Allen

& Hamilton; (3) Mr. Gayle White, National Defense Industrial Association; and (4) Ms. Heidi Wood, Vice President, Morgan Stanley.

Summary of Hearing

Mr. Douglass testified on trends in aerospace trade and U.S. market share in relation to European competition and called for a 20 percent increase in NASA research and development funds for aerospace technology to compete against European R&D subsidies. He also testified about declines in U.S. commercial aviation sales and development of Boeing supercruiser to compete against the Airbus A380 superjumbo.

Mr. Moorman testified on trends in the space industrial base to support military, commercial, and civil space programs. The U.S. space industry has excess capacity for launch vehicles and satellite manufacturing. Even with numerous mergers of aerospace companies during the 1990s, adequate competition exists. However, the deteriorating financial health of these companies poses a threat, especially with the growing reluctance of companies to invest in restructuring and independent research and development.

Mr. White addressed the shortage of aerospace workers skilled in math, sciences, and engineering to meet human capital needs in aerospace companies. A survey of the top 10 aerospace firms revealed that 64 percent of job openings for engineers were not filled, and retirements over the next five years will result in even more openings. Security clearances and pay comparisons with other information technology workers further drive workers to other industries.

Ms. Wood addressed how private investment has flowed out of the aerospace sector over the past decade and how investment trends relate to human capital trends. Wall Street analysts consider aerospace a "basic industry" rather than "high technology" due to this decline.

4.5(e)—Space Launch Initiative: A Program Review

June 20, 2001

Hearing Volume No. 107–11

Background

The hearing addressed NASA's procurement practices and investments in key technology areas and processes for the development of new launch vehicle architectures that will increase the national launch capability.

Witnesses included: (1) Mr. Dennis Smith, Program Manager of the Space Launch Initiative (SLI)/2nd Generation RLV Program Office, NASA; (2) Mr. Allen Li, Director of the Acquisition and Sourcing Management at the U.S. General Accounting Office (GAO); (3) Mr. Steve Hoeser, a space launch analyst; and (4) Mr. Tom Rogers, Chief Scientist of the Space Transportation Association (STA).

Summary of Hearing

Mr. Smith testified that the SLI is a NASA program to investigate new space transportation architectures and to invest ap-

proximately $4.85 billion between FY 2001 and FY 2006 for risk reduction and technology development efforts supporting at least two competing industry solutions. He outlined the process for determining the top level requirements and program goals for NASA's SLI, as well as measures NASA plans to use to achieve a viable vehicle architecture in 2006.

Mr. Li provided an assessment of NASA's management structure and its contributions to past problems with X-vehicle programs. He testified that NASA needs to address critical areas, such as adequate project funding, cost risk provisions, effective and efficient coordination, communication within the agency, and periodic revalidation of underlying assumptions, in order to avoid problems in future programs.

Mr. Hoeser provided key observations related to NASA's SLI based upon his experience with the Strategic Defense Initiative Office's (SDIO) Delta Clipper Experimental Launch Vehicle Program. He concludes that the SLI Program will not result in a new launch vehicle within the scheduled time frame.

Mr. Rogers summarized that NASA's SLI is representative of "old fashioned" Cold War thinking that promotes an entitlement program for NASA. He proposed that the government seek creative ways for financing development of near-Earth space and planetary exploration by supporting the private sector's efforts in realizing new space markets.

4.5(f)—Space Tourism

June 26, 2001

Hearing Volume No. 107–12

Background

The hearing reviewed the issues and opportunities for flying nonprofessional astronauts in space, the appropriate government role for supporting a space tourism industry, use of the Space Shuttle and Space Station for tourism, safety and training criteria for space tourists, and the potential commercial market for space tourism.

Witnesses included: (1) Mr. Dennis Tito, Space Tourist; (2) Mr. Mike Hawes, NASA; (3) Dr. Buzz Aldrin, Astronaut; and (4) Mr. Rick Tumlinson, Space Frontier Foundation.

Summary of Hearing

Mr. Tito, the first person to pay to visit the International Space Station, provided his perspectives on his experience aboard the Space Station. He also testified on the potential benefit of human space travel and tourism to society, as well as his observations on the Russian space program.

Mr. Hawes, Deputy Associate Administrator for Space Station at NASA, testified on U.S. Government policies and NASA's role regarding space tourism. He also addressed the issues related to nongovernment travelers aboard the Space Shuttle and the International Space Station and the need for a set of agreed-upon criteria for selecting crew to fly to the Space Station.

Dr. Aldrin, provided testimony on what types of activities could be enabled or enhanced by space tourism and the major hurdles that must be overcome before the space tourism industry could be self-sustaining. Dr. Aldrin focused on the need for low cost, reliable launch systems as the key barrier to space tourism and a major issue for the entire space program.

Mr. Tumlinson, Space Frontier Foundation, provided testimony on his views regarding the appropriate role of the government in supporting the space tourism industry. Specifically, Mr. Tumlinson testified that the Space Station is a research laboratory and not an appropriate destination for tourists. Further, he testified that the government should pursue policies which promote space tourism, but should not compete for business with private sector enterprises.

During the question and answer period, Mr. Tito claimed that the Space Station's life support system is capable today of supporting a permanent six-person crew. Mr. Hawes testified that the station is not capable of supporting a six-person crew as currently configured. The conflict was not resolved in the hearing, but NASA's response to the question for the record indicates that the station has the capability to support a six-person crew for limited periods of time.

4.5(g)—Life in the Universe

July 12, 2001

Hearing Volume No. 107–17

Background

The hearing reviewed ongoing efforts with NASA and the privately-funded SETI Institute's space science and astrobiology programs to search for life elsewhere in the universe.

Witnesses included: (1) Dr. Neil Tyson, Hayden Planetarium; (2) Dr. Jack Farmer, NASA Astrobiology Institute/Arizona State University; (3) Dr. Ed Weiler, NASA Space Science; and (4) Dr. Chris Chyba, SETI Institute.

Summary of Hearing

Dr. Tyson testified on the public's intense interest in the search for intelligent extraterrestrial life and how humans have depicted aliens in movies, magazines, and television. The actual discovery of extraterrestrial intelligence will result in a profound change in human self-perception.

Dr. Farmer explained NASA efforts to find microbial (as distinguished from intelligent) extraterrestrial life elsewhere in the solar system. The efforts are concentrated on Mars and Europa, one of Jupiter's moons, where liquid water possibly exists. Liquid water is one of the pre-conditions for life to form. Several satellite probes are planned during the next decade to search for life in the solar system.

Dr. Weiler testified regarding NASA's Origins Program to find extrasolar planets through a series of planned space-based telescopes over the next 15 years. The Hubble Space Telescope and ground telescopes have found over 70 Jupiter-sized planets in other solar systems, and more precise telescopes are needed in order to

find Earth-like planets in nearby star systems. Dr. Weiler characterized the search area and vast distances involved with a photograph of the Hubble Space Telescope Wide Field Camera. He expressed complete confidence that NASA's search will find extraterrestrial life with a 50 percent chance of finding intelligent extraterrestrial life.

Dr. Chyba explained the SETI Institute's Phoenix Program of ground-based radio observatories and distributed signal processing to search for radio signals from extraterrestrial intelligence. The SETI Institute's program is privately funded with several philanthropic efforts and has a highly successful public outreach program, SETI@Home. Dr. Chyba testified about the need for fairness in the competition for NASA research grants involving the SETI Institute.

4.5(h)—Developing the Next Generation Air Traffic Management System

July 19, 2001

Hearing Volume No. 107–6

Background

The hearing examined industry and government efforts to develop the next generation Air Traffic Management (ATM) system. Many aviation experts believe the current ground-based system cannot be stretched much farther to achieve the capacity increases necessary to accommodate predicted growth. In early summer the Federal Aviation Administration announced a major initiative known as the Operational Evolution Plan (OEP) that proposed a number of improvements to increase capacity in the National Airspace System (NAS) by 2011. If successful, these enhancements are expected to add 30 percent capacity, but predicted growth in traffic will offset these gains. The hearing focused on government and industry efforts to develop ATM hardware and systems beyond the ten-year horizon.

Witnesses were: (1) Professor R. John Hansman, Massachusetts Institute of Technology; (2) Mr. Steve Zaidman, Associate Administrator for Research and Acquisitions, Federal Aviation Administration; (3) Mr. Sam Venneri, Associate Administrator, NASA; and (4) Mr. John Hayhurst, President, Air Traffic Management, The Boeing Company.

Summary of Hearing

Professor Hansman testified that the Nation's air traffic system is congested and the potential for developing new capacity is constrained by the operational concepts employed by FAA, as well as landside facilities such as the number of runways and gates.

Mr. Zaidman stated that FAA's Operational Evolution Plan will meet near term traffic predictions (for the next ten years) but will do so in a way that simply meets expected growth in demand. He also stated that FAA no longer does long-term research and development, relying instead on NASA to perform this role. He also cautioned that FAA is reliant on industry and academia to meet future challenges.

Mr. Venneri offered several solutions NASA believes would produce new capacity, such as computer-based decision support tools for air traffic controllers, the Small Aircraft Transportation System, and the development of a global communications, navigation, surveillance ATM system. The latter initiative, however, would require many years to complete, and as a first step toward this goal, Mr. Venneri urged that NASA be permitted to pursue the Virtual Airspace Modeling project.

Mr. Hayhurst described Boeing's air traffic management proposal as a satellite-based, networked constellation of communications, navigation and surveillance satellites, capable of providing precise navigational data to pilots and air traffic controllers. It would permit aircraft to fly direct trajectories with minimal guidance from controllers. Boeing is in the process of developing a requirements document with input from all stake-holders and plans to release this document during the first half of 2002.

4.5(i)—Space Planes and X–Vehicles

October 11, 2001

Hearing Volume No. 107–22

Background

The hearing examined space plane technologies and the opportunities they would create for civil, military, and commercial space-based applications.

Witnesses included: (1) Dr. Steve Lambakis, Analyst, national security and international affairs at the National Institute of Public Policy; (2) Mr. Peter Huessy, President, PRH & Company; (3) Mr. Mitch Clapp, CEO, Pioneer Rocket Company; and (4) Ambassador Henry Cooper, Chairman, High Frontier and Applied Research Associates.

Summary of Hearing

Dr. Lambakis explained how space plane capabilities would transform current commercial, civil, and military space activities and how such capabilities would fit into an overall U.S. aerospace architecture. He testified that the difficulty in determining how the U.S. should proceed in space results from an unsettled and fragmented policy concerning the use of space.

Mr. Huessy illustrated operational concepts for a military space plane. He summarized that the rapid deployment of a military space plane could serve to deny an adversary the ability to prosecute a conflict.

Mr. Clapp's testimony focused on commercial applications for space planes and what space plane flight demonstration should be pursued before proceeding to an operational system. He testified that the X–37 Program provides a significant benefit to future reusable space systems by demonstrating in-space transportation operations.

Ambassador Cooper addressed how past administrations supported DOD and NASA space plane programs and what level of U.S. investments is needed for space plane development in the future. He testified that since past administrations diverted the path

of "build, test, grow" programs, close Congressional oversight is needed to encourage the bureaucracy to continue on a path towards an operational space plane.

4.5(j)—A Review of Civil Aeronautics Research and Development

March 7, 2002

Hearing Volume No. 107–67

Background

The hearing was held on the Federal Government's proposed FY03 budget and investment strategy for civil aeronautics research funded by the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA). While budget submissions for both agencies suggested a vigorous, ongoing research and development program important to solving many of our country's aviation-related problems, the FY03 funding proposal would shrink NASA's Aeronautics budget by $58 million below FY02 levels. Likewise, FAA's Research, Engineering and Development program would be reduced by $23 million below FY02. Agency officials were invited to explain the rationale behind their budget submissions. Industry experts were asked to give their views about the budget proposals.

Witnesses were: (1) Mr. Sam Venneri, Associate Administrator, National Aeronautics and Space Administration; (2) Mr. Steve Zaidman, Associate Administrator, Federal Aviation Administration; (3) Mr. Rich Golaszewski, Executive Vice President, GRA Inc.; (4) Mr. David Swain, Chief Technology Officer, the Boeing Company; and (5) Dr. John Cassidy, Senior Vice President, United Technologies Corporation.

Summary of Hearing

Mr. Venneri provided oral testimony of the major accomplishments in NASA's Aeronautics R&D program during FY 2001, singling out successes with the Helios high-altitude flying wing aircraft, demonstration of a synthetic-vision system for use on commercial aircraft, and prototyping decision support tools for use by the FAA air traffic control community. He also highlighted the release of NASA's new R&D investment roadmap, the "Aeronautics Blueprint," that will be used to guide future agency spending decisions.

Mr. Zaidman discussed FAA's FY 2003 Research, Engineering and Development budget request and reviewed the current investment strategy. He pointed out that approximately 80 percent of the budget is spent on safety-related activities such as finding solutions related to aging aircraft, aging wiring, and composite materials; 10 percent spent on environmental research; and 10 percent on weather research. Mr. Zaidman emphasized FAA's close working relationship with NASA and the Transportation Security Administration on research.

Mr. Golaszewski testified about the continuing decline in spending for aeronautics-related research and development by both government and industry, and drew a corollary between this trend and

our domestic industry's continuing decline in world market share for aerospace products. He noted that over the previous 15 years R&D investment by government and industry has been reduced by one-half. He concluded his oral statement by suggesting that the U.S./European Union agreement on government investment in large civil airframes be revisited in light of robust R&D funding programs put in place by the European Union.

Mr. Swain stated that the government must continue to underwrite high-risk, long-term research programs important to the aeronautics industry. Technology spin-offs from these programs have had a significant impact on industry and produced critical new capabilities for our nation's defense. He also spoke about the necessity of pushing forward with research and development on a new air traffic management system to replace the current system.

Dr. Cassidy applauded NASA's "Aviation Blueprint." He raised concerns, though, about declining investment in research and development spending by government and industry. He cited the 50 percent decline in NASA aeronautics R&D spending over the last five years as a cause for concern. He noted that reduced R&D investment ultimately results in fewer new technologies and loss of market share for domestic companies that rely on NASA to lead the way in high-risk, long-term research programs.

4.5(k)—Space Shuttle and Space Launch Initiative

April 18, 2002

Hearing Volume No. 107–79

Background

The hearing examined NASA's plans to operate and maintain the Space Shuttle and NASA's strategy for developing a second-generation Reusable Launch Vehicle (RLV) to replace the Space Shuttle. Specifically, the hearing reviewed NASA's plans for Shuttle safety and supportability upgrades, proposed reductions in Shuttle flight rate, the status of Shuttle launch infrastructure, plans for competitive sourcing of the Shuttle, ability of the workforce to support planned missions, and the status of studies to extend the operational life of the Space Shuttle beyond 2012. In addition, the hearing reviewed NASA's plans to develop and demonstrate technologies for a second-generation reusable launch vehicle to replace the Space Shuttle under the Space Launch Initiative. Taken together, NASA's space transportation programs may cost $50–$60 billion over the next ten years.

Witnesses included: (1) Mr. Fred Gregory, Associate Administrator for the Office of Space Flight, NASA; (2) Mr. Richard Blomberg, Chair of NASA Aerospace Safety Advisory Panel; (3) Mr. Sam Venneri, Associate Administrator for Aerospace Technology, NASA; and (4) Mr. Gerard Elverum, Member of the NASA Space Transportation Subcommittee of the Aerospace Technology Advisory Committee.

Summary of Hearing

Mr. Gregory testified that the next decade poses new challenges for the Space Shuttle. Mr. Gregory testified that over the past ten

years, the investment in Space Shuttle infrastructure was severely limited, due mainly to annual budgets that were unadjusted for inflation and other NASA priorities. NASA is investigating the cost and technical impacts that limiting the Shuttle flight rate to four flights per year will have to Agency programs. Mr. Gregory testified that NASA's plans to implement a prioritized list of Space Shuttle safety and supportability upgrades. This plan assumes that a new vehicle for human space flight transportation will be available by early next decade. Mr. Gregory also testified about the need and plans to revitalize Space Shuttle infrastructure and to retain a skilled workforce of both civil servants and contractors. NASA is investigating options of competitive sourcing for Space Shuttle operations, and using the Space Shuttle as a possible pathfinder to developing new technologies that could be used in a next generation RLV.

Mr. Blomberg testified that the Panel believes the repeated postponement of safety upgrades, the delay in restoring aging infrastructure, and NASA's failure to look far enough ahead to anticipate and correct shortfalls in critical skills and logistics availability inevitably increases the risk of operating the Space Shuttle. Mr. Blomberg said that the Aerospace Safety Advisory Panel believes it is realistic to adopt a Space Shuttle phase-out date in the 2022 to 2025 timeframe rather than NASA's current phase-out date of 2012. Mr. Blomberg observed that any plan to transition from the current operational posture to one involving significant privatization would inherently involve an upheaval with increased risk in its wake.

Mr. Venneri testified about NASA's strategic goals for a next generation space transportation vehicle—to significantly reduce the risk of crew loss, reduce ground processing times in addition to other life cycle cost drivers, and thus reduce the overall costs of access to space. NASA's plan for achieving these goals is the Integrated Space Transportation Plan (ISTP). Mr. Venneri stated that NASA's current ISTP calls for a decision at mid-decade (2006), depending on progress in the Space Launch Initiative (SLI) program's technology risk reduction, on whether to undertake full-scale development of a new human space flight transportation system which would be available by early next. Mr. Venneri testified that SLI would enable NASA to transition to a buyer of human space flight and International Space Station cargo launch services rather than as an operator of launch infrastructure.

Mr. Elverum recommended that NASA define up-front the next generation space transportation vehicle system and operating requirements then control the design of a new reusable launch vehicle by conservatively matching the design to a viable funding profile. Mr. Elverum recommended that SLI should have a program orientation to produce a robust, low-cost second generation RLV by about 2015 and only fund major technologies defined by the outcome of detailed, conservative system engineering results for credible multi-stage RLV candidates.

4.5(l)—NASA's Science Priorities

May 9, 2002

Hearing Volume No. 107–64

Background

The hearing examined NASA's programs in Space Science, Earth Science, and Biological and Physical Research. Also examined were strategies used to prioritize the missions and science goals within each of these enterprises.

Witnesses included: (1) Dr. Edward Weiler, NASA Associate Administrator for Space Science; (2) Dr. Ghassem Asrar, NASA Associate Administrator for Earth Science; and (3) Ms. Mary Kicza, NASA Associate Administrator for Biological and Physical Research.

Summary of Hearing

Dr. Weiler testified on current accomplishments of NASA's Office of Space Science, including the recent STS–109 Space Shuttle servicing mission to the Hubble Space Telescope (HST), the future transition from HST to the Next Generation Space Telescope, and observations from the Chandra X–Ray Observatory and the Mars Global Surveyor. Dr. Weiler strongly advocated the Nuclear Systems Initiative proposed in the FY 2003 budget. He testified that nuclear power and nuclear electric propulsion would dramatically increase the lifetime of spacecraft, enable faster spacecraft, and increase science return. He advocated the proposal "New Frontiers" program of competitive missions for solar system exploration, and he stated that a future mission to Pluto and the Kuiper Belt could possibly be funded under this program with newer, better technology than currently proposed for such a mission.

Dr. Asrar testified on current status of NASA's Earth Science Enterprise, including the deployment of the Earth Observing System (EOS) to provide data on the interaction of the Earth's atmosphere, oceans, and continents. Dr. Asrar also discussed NASA's participation in the U.S. Global Change Research Program and the Climate Change Research Initiative. Dr. Asrar testified that advice from the science community has led to a prioritized list of 23 specific research questions to be addressed by missions of the Earth Science Enterprise. Dr. Asrar testified that one of the primary aims of the Earth Science Applications Program is to "expand and accelerate the realization of societal and economic benefits from Earth science, information, and technology."

Ms. Kicza discussed the status of NASA's Biological and Physical Research Enterprise. She testified that research on the International Space Station and on the upcoming STS–107 space shuttle mission will make significant contributions in a number of disciplines in both biological and physical sciences. Ms. Kicza also testified that, in addition to receiving research prioritization advice from the National Research Council, NASA has assembled a team of experts (Research Maximization and Prioritization (ReMaP)) task force to help assess research priorities for biological and physical research. Ms. Kicza stated that NASA has elected to engage an

internal NASA ISS Utilization Concept Development Team to examine options for the management of ISS utilization, including the possibility of management of the same station by a Non-Governmental Organization (NGO).

4.5(m)—How Space Technology and Data Can Help Meet State and Local Needs

May 20, 2002

Hearing Volume No. 107–69

Background

The hearing addressed how data from space-based and aircraft-based remote sensing systems can help with land use planning, severe weather and natural disaster management, and transportation planning for state and local needs.

Witnesses included: (1) Dr. Ray Williamson, Research Professor, George Washington University Space Policy Institute; (2) Dr. Edward Martinko, Director, Kansas Applied Remote Sensing Program; (3) Mr. Ron Birk, Director, Applications Division, Earth Science Enterprise, NASA; and (4) Dr. Kevin Price, Professor of Geography, University of Kansas.

Summary of Hearing

Dr. Williamson testified that state and local communities have benefited substantially over the years from federal investments in space technologies, including remote sensing, global positioning, weather monitoring, and geospatial information services. Dr. Williamson showed that the cost and risks of natural disasters could be reduced by the predictive techniques made possible by investments in Earth science research. Dr. Williamson observed that data analysis for Earth science research is often under-funded compared to the satellite budget, that collected data from Earth science satellites is often unused, and that training is needed to encourage wider use of the data already available.

Dr. Martinko testified on how university-affiliated remote sensing organizations assist federal, state, and local agencies in overcoming the barriers of using satellite imagery. Dr. Martinko recommended an often-iterative process of extensive research, demonstration projects, pilot studies, and a continuing program of outreach with each agency. Dr. Martinko recommended funding for the development of decision support tools, the establishment of regional centers of expertise to provide agencies support with remote sensing applications, and data continuity with an open data policy of earth observations.

Mr. Birk testified on NASA's Earth Science Applications Program and the strategy for the program. The overarching goal for the Earth Science Applications Program is to bridge the gap between Earth science research results and the adoption of data and prediction capabilities for reliable and sustained use in decision support. Mr. Birk highlighted the program partnerships established to work with NASA to assimilate Earth science data into decision support systems, and then to implement them locally throughout the United States.

Dr. Price testified on the unique application of remote sensing information to agriculture planning and monitoring. Dr. Price recommended that the key link to technology transfer of remote sensing is the establishment and continued support of applied research to bridge between fundamental research and commercial product development. Applied research in remote sensing increases the number of users, relevance to the taxpayer, return on investment, and commercial involvement.

4.5(n)—NASA Workforce and Management Challenges

July 18, 2002

Hearing Volume No. 107–85

Background

The hearing examined the Administration's goals for transforming the agency over the next five years, the top management challenges that must be overcome to realize these goals, the challenges NASA faces in reshaping and restructuring its workforce, the need for legislation to provide new and expanded authorities for recruiting and retaining a high-quality workforce, and how NASA's legislative proposals on human capital support the transformation of the agency and its workforce.

Witnesses included: (1) The Honorable David Walker, Comptroller General of the United States; (2) The Honorable Sean O'Keefe, Administrator, NASA; and (3) Mr. Mark Roth, General Counsel, American Federation of Government Employees (AFGE).

Summary of Hearing

Mr. Walker testified on the General Accounting Office's perspective to NASA's top management challenges, focusing on its human capital challenges but also including it's financial and contract management. He observed that modern, effective, credible, and equitable human capital strategies are key to any successful transformation effort. He testified that such a transformation will take five to seven years, and while a vast majority of the transformation efforts can be done within the context of current law, that NASA needed additional authority to provide reasonable flexibility with appropriate safeguards to prevent abuse of employees.

Mr. O'Keefe testified that the President's Management Agenda identified human capital as one of the top five issues that need to be confronted. NASA has three times as many scientists and engineers over the age of 60 years old as under the age of 30 years old, and the human capital pipeline in science and engineering undergraduate and graduate schools is declining. NASA's strategy is fourfold: 1) to use existing authorities under Title 5 and the Space Act of 1958, as amended; 2) to develop an agency-wide human capital strategic plan to begin targeted hiring objectives, professional development strategies, and workforce shaping techniques that draw the best benchmarking from across federal agencies; 3) to refine NASA's mission and vision to include the inspiration of the next generation of explorers through education initiatives; and 4) to seek additional legislative authority based on the Managerial

Flexibilities Act. The areas emphasized in NASA's request for additional legislative authorities emphasize the need to recruit experienced scientists and engineers for mid-level entry, to recruit to achieve diversity objectives, to retain high performers, to use innovative human capital techniques that have been pilot tested in other agencies previously.

Mr. Roth testified on NASA's draft proposals for civil service exemptions. Mr. Roth testified that the human capital crisis is government-wide, but that it is unwise to make necessary civil service changes on an agency-by-agency basis. The AFGE opposes most of NASA's human resource proposals, and Mr. Roth noted that the primary jurisdiction for this legislation is with the Committee on Government Reform. Mr. Roth criticized NASA's program for downsizing and outsourcing efforts over the past decade and that NASA's human capital proposals are paradoxical by offering buyouts to certain employees while offering recruitment and retention bonuses to others. AFGE opposes an extension of the Interagency Personnel Act and NASA's request for direct hire authority. While the AFGE supports bonuses, studies have shown that less than one percent of eligible federal employees received recruitment and retention bonuses due to lack of funds. The AFGE does not oppose demonstration projects in general, but NASA's proposal needed to be re-drafted to answer certain concerns.

4.5(o)—The Threat of Near-Earth Asteroids

October 3, 2002

Hearing Volume No. 107–89

Background

The hearing examined the progress of NASA toward the current goal of identifying and tracking 90 percent of Near-Earth Objects (NEOs) larger than one kilometer in size by 2008. In addition, the hearing explored the question of next steps beyond this survey goal, including the costs, benefits, and technical challenges of extending the survey to include smaller, yet still potentially very hazardous, objects. Agency roles and interagency cooperation in the NEO survey effort were discussed. The role of amateur astronomers was also discussed, in light of the passage of H.R. 5303, the "Charles 'Pete' Conrad Astronomy Awards Act," introduced by Rep. Dana Rohrabacher (R–CA) to reward amateur astronomers who discover and track NEOs.

Witnesses included: (1) Dr. Edward Weiler, NASA Associate Administrator for Space Science; (2) Dr. David Morrison, Senior Scientist, NASA Ames Research Center; (3) Brigadier General Simon "Pete" Worden, U.S. Air Force; (4) Dr. Brian Marsden, Director, Minor Planet Center, Smithsonian Astrophysical Observatory; and (5) Dr. Joseph Burns, Irving Porter Church Professor of Engineering and Astronomy, Cornell University.

Summary of Hearing

Major topics addressed included the risks posed by NEOs, the status of the current U.S. survey effort for NEOs, recommendations for extending current survey goals to include smaller, more numer-

ous objects, and the challenges of data management. Dr. Morrison testified on the threat of collisions with asteroids and comets. He stated that the greatest risk today is not from objects large enough to cause global extinctions (such as is believed to have caused the extinction of the dinosaurs) but rather from objects large enough to perturb the Earth's climate on a global scale by injecting large quantities of dust into the stratosphere. Objects of about one kilometer in size pose such a threat and are thus the target of the current U.S. survey for NEOs. He stated that the next logical goal is to search for objects that could kill millions of people upon impact, and thus a target of objects 200–300 meters in diameter would make sense since these pose the greatest tsunami danger. Dr. Morrison emphasized that the goal of the current survey is not to find objects on their final plunge toward Earth, but rather to identify objects in nearby orbits for future monitoring. Thus a discovery of an object that has already passed the Earth in its orbit is still a "success."

Dr. Weiler testified on progress of NASA's current ground-based survey for NEOs, given the current goal of identifying 90 percent of Near-Earth Asteroids larger than one kilometer in size by 2008. Dr. Weiler stated that there are estimated to be about 1000 such asteroids, and that the six groups currently funded by NASA for such research have together discovered over 600 objects and are ahead of the predicted schedule; it is thus likely that the 2008 goal will be reached. As for extending the survey goal to comprehensively include objects smaller than one kilometer in size, Dr. Weiler felt that it was premature to decide what an extended goal should be. Dr. Weiler stated that if such an extended survey effort were conducted from the ground, then NASA should not play a part in the survey effort because NASA is primarily an agency for space-based missions. He stated that NASA's role is better suited for detailed study of particular asteroids and comets, such as the NEAR–Shoemaker mission and the upcoming DAWN, Deep Impact, and Stardust missions. He also stated that new technology from the Nuclear Systems Initiative and the In-Space Propulsion Initiative should benefit future missions for detailed studies of asteroids and comets.

Dr. Burns testified on the recommendations regarding NEOs from the recent National Research Council report entitled "New Frontiers in the Solar System," resulting from the Solar System Exploration (SSE) Survey conducted with scientists nationwide. One of the primary recommendations from the report is for NASA and the National Science Foundation to contribute equally to the construction and operation of a Large-aperture Synoptic Survey Telescope (LSST), a 6.5-meter-effective-diameter, very wide field (~3 deg) telescope that would produce a digital map of the visible sky every week, at a total cost of $125 million. Dr. Burns stated that the LSST could locate 90 percent of all NEOs down to 300 meters in size, enable computations of their orbits, and permit assessment of their threat to Earth. Dr. Burns testified that NASA should continue to be involved in ground-based NEO surveys even if the survey goals were extended, because of NASA's experience with ground-based telescopes and because NASA has always been

charged with using ground-based telescopes if they aided space-based missions.

Dr. Marsden testified on the management of data reported daily to the Minor Planet Center of the Smithsonian Astrophysical Observatory regarding the observations of asteroids and comets. NEOs comprise less that one percent of the observations of asteroids as a whole. Dr. Marsden testified that the Minor Planet Center collects reports from around the world of detections of NEOs and other asteroids and comets and publishes confirmed detections electronically in the Minor Planet Electronic Circular. Dr. Marsden stated that augmentation of the Minor Planet Center staff is essential if the number of asteroid discoveries continues to increase, as would be expected with an extension of the NEO survey goals to include objects of smaller sizes. Dr. Marsden testified that most follow-up tracking observations of NEOs are made by amateur astronomers and that the Pete Conrad award, introduced by Subcommittee Chairman Dana Rohrabacher and passed by the House of Representatives as H.R. 5303, would be an encouragement to them. He stated that amateurs also need ready access to electronic equipment to make their work possible. Dr. Marsden testified that attention should also be given to long-period comets, which could pose an even greater risk than asteroids because they are less predictable.

General Worden testified that the U.S. military is developing sensitive surveillance technologies that could serve in a "dual-use" capacity by contributing to the detection of NEOs. Such technology would augment the current efforts of U.S. military telescopes used by NASA in NEO projects such as LINEAR Gen. Worden stated that while developing mitigation strategies for any threatening object discovered should be a high priority, the "command and control" structure is even more important, providing timely coordination of mitigation plans. Gen. Worden stated that the U.S. military could serve in such a coordination role. Gen. Worden testified that infalling asteroids explode in the atmosphere roughly once a month as detected by military surveillance equipment, and that such explosions could be mistaken for a nuclear detonation, sparking an unwarranted international response in times of international tension. He recommended a "clearinghouse" structure for quick worldwide notification when the U.S. military detects such an asteroid impact in the atmosphere.

Appendix

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE
SUITE 2320 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–6301
(202) 225–6371
TTY: (202) 226–4410
http://www.house.gov/science/welcome.htm

March 16, 2001

The Honorable Jim Nussle
Chairman
Committee on the Budget
Washington, DC 20515

Dear Mr. Chairman:

Pursuant to the provisions of clause 4(f) of House Rule X of the Rules of the House of Representatives for the 107th Congress and Section 301(d) of the Congressional Budget Act of 1974, as amended, I am transmitting the Views and Estimates of the Committee on Science for Fiscal Year 2002.

I look forward to working with you and your Committee in developing this year's budget.

Sincerely,

SHERWOOD L. BOEHLERT
Chairman

cc: The Honorable Ralph Hall
The Honorable John Spratt

VIEWS AND ESTIMATES

COMMITTEE ON SCIENCE FOR FISCAL YEAR 2002

BACKGROUND

Science and technology are the keystones of our economic prosperity: Economists attribute much of the Nation's improvement in productivity in recent years to the fruits of research and development (R&D)—and that productivity improvement has fuelled the longest period of economic expansion in our nation's history.

Moreover, science and technology have the potential to cure numerous domestic and global social ills—disease, poverty, hunger, cultural isolation and environmental degradation, to name just a few.

But advances in science and technology do not come cheap or without focused effort; nor are they solely the responsibility of the private sector. Throughout our history, and especially in the years since World War II, the Federal Government has played a fundamental role in underwriting research and development, especially (but not exclusively) basic research at the Nation's universities. This investment, which has a long history of bipartisan support, has paid off with handsome benefits for all Americans.

While the percentage of national R&D sponsored by the Federal Government has declined in recent years, the federal role remains essential. Indeed, as competitive pressures have led many industrial enterprises to focus research on projects with shorter-term benefits, longer-term research depends more than ever on federal support.

None of these assertions is new or unfounded. They are, for example, discussed in the Committee's report *Unlocking Our Future: Toward a New National Science Policy,* prepared by Congressman Vernon Ehlers, at the request of the Speaker, in the 105th Congress.

ISSUES FOR THE 107TH CONGRESS

In the 107th Congress, the Committee intends to continue to build on, and implement the principles in the Ehlers report and similar reports that have underscored the need to invest in R&D.

The Committee will be especially attentive to issues relating to education, energy policy and the environment—three issues central to the Nation in which the science agencies under the Committee's jurisdiction play a significant role.

No research and development agenda will be successful or long-lived without a strong, healthy education system—a system that from kindergarten through graduate school ensures that the Nation has a scientifically literate citizenry and an adequate science and engineering workforce. Currently, our system provides neither. The most recent international surveys show American students lagging behind their foreign counterparts in science, and American performance gets worse the longer students are in school. Moreover, the continuing need to increase the number of H–1B visas is a glaring indication that too few Americans are prepared for jobs that require technical skills.

In his Budget Blueprint, the President rightly acknowledges that the National Science Foundation (NSF) has an important role to play in improving science and mathematics education. The Committee looks forward to working with the Administration and our colleagues in Congress to ensure that NSF has the funding to contribute significantly to federal efforts to improve science and math education.

Energy policy also depends on science and technology—to improve the extraction and efficiency of fossil fuels, and to develop newer, safer, more efficient and more environmentally benign ways to generate and exploit energy. Therefore, the energy supply programs of the Department of Energy must be adequately funded. Those programs also must be reviewed to ensure that they are operating in the most efficient and effective way.

Environmental policy is also—or certainly ought to be—founded on science and technology. Environmental laws and regulations must be based on the soundest and most recent research. In addition, R&D can lead to environmental solutions by developing more environmentally friendly technologies.

The Committee intends to work to improve the quality of environmental research. The Committee will be reviewing the organizational structure of research at the Environmental Protection Agency (EPA). The Committee is pleased to see more agencies, most notably NSF, making a commitment to environmental research—an area in which many fundamental questions remain unanswered.

The Committee will also work to enhance federal research in other fundamental areas, such as information technology, which are important to our economy. The Committee will once again draw on the recommendations of the Congressionally-

chartered President's Information Technology Advisory Committee (PITAC), whose term was recently extended by President Bush.

Finally, the Committee will review the balance within the federal research portfolio, which has become a growing concern as the budget of the National Institutes of Health (NIH) has grown far faster than that of any other science agency. No one would gainsay the contributions of NIH, but nor can anyone deny that scientific progress, even in biomedical fields, depends on advances in a wide variety of disciplines.

The Committee looks forward to working with the Administration and our Congressional colleagues to try to develop ways to determine whether the current portfolio is too heavily weighted toward NIH, and, if it is, to figure out what a balanced portfolio would be.

RECOMMENDATIONS FOR AGENCIES

These recommendations are general because the President's budget document, *A Blueprint for New Beginnings,* understandably, provides only sketchy details at this point for most of the agencies under the Committee's jurisdiction.

SUBCOMMITTEE ON RESEARCH

National Science Foundation

NSF, which the Committee intends to reauthorize this year, funds about 25 percent of the basic research conducted at U.S. universities, and a far higher percentage of the research in selected fields. In addition, NSF funds programs to improve K–12 and undergraduate education, and its fellowships and research assistantships support many graduate and post-doctoral students.

In Fiscal 2001, NSF received a 14 percent increase, the largest dollar increase in its history, and some Members of Congress, on a bipartisan basis, have called for doubling NSF's budget over five years. President Ronald Reagan called for such a doubling in the 1980s.

The Committee is concerned that the Budget Blueprint calls for only a minuscule increase in the NSF budget for FY 2002, and appears to cut funding for research grants and/or research equipment (even in current dollars). While the Committee understands that macroeconomic constraints may prevent NSF from increasing at last year's unprecedented rate, NSF should continue to grow in FY 2002 and future years. The Committee looks forward to working with the Administration, which has expressed support for NSF's mission and programs, to ensure that its funding is commensurate with its importance.

In addition, while the Committee is gratified that the President has recognized the essential work of NSF in improving science and mathematics education, the Committee believes that greater funding may be necessary to carry out that mission. The Administration has recommended spending $200 million on a program of new grants for partnerships among states, universities and school districts—a promising approach. However, the proposal includes only $90 million in new funding, and the Committee awaits with interest the specific proposal for redirecting current education spending at NSF.

The Committee is pleased that the Administration will be reviewing NSF programs to determine the optimal grant size and duration, and to improve management of large projects.

Federal Emergency Management Agency—United States Fire Administration

The Fire Administration helps localities improve their ability to prevent, control and extinguish fires. The enacted authorization level (P.L. 106–503) for the Fire Administration programs within the Committee's jurisdiction for FY 2002 is $47.8 million.

National Earthquake Hazards Reduction Program (NEHRP)

NEHRP is an interagency program led by the Federal Emergency Management Agency and including NSF, the National Institute of Standards and Technology, and the U.S. Geological Survey. The program is credited with reducing the loss of life and property from earthquakes through improving emergency response, knowledge of earthquake risks, and earthquake engineering. Most states face at least some risk from earthquakes.

The enacted authorization level (P.L. 106–503) for NEHRP for FY 2002 is $108.5 million for the base program, with additional authorizations for multi-year efforts to create and operate the Advanced National Seismic Research and Monitoring System, to create the George E. Brown, Jr. Network for Earthquake Engineering Sim-

ulation, to study the New Madrid fault, which threatens the eastern half of the United States; and to fund a Scientific Earthquake Studies Advisory Committee at the Geological Survey.

SUBCOMMITTEE ON ENVIRONMENT, TECHNOLOGY, AND STANDARDS

Environmental Protection Agency (EPA)

The Committee has jurisdiction over EPA research and development funded in three appropriations accounts: Environmental Programs and Management, including the Science Advisory Board; Science and Technology, including Superfund R&D; Leaking Underground Storage Tank R&D; and Oil Spill Research; and State and Tribal Assistance Grants (Clean Air Partnership Demonstration Fund).

The Budget Blueprint provides no indication of funding levels for EPA's R&D programs, although it does, encouragingly, state that "EPA intends to improve the role of science in decision-making." The Committee looks forward to working with the Administration to accomplish this, both by reviewing the organizational structure of R&D at EPA, and by ensuring adequate funding for R&D programs. In doing so, the Committee will draw heavily on the National Research Council's report *Strengthening Science at the U.S. Environmental Protection Agency,* published last year.

National Oceanic and Atmospheric Administration (NOAA)

The work of NOAA, which accounts for more than half of the Department of Commerce's budget, affects every American, particularly through the National Weather Service.

The Committee is pleased that the Budget Blueprint calls for an increase in funding for NOAA overall and increased funding of $83 million to continue procurement of the next generation of weather satellites. The Committee also notes the Administration's stated intention to reallocate funds within NOAA "to ensure that funds are targeted to the highest priority environmental needs." The Committee awaits, with interest, the specific details of the proposed reallocation.

The Committee believes that the Nation must vastly increase its knowledge and understanding of the atmosphere, oceans and climate—areas of research in which progress has been made in recent years, largely because of the increased availability of technology. The Committee looks forward to working with the Administration to ensure that research progress continues apace.

Department of Commerce—Technology Administration

The Budget Blueprint provides few indications about plans for the programs under the Technology Administration, which the Committee created in 1988 (P.L. 100–48).

First priority must be given to enhancing the Scientific and Technical Research and Services account of the National Institute of Standards and Technology (NIST). As NIST celebrates its 100yh anniversary, its laboratory programs, which help industry compete at home and abroad, are more important than ever.

The Committee also continues to support the Manufacturing Extension Partnership, which helps smaller manufacturers modernize to remain competitive.

Finally, the Committee looks forward to working with the Administration as it reviews the Advanced Technology Program (ATP). The Committee hopes that ways can be found to structure ATP so it can continue to be a catalyst for innovation without being an ideological lightning rod. One possible approach would be to increase the role of the states in ATP.

National Technical Information Service (NTIS)

The Committee looks forward to working with the Administration to determine the best method to enable NTIS to inform the public as a self-sustaining entity.

Department of Transportation—Surface Transportation Research and Development

The Committee looks forward to working with the Administration to ensure that adequate funding is provided for this account. In particular, the Committee is interested in steps that would increase the use of alternative fueled vehicles.

SUBCOMMITTEE ON ENERGY

Department of Energy (DOE)

The Committee has jurisdiction over DOE's civilian energy research, development, and demonstration programs and commercial application of energy technology activities.

The Committee is concerned that the Budget Blueprint contains a three percent cut in DOE's budget from FY 2001 levels. However, it is impossible to analyze the implications of this proposal without further details.

The Committee is particularly concerned about the future of the Office of Science, which funds user facilities and academic research. In recent years, many user facilities have had to cut back their hours because of funding limitations, idling investments that have cost taxpayers billions. In addition, the Committee believes that money must be budgeted now to address the aging of many DOE facilities and staff. The Committee continues to closely monitor the construction of the Spallation Neutron Source at Oak Ridge National Laboratory to ensure that it remains on schedule and budget.

The Committee is pleased that the Budget Blueprint calls for increased spending on solar and renewable energy research. However, the Committee believes that this increased spending should occur regardless of the fate of the Administration's proposal to open up the Arctic National Wildlife Refuge to drilling. Energy conservation and efficiency programs also must be part of a comprehensive energy policy.

The Committee is also pleased that the Budget Blueprint calls for reforms and investment in the Clean Coal program. The Committee awaits, with interest, the details of these proposals. The Committee believes the Nation requires a balanced energy supply research portfolio with healthy funding for coal, oil, nuclear and renewable energy sources, as well as energy efficiency and conservation.

The Committee shares the Administration's concerns about DOE contract management, and its plans to review DOE cost-sharing policies. The Committee is pleased with the Administration's praise for the program devoted to advanced automotive R&D.

SUBCOMMITTEE ON SPACE AND AERONAUTICS

National Aeronautics and Space Administration (NASA)

The Budget Blueprint includes a two percent increase for NASA for FY 2002, but it is difficult to assess the adequacy of that request without further details.

Of greatest concern is the future of the International Space Station. The Committee continues to support development of the Space Station within the $25 billion development cap enacted into law last year (P.L. 106–391). The Committee applauds the Administration for reviewing the costs of the Space Station and for its commitment to solving the Space Station's funding problems within the Human Space Flight appropriations accounts. However, the Committee remains concerned that the proposed steps to contain the Space Station's cost growth may prove inadequate to addressing a $4 billion problem. The Committee is especially concerned that NASA does not seem to have any milestones or contingency plans to evaluate the success of its redesign proposals or to respond if the redesign saves less money than expected. Moreover, the redesign plans could create troubles of their own. For example, reducing or eliminating work on the propulsion module and Crew Return Vehicle may prolong U.S. dependence on Russia for critical Station functions. The Committee awaits additional detail from the Administration on its plans to address these issues and to preserve a viable research program on a redesigned Space Station.

The Committee agrees with the Administration's commitment to safe operation of the Space Shuttle and its intention to move forward with Space Shuttle safety upgrades.

The Committee appreciates the Administration's commitment to space and earth science, particularly its decision to ensure that the Mars exploration program and the second generation of Earth Observing Satellites are adequately funded. The Committee, noting the cancellation of the Pluto-Kuiper Express, believes that NASA should develop an integrated science strategy for exploring the outer planets.

The Committee is concerned by the indication that aeronautics programs will be cut, continuing a baleful trend. The Committee urges the Administration to quickly appoint the Commission on the Future of the Aerospace Industry called for in the Defense Authorization Act for fiscal 2001 (P.L. 106–398).

The Committee endorses the principles laid out in the Budget Blueprint for the Space Launch Initiative.

The Committee looks forward to working with the Administration as it reviews ways to strengthen NASA's "critical capabilities."

The enacted authorization level for NASA for FY 2002 (P.L. 106–391) is $14,625,400.

Federal Aviation Administration (FAA)

The Committee looks forward to working with the Administration to develop an integrated R&D strategy for aeronautics. This will require an increased investment

in research and development, both to ensure the health of the U.S. aeronautics industry—which, from its infancy, has drawn on federally supported R&D—and to resolve the growing problems in air traffic control. Our nation's competitors, especially European governments, are making such an investment. If action is not taken now, the Nation will face a future crisis. Already, the average age of U.S. aeronautical engineers is reaching the upper 40s and a lack of domestic wind tunnels is driving U.S. engineers to rent time in European research facilities.

The Committee calls on the Administration to allow modest growth in the Office of Commercial Space Transportation to meet the goals of the Commercial Space Transportation Competitiveness Act of 2000 (P.L. 106–405). That law authorizes $16,478,000 for the Office in FY 2002.

Department of Commerce—Office of Space Commercialization

The Committee urges continued funding of this office, which has played a useful role in promoting the commercialization of space, working with private industry, and making the best use of the Global Positioning System. P.L. 106–405 authorizes $608,000 for the Office in FY 2002.

Signatures for Committee on Science Views and Estimates

The Honorable Sherwood L. Boehlert
Chairman

The Honorable Lamar S. Smith

The Honorable Constance A. Morella

The Honorable Christopher Shays

The Honorable Curt Weldon

The Honorable Dana Rohrabacher

The Honorable Joe Barton

The Honorable Ken Calvert

The Honorable Nick Smith

The Honorable Roscoe G. Bartlett

The Honorable Vernon J. Ehlers

The Honorable Dave Weldon

The Honorable Gil Gutknecht

The Honorable Chris Cannon

The Honorable George R. Nethercutt, Jr.

The Honorable Frank D. Lucas

Committee on Science Views and Estimates

The Honorable Gary G. Miller

The Honorable Judy Biggert

The Honorable John Abney Culberson

The Honorable W. Todd Akin

The Honorable Timothy V. Johnson

The Honorable Mike Pence

The Honorable Felix J. Grucci, Jr.

The Honorable Melissa A. Hart

Committee on Science Views and Estimates

The Honorable Ralph M. Hall
Ranking Minority Member

The Honorable Bart Gordon

The Honorable Jerry F. Costello

The Honorable James A. Barcia

The Honorable Eddie Bernice Johnson

The Honorable Lynn C. Woolsey

The Honorable Lynn N. Rivers

The Honorable Zoe Lofgren

The Honorable Nick Lampson

The Honorable Bob Etheridge

The Honorable Sheila Jackson-Lee

The Honorable John B. Larson

The Honorable Mark Udall

The Honorable David Wu

The Honorable Anthony D. Weiner

The Honorable Brian Baird

Committee on Science Views and Estimates

The Honorable Joseph M. Hoeffel

The Honorable Joe Baca

The Honorable Jim Matheson

The Honorable Steve Israel

The Honorable Dennis Moore

MINORITY ADDITIONAL VIEWS
FY 2002 VIEWS AND ESTIMATES
TO THE HOUSE BUDGET COMMITTEE
MARCH 16, 2001

Introduction

Like last year, it is difficult to take a position on the Majority's Views and Estimates for FY 2002 since the report fails to meet its legislative mandate of providing a five-year funding recommendation for agencies under our jurisdiction. Perhaps the majority's lack of detail reflects the lack of specificity in the President's budget document *A Blueprint for New Beginnings*. Despite its failings, however, many of us signed the Majority's Views and Estimates to show support for our new Chairman, and because the content of that report was both inoffensive and generally pointed in the right direction.

However, our deference to the Chairman should not be viewed as indifference to the fate of Federal research funding. What we know of the new Administration's budget concerns us. We are pleased to see a healthy increase for NIH in the request. Defense basic research may also fare well once the final budget is submitted. But the numbers available on NSF and NASA cause us deep concern. Neither of these premier science agencies receives a requested increase that even keeps pace with inflation. Lest some view our reaction to this request as overly partisan, we will rely on the reaction of another New York Republican to summarize our view: James Walsh, the House VA–HUD–IA Appropriations Subcommittee Chairman, dismissed the NSF request as falling surprisingly far short fiscally.

Almost three years ago, the Majority released the oft-cited Science Policy Study. That document says that ". . .to build upon the strength of the research enterprise we must make federal research funding stable and substantial." What that document didn't say is whether that steady and substantial funding should trend upwards or downwards in absolute terms over time. After all, a Federal research portfolio which slowly declines from $90 billion to $80 billion does show a steady and substantial funding profile. Unfortunately, the Majority's Views add no clarification to the vague language of that report. Such ambiguity and indecision, in the newly tightened budget climate, is dangerous.

We want to clearly state that we believe—along with such diverse sources as Allen Bromley, Federal Reserve Chairman Alan Greenspan, Andy Grove of INTEL, and the Hart-Rudman Commission on National Security—that Federal funding for research is a necessary precondition for continued economic success and security in our high technology economy. We also believe that funding for our science agencies—all of our agencies, not just a select set—must be increased.

National Science Foundation

In light of the essential role research plays in driving the economy and serving national security, it is disappointing that the Administration's requests for NSF and other civilian science agencies (with the exception of NIH) are at or below appropriations levels for the current fiscal year. For NSF, the budget request proposes a total increase of only $56 million (1.3 percent), and all of that and more goes to education programs rather than research. Adjusted for inflation, this request will result in a three to four percent decline in NSF's budget for competitive research grants.

Within this declining budget, NSF is instructed to launch a $200 million initiative in science education, introduce a new program in mathematics research, and maintain existing research initiatives in information technology, bio-complexity and nanotechnology. The core, discipline-based research programs at NSF will be eroded both by inflation and by these new initiatives.

Of course, the Majority understands the importance of Federally supported research and no doubt agrees that NSF plays a vital role in support of basic research and education across all fields of science and engineering. Unfortunately, their budget guidance fails to follow through. We were surprised that the Majority did not recommend a robust funding level for NSF. At a bare minimum we believe they could advocate a funding increase for the Foundation that keeps pace with inflation for all the programs at the agency.

Vowing to work with the Administration to ensure that funding is in line with the agency's importance is an inadequate position in a document that will guide the Budget Committee in its mid-March markup of a Budget Resolution. We too will work with the Administration, but we believe it is necessary to increase the NSF budget for FY 2002 by at least 15 percent to enable the Foundation to carry out adequately its vital role in support of science and engineering education and re-

search. We agree with Dr. D. Allen Bromley, former President Bush's science advisor from 1989–1993, who made the following statement regarding the Administration's FY 2002 funding request in a March 9 *New York Times* op-ed:

> "The Bush budget includes cuts, after accounting for inflation, to the three primary sources of ideas and personnel in the high-tech economy: NSF is cut by 2.6 percent, NASA by 3.6 percent, and the Department of Energy by an alarming 7.1 percent. The proposed cuts to scientific research are a self-defeating policy. Congress must increase the federal investment in science. No science, no surplus. It's that simple."

National Aeronautics and Space Administration

With regard to the National Aeronautics and Space Administration there are several points that need to be made if the Budget Committee is to have a proper context for its deliberations. We would note that the proposed percentage increase in NASA's funding level is *half* the average increase proposed for the Federal Government's discretionary accounts. This increase, which is lower than inflation, when coupled with the dismal requests for other civilian R&D agencies, sends a negative message about the relative priority that the Administration attaches to Federal investments in cutting-edge research and development.

It is discouraging that the Administration is intent on cutting NASA's aeronautics programs, would eliminate two planned space science projects (the Pluto-Kuiper Express and Solar Probe missions), discontinue remote sensing and environmental applications projects, and "reduce" information technology programs. No convincing rationale for those cuts is provided other than the implicit one of attempting to meet an artificially low funding level for NASA as a whole. The Administration's budget request proposes making significant changes to the International Space Station program. We strongly believe that the Administration needs to ensure that any actions taken to mitigate the effects of cost growth do not wind up undermining the utility of the research facility in which we have invested so many taxpayer dollars. At a minimum, we would advise the Budget Committee to provide a budget increase to NASA that tracks the rate of technical inflation.

Other Agencies

What we are hearing about the treatment of research accounts at the Department of Energy and Interior also concerns us. The budget lacks much detail on these areas, but rumors of cuts up to 20 percent seem to be dominating the specialized press for these agencies.

One specific example that has received wide treatment in the press can be found in the reports of a seven percent cut to the renewable and efficiency energy research programs at the Department of Energy. Such a step would be an unwise approach to reducing our dependence on foreign oil and diversifying our energy production portfolio. The Bush budget and the Majority Views claim an increase in this account, but it would not materialize until FY04 and then only under the far-from-certain scenario of oil extraction from the Arctic National Wildlife Refuge. We would ask the Budget Committee to recommend that these programs continue to grow at a rate equivalent to that approved by the Republican Congress over the past several years.

Conclusion

Finally, many in the science and education community have begun to ask whether there is an "imbalance" in our research portfolio, with too much funding being concentrated in the biomedical sciences. The Administration, by flat funding NSF while moving NIH along the path towards its five-year doubling goal, exacerbates this problem. We don't pretend to know what the exact balance among science investments should be, but our intuitive sense is that there is already an imbalance, and making it worse is not a productive step.

The Majority's promise to work with the Administration to see **"if"** the portfolio is too heavily weighted toward the NIH is too weak. Frankly, this is a step back from last year's views, when the Majority condemned an over-investment in biomedical work to the exclusion of other fields. The FY 2001 Committee Views stated that "contributions of computer science, physics, mathematics, engineering and other fields to biomedical research illustrate the need to secure funding for fundamental science as part of the Federal Government's overall research agenda." This language is more in keeping with our views.

We stand ready to work with the Majority in the effort to educate the new Administration on the importance of Federal R&D to our economic vitality and national security. We stand ready to engage the Administration in an ongoing dialogue about the best way to invest in the future of our nation. However, we know that the Budg-

et Committee cannot wait for that day when the Administration comes to understand the obvious—that R&D is the lifeblood of innovation and underlies economic growth. Therefore, we have tried to provide at least minimal guidance on how to responsibly treat civilian research accounts in the FY 2002 budget.

Ralph M. Hall, MC
Bart Gordon, MC
Jerry F. Costello, MC
James A. Barcia, MC
Eddie Bernice Johnson, MC
Lynn C. Woolsey, MC
Lynn N. Rivers, MC
Zoe Lofgren, MC
Sheila Jackson Lee, MC
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Anthony D. Weiner, MC
Brian Baird, MC
Joseph M. Hoeffel, MC
Joe Baca, MC
Jim Matheson, MC
Steve Israel, MC
Dennis Moore, MC

Joe Baca

THE HONORABLE JOE BACA
ADDITIONAL VIEWS
FY 2002 VIEWS AND ESTIMATES
TO THE HOUSE BUDGET COMMITTEE
March 14, 2001

I am concerned that the President's proposed budget will cut funding for science and technology programs, costing us good, well-paying jobs – jobs that are created by small businesses in the new Global Economy.

I am concerned about proposed reductions in programs such as the Advanced Technology Program and the Manufacturing Extension Partnership of the National Institute of Standards and Technology (NIST). Cuts in these programs will affect our Nation's competitiveness.

The National Institute of Standards and Technology is our Nation's oldest Federal laboratory, with a mission that dates back to the founding of our Republic. NIST employs about 3,300 people, with some of our Nation's finest and most dedicated Federal scientists, including Nobel Prize winners.

In the past 100 years, NIST has helped to maintain United States technology at the cutting edge, while also making contributions to our economy and international competitiveness. Many advances can be traced to the assistance of the National Institute of Standards and Technology, including satellite systems, communication and transportation networks, image processing, DNA diagnostic `chips', smoke detectors, automated error correcting software for machine tools, atomic clocks, X-ray standards for mammography, scanning tunneling microscopy, pollution control technology, high-speed dental drills, laboratories, factories, hospitals, businesses, and the extended enterprises of the new economy.

I am also troubled by potential proposed cuts in other science programs, such as an apparent decision to cut the Energy Department's budget to $19 billion, roughly $700 million below current levels. At a time when our states, including California, are facing great challenges in providing sufficient energy, and at reasonable prices, we should not be cutting funding for programs, such as those which explore renewable energy sources.

America has been on a course of jobs and prosperity, developed by the hard work of the American people over the last eight years. We should not change course. We still have much work to do in our communities, to encourage research and development, foster small business development, launch new high-tech revolutions. We must create new jobs, provide educational opportunities, ensure that all who are willing to work can advance.

Therefore, as the Congress celebrates this year the centennial of NIST and its proud traditions, let us resolve not unilaterally to disarm our nation of the finest minds and resources, which have led to an economic and technological renaissance. Our nation is the admiration of the modern world. People come here to learn in our universities, work in our corporations, and find a better life. Let us resolve to continue our fight to keep America number-one in scientific innovation and job creation.

Judy Biggert
The Honorable Judy Biggert

ADDITIONAL VIEWS AND ESTIMATES OF REPRESENTATIVE JUDY BIGGERT

While I share the views of the Science Committee as outlined in its views and estimates for Fiscal Year 2002, I wanted to take this opportunity to emphasize an issue of particular importance to me.

Scientific research may not be as politically popular as health care and education right now, but science is as important to progress in these two areas as it is to America's continued economic growth and national security. It is for this reason that I believe Congress must maintain the federal government's commitment to scientific research and development by increasing funding for the Department of Energy's (DOE) Office of Science.

Economic experts maintain that today's unprecedented economic growth would not have been possible were it not for the substantial investment in research made by the public and private sectors over the past several decades. For America to continue to benefit from this kind of investment, we must provide strong financial support for basic research across all of the scientific disciplines – including the DOE's Office of Science.

The Office of Science is the nation's primary supporter of the physical sciences, providing an important partner and key user facilities in the areas of physics, mathematics and advanced computing, chemistry, geology, biology, environmental sciences, and engineering. The Office of Science supports a unique system of programs based on large-scale, specialized user facilities and large teams of scientists focused on national priorities.

This makes the Office of Science unique among, and complementary to, the scientific programs of many other federal science agencies, including the National Institutes of Health (NIH) and the National Science Foundation (NSF). I applaud the strong support shown by Congress in recent years for research conducted within the NIH and NSF, and I commend President Bush for supporting efforts to double NIH funding by 2003.

This level of support should be extended to DOE's Office of Science because future medical breakthroughs depend on fundamental advances in the physical sciences and other research conducted by the Office of Science. One recent example is the Human Genome Project, which progressed so rapidly because of advanced computing technology and biological technology pioneered by the DOE Office of Science. Harold Varmus, former director of the NIH, said, and I quote, "Medical advances may seem like wizardry. But pull back the curtain, and sitting at the lever is a high-energy physicist, a combinational chemist, or an engineer."

Unfortunately, the reality of the situation is that while federally supported medical research like that conducted by NIH has skyrocketed, funding for research in the physical sciences has remained stagnant. During the past decade, funding in constant dollars for the DOE Office of Science was reduced by approximately 13 percent.

It is the research itself that has been most significantly impacted, since the costs of maintaining existing facilities and their associated staffs continue to rise with inflation. This has prevented the Office of Science from fully participating in technical areas important to DOE's statutory mission, such as high performance computing and nanotechnology.

This erosion of resources has also reduced the number of scientists and students conducting physical science research at DOE's national user facilities and America's colleges and universities. This aspect alone could have a disastrous long-term effect.

Already, doctoral candidates are choosing life sciences over physical sciences. In 1999, the number of doctorates awarded in science and engineering was the lowest figure in six years. This trend is reflected in undergraduate degrees as well, which over the past decade have declined significantly.

Doubtless this exacerbates a shortage of highly skilled labor, posing a serious dilemma for academia, business, and government leaders alike because of the potential effect it could have on America's continued economic growth.

This shift in human capital and resources to the life sciences has had a dramatic impact on America's ability to engage in cutting edge physical sciences research. It also poses a threat to our national security, but you don't have to take my word for it.

According to the Hart-Rudman Report on National Security, and I quote "...the U.S. government has seriously underfunded basic scientific research in recent years. The quality of the U.S. education system, too, has fallen well behind those of scores of other nations. **...the inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine."**

The report goes on to recommend doubling the federal government's investment in science and technology research and development by 2010. While I understand that it may not be practical to double the federal research and development budget this year, I believe Congress should take the necessary steps to move in that direction. One of the first steps should be to increase federal funding for the research and development conducted by the DOE Office of Science.

The Budget and Science Committees are key to taking that first step forward. By recommending that the Office of Science receive a substantial FY 2002 budget increase, these Committees can begin to reverse this troubling situation and help the DOE attract the best minds, support the maintenance and construction of modern facilities, and continue to provide the quality of scientific research that has been its trademark for so many years.

I look forward to working with the Budget and Science Committees, the administration, and the DOE to ensure adequate funding and continued oversight of the DOE Office of Science. Congress must continue to support the research that has been crucial to America's economic success, national security, and the health and education of its people.

Connie Morella

SUPPLEMENTAL VIEWS
VIEWS & ESTIMATES
SUBMITTED BY
CONSTANCE A. MORELLA
COMMITTEE ON SCIENCE
FISCAL YEAR 2002
MARCH 15, 2001

It is my understanding that the Committee's Views and Estimates do not call for the lessening of funding to the National Institutes of Health (NIH). However, to clarify this point, I wish to go on record as supporting the current funding path for NIH and recognize the many accomplishments made in biomedical research due to increased federal funding. I look forward with working with Chairman Boehlert, the Administration, and our other Congressional colleagues to develop ways to significantly increase funding for all basic science research programs.

Congress of the United States
Washington, DC 20515

SUPPLEMENTAL VIEWS
VIEWS & ESTIMATES for FISCAL YEAR 2002
COMMITTEE ON SCIENCE

MARCH 16, 2001

We are concerned about the state of the facilities of NIST's laboratories in my district in Boulder, Colorado.

In 1950, NIST established a cryogenic engineering laboratory and radio facilities on land donated by citizens of Boulder. NIST's Boulder facilities were expanded in the mid-1960s, when NIST and the University of Colorado (CU) joined forces to create the Joint Institute for Laboratory Astrophysics (JILA), a cooperative effort that has gained widespread recognition in atomic physics and other fields and that has yielded numerous amazing discoveries.

NIST's Boulder scientists have received the Nobel Prize in Physics and other internationally prestigious awards in recognition of their work. But the real distinction of NIST's Boulder labs is that its scientists have made such important scientific discoveries in an increasingly substandard working environment. As the Boulder facility approaches its 50th anniversary, we believe it is important for this Committee to recognize its distinct contribution to NIST's overall mission.

Last year NIST celebrated the completion of the Advanced Chemistry Science Laboratory at its Gaithersburg campus. After an $80 million investment, NIST can now boast another world-class facility in which to conduct more world-class research. Also at Gaithersburg just last year, ground was broken for the Advanced Measurement Laboratory, which has projected costs of over $200 million.

Now that Gaitherburg's needs have been addressed, NIST's Boulder campus is next in line to receive critical funding for construction and maintenance projects – this according to NIST's published plans listing construction and maintenance project priorities for the labs.

When visiting NIST's Boulder labs on March 9, Commerce Secretary Don Evans reportedly did not commit to fixing the problems at NIST, but did say his department needs to take care of "core needs" such as the ones at NIST.

We think it is essential that the Administration recognize the value of the Boulder labs' contributions and the necessity of upgrading the facilities so that the Boulder scientists can continue to produce top-flight research. NIST's Boulder campus has done much for Colorado and for the nation – and it can continue to do so. But to get the full value from this asset, we must invest properly in its upkeep.

Rep. Mark Udall

Rep. Vernon Ehlers

Rep. James Barcia

Rep. Constance Morella

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U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE
SUITE 2320 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–6301
(202) 225–6371
TTY: (202) 226–4410
http://www.house.gov/science/welcome.htm

March 25, 2002

The Honorable Jim Nussle
Chairman
Committee on the Budget
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Pursuant to the provisions of clause 4(f) of House Rule X of the Rules of the House of Representatives for the 107th Congress and Section 301(d) of the Congressional Budget Act of 1974, as amended, I am transmitting the Views and Estimates of the Committee on Science for Fiscal Year 2003.

Sincerely,

SHERWOOD L. BOEHLERT
Chairman

SLB/vt
Enclosure

cc: The Honorable Ralph Hall
The Honorable John M. Spratt, Jr.

VIEWS AND ESTIMATES OF THE
COMMITTEE ON SCIENCE FOR FISCAL YEAR 2003

BACKGROUND

Science and technology are the keystones of our economic prosperity and national security.

Economists attribute much of the Nation's improvement in productivity in recent years to the fruits of research and development (R&D)—and that productivity improvement fueled the longest period of economic expansion in our nation's history.

Advancements in science and technology were also critical to the Nation's ability to triumph in the Cold War. (Indeed, Cold War-era investments in science and technology, especially those made in the wake of the Soviet launch of Sputnik, laid much of the foundation for the broad, successful scientific and engineering enterprise the U.S. boasts today.) New ideas, understandings and technologies spawned by research and development are likely to be just as essential to winning the war against terrorism.

Moreover, science and technology have the potential to cure numerous domestic and global social ills—disease, poverty, hunger, cultural isolation and environmental degradation, to name just a few.

But advances in science and technology do not come cheap or without focused effort; nor are they solely the responsibility of the private sector. Throughout our history, and especially in the years since World War II, the Federal Government has played a fundamental role in underwriting research and development, especially (but not exclusively) basic research at the Nation's universities. This investment, which has a long history of bipartisan support, has paid off with handsome benefits for all Americans.

While the percentage of national R&D sponsored by the Federal Government has declined in recent years, the federal role remains essential. Indeed, as competitive pressures have led many industrial enterprises to focus research on projects with shorter-term benefits, longer-term research depends more than ever on federal support.

None of these assertions is new or unfounded. They are, for example, discussed in the Committee's report *Unlocking Our Future: Toward a New National Science Policy,* prepared by Congressman Vernon Ehlers, at the request of the Speaker, in the 105th Congress.

INTERAGENCY ISSUES FOR THE 107TH CONGRESS—Second Session

In the second session of the 107th Congress, the Science Committee will continue to focus on its three top priorities—mathematics and science education, energy policy and the environment—as well as coming up with new approaches to fighting the war against terrorism and undertaking an in-depth review of the space program. Most of the Committee's concerns and interests in these and other areas are captured in the agency-by-agency discussion in the next section. But three sets of central concerns that cut across agency lines need to be reviewed first.

Presidential Initiatives

The Administration's budget highlights four "multi-agency R&D priorities"—work on anti-terrorism, networking and information technology, nanotechnology, and climate change. (*Analytical Perspectives,* p. 164) The Committee strongly endorses these initiatives, and agrees that they deserve priority in funding.

The Administration is still developing its procedures for developing, managing, prioritizing, and categorizing anti-terrorism R&D. This is understandable given how quickly the United States has had to change its focus since September 11th. The Committee looks forward to working with the Administration in putting together a portfolio of anti-terrorism R&D that addresses a wide range of threats in both the long- and short-term. (The Committee's own initiatives in this area are discussed below.)

The Administration proposes a three percent increase for the interagency program on Networking and Information Technology (NITRD). The Committee believes this is the bare minimum the program needs. The Committee, by voice vote, late last year approved H.R. 3400, which would provide the NITRD agencies under our jurisdiction with $35 million more in Fiscal Year (FY) 03 than the Administration has requested. Under the bill, which is based on the recommendations of the President's Information Technology Advisory Committee (PITAC), spending on the Committee's NITRD agencies would increase from $1.076 billion in FY02 to $1.157 billion in FY03 to $1.688 billion in FY07.

The Administration proposes increasing spending on nanotechnology by 17 percent. This promising, broadly applicable technology field merits the additional

spending. The Committee may address nanotechnology R&D in legislation later in the year.

The Administration proposes two new initiatives designed to address climate change, over and above the ongoing U.S. Global Change Research Program—$40 million for a Climate Change Research Initiative, designed to address questions most relevant to policy-makers; and $40 million for a National Climate Change Technology Initiative. While the details of the initiatives remain to be worked out, the Committee supports this new, focused effort. The Committee plans to reauthorize the U.S. Global Change Research Program this year.

Anti-terrorism R&D

Just like the Cold War, the war against terrorism will be won in the laboratory as much as on the battlefield. While some R&D must be devoted to finding short-term solutions to immediate concerns, the Nation must invest in long-term R&D to develop new approaches to both current and future threats. The Committee approved two bills last year designed to do just that, and is committed to see the programs created by them receive adequate funding.

The Committee, by voice vote, approved H.R. 3394, the Cyber Security Research and Development Act, in December, and the House passed the bill by a vote of 400–12 in February. The bill would establish new research initiatives at both the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST) designed to come up with innovative approaches to computer security, and to draw more senior researchers and students into the field. For FY03, the bill authorizes $73 million for NSF and $32 million for NIST.

The Committee also approved, by voice vote, H.R. 3178, the Water Infrastructure Security and Research Development Act, which the House passed by voice vote. The bill authorizes $12 million in FY03 for R&D related to water security at the Environmental Protection Agency.

Balance in the Federal Research Portfolio

While the Committee believes that the Administration has chosen the appropriate priorities for the federal R&D budget, it is nonetheless concerned that the biomedical sciences, in general, and the National Institutes of Health (NIH), in particular, are growing out of all proportion to any other element of the R&D budget. Indeed, just the increase proposed for the NIH in FY03 is larger than the entire proposed research budget for NSF. While the Committee supports the doubling of NIH, it is concerned that unless the needs of other agencies are addressed, many scientific opportunities will be missed and even health research itself will be retarded.

Similarly, while Defense Department development programs are critical to our national security, those programs alone cannot create a stable and secure American society or even ensure our protection from enemy attacks over the long-term. Yet while the Pentagon is slated to receive a 12 percent increase, basic and applied research in the Defense Department are flat, and numerous programs in other agencies that unarguably contribute to Homeland Security receive tepid increases.

The Committee will continue to review the balance within the federal research portfolio. The Committee looks forward to working with the Administration and our Congressional colleagues to develop ways to determine whether the current portfolio is too heavily weighted toward NIH, and, if it is, to figure out what a balanced portfolio would be.

RECOMMENDATIONS FOR AGENCIES

SUBCOMMITTEE ON RESEARCH

National Science Foundation (NSF)

The National Science Foundation funds about 25 percent of the basic research conducted at U.S. universities, and a far higher percentage of the research in selected fields. NSF funds basic research across nearly all disciplines of science and engineering, making NSF-supported research integral to progress in priority areas such as health care and national security, among others. In addition, NSF funds programs to improve K–12 and undergraduate education, and its fellowships and research assistantships support many graduate and post-doctoral students.

The FY03 budget request for NSF is $5.04 billion, $239.91 million—or five percent—over the FY02 appropriation. However, $76 million of the increase does not represent new spending, but rather is existing funding associated with three programs the Administration proposes to transfer to NSF—the Sea Grant program, now at the National Oceanographic and Atmospheric Administration (NOAA); hy-

drology programs now at the U.S. Geological Survey (USGS); and certain environmental education programs, now at the Environmental Protection Agency (EPA).

The transfers are unlikely to occur, and, in any event, none of the transferred money would be available to strengthen existing NSF programs or create new ones. After subtracting the transfers, NSF is left with an actual proposed increase of about 3.4 percent—or about one percent above inflation. This is not a significant increase for an agency charged with ensuring the overall health of the Nation's university research enterprise—an agency that the Office of Management and Budget (OMB) has held up as a model of good management.

The Committee believes that NSF needs an increase (exclusive of any transfers) of at least $420 million, or 8.8 percent, over FY02 levels. This request would increase funding for NSF's core science programs, enabling NSF to begin funding highly ranked grant proposals that are turned down solely for lack of funding; fully fund K–12 education programs that have been authorized by the House; and would fund large facility projects that have already been approved by the National Science Board.

Education and Human Resources

The Committee is pleased that the budget request for NSF's education programs reflects a continued commitment to the Mathematics and Science Partnership program, requested at $200 million. The Committee thus fully supports this request, which was authorized by H.R. 1858, the National Mathematics and Science Partnerships Act, which the House passed by voice vote last year.

The Committee is also pleased to see that two other programs authorized by H.R. 1858, the Noyce Scholarship Program and the Digital Library Program, are included in the budget request, albeit at lower levels than authorized. The Committee will continue to push for full funding of these efforts.

In addition, the Committee is encouraged to see funding for the Tech Talent Program (referred to as the Science Technology, Engineering and Mathematics Talent Expansion (STEP) Program), which would be authorized by H.R. 3130, the Tech Talent Act, which the Committee plans to approve this spring.

The Committee fully supports the proposed increase in graduate fellowship stipends from $21,500 to $25,000 in the current budget request.

Federal Emergency Management Agency (FEMA)—United States Fire Administration (USFA)

The U.S. Fire Administration helps localities improve their ability to prevent, control and extinguish fires. The enacted FY03 authorization level (P.L. 106–503) for the Fire Administration's Fire Prevention and Control programs is $50.0 million; the FY03 budget request is $40.7 million. This represents a decrease of $9.6 million from the FY02 Current Estimate of $50.3 million.

In addition to the Fire Prevention and Control Act programs authorized in P.L. 106–503, the FY01 Defense Authorization Act (P.L. 106–398) authorized the Assistance to Firefighters Grant Program (administered by USFA) to provide direct assistance to local fire departments for training, purchase of equipment, and other purposes. The FY02 Defense Authorization Act (P.L. 107–107) increased the authorization for this program to $900 million per year through FY04, and expanded its scope to include grants for equipment and training to help firefighters respond to a terrorist attack or an attack using weapons of mass destruction. In FY02, this program received $150 million through the Veteran's Administration, Housing and Urban Development and Related Agencies Appropriation (P.L. 107–73) and an additional $210 million through the Department of Defense (supplemental) Appropriations Act (P.L. 107–117), for a total of $360 million.

In the Administration's FY03 budget request, the Assistance to Firefighters Grant Program is incorporated into a FEMA-wide $3.5 billion National Preparedness Program. (The grant program is still expected to give out an estimated $164.8 million in awards in FY03, nonetheless, using unspent FY02 funds.) While the details of the National Preparedness Program are not yet in place, the Committee is concerned that these funds may be distributed in a manner that reduces the dollars that fire departments receive as states take a share of the funds for themselves or focus on other responders. The Committee strongly recommends that the Assistance to Firefighters awards continue to be awarded directly to local career and volunteer fire departments through the current competitive process.

National Earthquake Hazards Reduction Program (NEHRP)

NEHRP is an interagency program led by FEMA and including NSF, the National Institute of Standards and Technology (NIST), and the U.S. Geological Survey (USGS). The program is credited with reducing the loss of life and property from

earthquakes through improving emergency response, knowledge of earthquake risks, and earthquake engineering. Most states face at least some risk from earthquakes.

The enacted authorization level (P.L. 106–503) for NEHRP for FY03 is $122.6 million for the base program, with additional authorizations for multi-year efforts to create and operate the Advanced National Seismic Research and Monitoring System (ANSS, $44.0 million) and to build the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES, authorized at $4.5 million for FY03).

The FY03 budget request for NEHRP is $115.7 million, a decrease of $10.6 million, or 8.4 percent. This decrease reflects a planned reduction from FY02 levels of $10.8 million for NEES construction. All NEHRP agencies are flat funded in the President's request: NSF, $33.8 million; FEMA, $14.7 million; USGS, $47.6 million; and NIST, $2.5 million. The Committee is concerned that the request for the ANSS is only $3.9 million, a fraction of the authorized level.

SUBCOMMITTEE ON ENVIRONMENT, TECHNOLOGY & STANDARDS

Environmental Protection Agency (EPA)

The proposed FY03 budget for the EPA's science and technology functions calls for a 6 percent increase over the FY02 appropriation, excluding funds provided in the Supplemental Appropriation. The Committee supports the EPA's request for funding to help communities meet the new arsenic drinking water standards and improve the science of cumulative risk assessment. It also supports the additional funding for research related to homeland security, such as the detection and remediation of biological and chemical contamination in buildings.

The Committee is concerned, however, that the proposed budget for EPA's core science and technology activities (excluding the funding for new homeland security research) will decline by four percent from FY02. More troubling still, the EPA's core funding for the Office of Research and Development, which carries out more than 80 percent of EPA's R&D activities is lower than it was in FY99. In real dollars, this represents a decline in funding over the last four years. In addition, the Committee recommends restoring funding for the Science to Achieve Results (STAR) Fellowships, which have supported hundreds of graduate and undergraduate students in the environmental sciences.

National Oceanic and Atmospheric Administration (NOAA)

The proposed budget would reduce NOAA funding by $142 million (or about four percent) below FY02 levels. The gross figure is somewhat misleading, though, as the Administration's budget fully funds the critical functions of the Agency and provides significant, needed increases for the National Weather Service.

(Most of the reduction reflects the proposed elimination of Congressional earmarks and the proposed transfer of the Sea Grant College Program to NSF. The Committee does not support the proposed transfer of the Sea Grant program, which needs some reform, but is integrally connected to NOAA's mission.)

The Committee is pleased that the Administration would provide $18 million in new money for NOAA's portion of the President's Climate Change Research Initiative, and $171 million for overall climate research. The Committee looks forward to working with the Administration to shape and focus this new Initiative.

The Committee supports the Administration's request of $237 million for NOAA's new satellite program (NPOESS)—an increase of $79 million. This project, which is jointly funded by the Air Force, is vital to our future ability to forecast extreme weather. However, the Committee is concerned that despite the estimated $6.5 billion total cost of the project, NOAA has no plan to ensure that it will have the capability to process, assimilate and distribute all of the new data that NPOESS will generate. The Committee has asked the General Accounting Office to analyze the new project and report on current and future NOAA satellite data management needs.

Department of Commerce—Technology Administration

The bulk of the Technology Administration's funding goes to the National Institute of Standards and Technology (NIST), the Nation's oldest federal laboratory and still a leader in science and technology as reflected by the Nobel Prize awarded last year to one of its scientists. The Administration budget proposes to spend $389 million for the core NIST laboratory functions (the Scientific and Technical Research and Services account) in FY03—an increase of $68 million over FY02. The Committee is pleased with this generous request, but believes that in light of the focus on homeland security, additional funding could be provided for NIST's computer security efforts and for its investigation into the World Trade Center collapse, which could yield new ways to strengthen buildings to withstand terrorist attacks and natural disasters.

The Committee is also pleased that the budget request provides funding to complete the construction of the Advanced Measurement Lab in Gaithersburg and to undertake much needed improvements at NIST's laboratory in Boulder, Colorado.

The Committee takes issue with the proposal to sharply reduce funding for the Manufacturing Extension Partnership (MEP), which helps smaller manufacturers modernize to remain competitive.

In FY00 alone (the most recent year for which data is available), the program contributed $700 million in new or retained sales, $480 million in cost savings, and $900 million in new capital investments. The proposed budget would end federal support for almost all state MEP centers. This change would force most centers to shut their doors just as they could be contributing to economic recovery.

The Committee looks forward to working with the Administration on its proposed reforms to the Advanced Technology Program (ATP), which may at last help put the program on a path to stable funding.

National Technical Information Service (NTIS)

The Committee looks forward to working with the Administration to determine the best method of enabling NTIS to inform the public as a self-sustaining entity.

SUBCOMMITTEE ON ENERGY

Department of Energy (DOE)

The Committee has jurisdiction over DOE's civilian energy research, development, and demonstration programs and commercial application of energy technology activities.

The Committee is concerned that the proposed budget would cut programs under the Committee's jurisdiction by 2.4 percent. The proposed funding levels fall well below those that would be authorized under H.R. 4, the *Securing America's Future Energy Act of 2001,* which passed the House on August 2, 2001, by a vote of 240–184. To take just two examples, H.R. 4 would authorize $45 million for hydrogen R&D in FY03, but the request is $39.9 million. H.R. 4 would authorize $113.9 million for biofuels and biomass (excluding an additional $49 million for integrated bioenergy R&D), while the request is $86 million.

The Committee is particularly concerned about the future of the Office of Science, which funds user facilities and academic research. In recent years, funding limitations have forced many user facilities to restrict the number of hours they are available to researchers, causing investments that have cost taxpayers billions to sit idle. In addition, many DOE facilities are deteriorating and staff are nearing retirement, producing a looming problem that the Committee believes must be addressed with increased resources.

The Committee continues to closely monitor the construction of the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory, especially in light of a recent report by DOE's Inspector General indicating that capabilities and facilities have been pared back to keep the program under budget.

The Committee awaits further details on several of DOE's initiatives, including the Clean Coal program and FreedomCAR. While the Committee supports the goals of these programs (and has authorized the 10-year Clean Coal program with strict environmental goals), it needs additional details on these programs to assess their ability to achieve their goals. Similarly, the Committee awaits further details on the way the Administration applied its new performance criteria to the fossil fuel accounts that it proposes to cut.

The Administration's request for the Fusion Energy Sciences Program is $257.3 million, far short of the $335 million approved by the House in H.R. 4. Fusion's potential to wean the Nation from fossil fuels is tremendous, but much research remains to be done before that potential can be realized. The Committee notes with approval that the Administration is reassessing the potential U.S. role in the International Thermonuclear Experimental Reactor (ITER), which may significantly advance the science by achieving sustained-burning plasma. The Committee believes that U.S. participation in such important international research endeavors deserves serious consideration.

Finally, the Committee supports the Administration's proposal to spend $40 million in DOE on a National Climate Change Technology Initiative. The Committee is concerned, however, that DOE has not highlighted this proposal in its budget presentations and seems unable to provide any detail on how or where it will be carried out. This important initiative needs to become a focus within DOE if it is to be successful.

SUBCOMMITTEE ON SPACE AND AERONAUTICS

National Aeronautics and Space Administration (NASA)

The Administration proposes to increase funding for NASA by 0.7 percent in FY03, from $14.9 billion in FY02 to $15 billion in FY03. The Committee supports the level of the Administration's request.

The item of greatest concern in the NASA budget is the future of the International Space Station (ISS). The Committee continues to support development of the Space Station within the $25 billion cost cap enacted during the 106th Congress (P.L. 106–391). The Committee applauds the Administration for reviewing the costs of the Space Station and for its commitment to solving the financial and program management problems as outlined by the ISS Management and Cost Evaluation (IMCE) Task Force.

However, many critical decisions regarding the ISS remain to be made. NASA has not yet implemented many of the management reforms the IMCE recommended, and NASA has not yet identified the criteria that will be used to evaluate the Space Station program. In addition, the Research Maximization and Prioritization (REMAP) Task Force NASA established to evaluate ISS research priorities will not announce its findings until August.

Despite the uncertainty, the budget assumes $560 million in unspecified savings over the next five years; without those savings the three-person "Core Complete" Space Station cannot be assembled within the $25 billion cost cap.

The Committee agrees with the Administration that safety must be the highest priority in the operation of the Space Shuttle. The Committee applauds the Administration for examining competitive sourcing and privatization of the Space Shuttle, and awaits the results of the Administration's reviews, which are expected to be complete by late September. The Committee is concerned about the proposal to cut the Shuttle safety and supportability upgrades program by about $500 million between FY03 and FY07 to absorb unexpected increases in Shuttle operations and maintenance costs. The proposed cut is especially ill-timed as NASA told Congress last year that at least some of the safety upgrades were essential. The Committee expects NASA to develop more rigorous and realistic estimates of what it will cost to operate, maintain, and upgrade the Shuttle fleet. Estimates must not be based on unrealistic assessments of when the Shuttle might be replaced with a second-generation launch vehicle. The Committee supports increased funds to modernize the launch infrastructure at Kennedy Space Center to support planned mission needs.

The Committee appreciates the Administration's commitment to space and Earth science. The Committee, noting the cancellation of the Pluto-Kuiper mission and the deferment of the Europa mission, agrees that NASA should develop an integrated science strategy for exploring the outer planets. The Committee believes that investments in new technology, such as the Nuclear Systems Initiative, could significantly reduce spacecraft travel time and enable a more robust planetary exploration program.

The Committee supports the Administration's restructuring of NASA's Aerospace Technology Enterprise budget to more clearly link the budget and management structure to strategic goals. However, the Committee is concerned that the aeronautics program, once a core NASA program, does not have sufficient funds to usefully address the problems facing our aeronautics and aviation system. Moreover, the Committee urges the Administration to work to strengthen collaboration between NASA and FAA on aeronautics research and technology development.

Federal Aviation Administration (FAA)

The Committee looks forward to working with the Administration to develop an integrated R&D strategy for aeronautics. This will require increased investment in R&D, both to ensure the safety and security of the U.S. air traffic control system and to maintain the competitiveness of the U.S. aeronautics industry.

The Committee urges the Administration to increase coordination between the FAA's Office of Commercial Space Transportation and the U.S. Air Force regarding streamlining safety regulations for launch site operations. U.S. commercial launch providers face significant challenges from international competition. The U.S. government must develop policies and procedures that promote and encourage this key industry.

Department of Commerce—Office of Space Commercialization

The Committee urges continued funding of this office, which has played a useful role in promoting the commercialization of space, working with private industry, and making the best use of the Global Positioning System. P.L. 106–405 authorizes $626,000 for the Office in FY03.

SCIENCE COMMITTEE MINORITY ADDITIONAL VIEWS
FY 2003 VIEWS AND ESTIMATES
TO THE HOUSE BUDGET COMMITTEE
MARCH 12, 2002

The Administration's FY 2003 R&D Request

The Administration's FY03 R&D budget request can be summarized simply: weapons development increases 12 percent, the National Institutes of Health (NIH) increases 17 percent, and all other civilian and defense R&D is collectively frozen.

There is a business-as-usual quality to the civilian R&D portfolio. As has been the case stretching back well into the Clinton Administration, NIH is slated to receive nearly all of the civilian R&D increase. But the sense of continuity—perhaps inertia is a better word—extends beyond NIH's primacy. Even the multi-agency R&D priorities of this budget are holdovers from the later Clinton budgets: anti-terrorism, networking and information technology, nano-technology, and climate change.

Last year's Minority Views noted four major themes in the budget submission:

- The request reversed the trend toward parity, achieved in FY01, between defense and non-defense R&D.
- The imbalance between biomedical R&D and R&D in the physical sciences was further exacerbated.
- The budget submission stopped in its tracks the growing consensus that the NSF budget should grow at least at the same rate as the NIH budget.
- Cooperative Federal-industry R&D programs fared poorly.

Each of these statements is as true for the FY03 submission as it was last year:

- Defense R&D constitutes 52 percent of total R&D, the second consecutive budget to reverse a 15-year trend toward a greater civilian share.
- For the first time, the HHS R&D request ($27.683 billion) exceeds the R&D request of all other Federal civilian R&D ($26.046 billion).
- The five-year doubling path for NSF, started in FY01, is officially off the rails. The Foundation's increase for R&D is 1.5 percent, well below inflation.
- Several R&D collaborations involving academic, industry, and government remain targeted, including the Advanced Technology Program, Manufacturing Extension Partnership, and aviation R&D.

It is clear to us that except for NIH, federal science funding is not a high priority for this Administration. It also appears that the trends noted above will persist, given Presidential Science Advisor John Marburger's February 15, 2001 statement that ". . .the life sciences may still be under-funded relative to the physical sciences."

Metrics

Over this placid environment for R&D, storm clouds lurk. Much of the civilian R&D portfolio, the budget warns, will be subject to impending programmatic or management reviews, or both. For example, funding for much of NASA's science and human space flight accounts will depend on future, undefined studies. The FY03 budget implies few commitments by the Administration to the continuation of the Space Station, Mission to Planet Earth, or the Outer Planetary Program. On a smaller scale, the Smithsonian may see some of its science portfolio transferred to NSF after further study.

Utilizing a grading system (red, yellow, and green lights) across five management measures, OMB spills much ink asserting that performance metrics were applied in making budget allocations. Paradoxically, the Department of Defense, with its 12 percent increase, receives five red lights for management. NIH stays on its doubling path even though HHS, its parent department, garnered five red lights. NASA manages a yellow light for financial management in a sea of red, even though inept financial management is cited as the reason for putting the agency's flagship program—the Space Station—on life support. Then there is NSF, whose score surpassed every Federal department. Its reward is that core R&D accounts would grow by a mere $53 million (1.5 percent), which is less than inflation. Despite assertions that management scores mattered, it appears to us that they had no effect whatsoever on a particular agency's budget. Metrics may become the cloak behind which politics can carry on as before with a new patina of impartiality.

In a word, the theme for this year's R&D budget is incremental change, but with major programmatic changes pending that will be justified with as yet sketchy and opaque management criteria.

Majority Views

The Majority's Views and Estimates do question some proposed Administration cuts and correctly note areas where budgetary legerdemain masks sub-inflationary increases. However, it is difficult to take a firm position on the Majority's Views since they fail to meet the legislative mandate of five-year funding recommendations for all agencies under the Committee's jurisdiction. Despite its failings, however, many of us signed the Majority's Views to show support for the Chairman, and because the content of their report was both inoffensive and generally pointed in the right direction.

Our deference to the Chairman should not be viewed as indifference to the fate of Federal R&D funding. We believe the Majority should have gone farther. What particularly concerns us is that R&D requests for three premier scientific agencies—NSF, NASA, and DOE—fail to keep pace with inflation. It is appropriate to remember the wise words of the Hart-Rudman Commission on National Security/21st Century, which completed a thorough assessment of the Nation's post-Cold War security challenges six months before the attacks of September 11, 2001. The report, which accurately predicted terrorist attacks on U.S. soil, emphasizes that the U.S. "has seriously under-funded basic scientific research" and recommends that federal R&D funding be doubled by 2010. This recommendation is more, not less, relevant in the wake of last year's terrorist attacks and underscores the inadequacy of the FY03 civilian R&D request.

In this report, we have provided our views of R&D in the President's request. What follows is our guidance on specific aspects of agency budgets.

National Science Foundation

In light of the essential role which research plays in economic growth and national security, we are disappointed with the Administration's request for NSF. The $3.902 billion increase requested for NIH is by itself greater than the entire $3.783 billion Research and Related Activities account at NSF. According to OMB reporting requirements, the portion of NSF's budget devoted to research and research infrastructure would be increased by only $53 million—or 1.5 percent—under the President's request (after subtracting transferred programs). We believe that NSF should be put on a path to double its significant research and education work. H.R. 1472, introduced last year by Representative Eddie Bernice Johnson, calls for 15 percent increases to NSF's budget and this is what we would suggest to the Budget Committee. We recommend that the Function 250 account be adjusted to reflect an NSF research budget of $4.17 billion for FY03, with concomitant increases in the out-years.

National Aeronautics and Space Administration

The proposed increase for NASA is only 0.66 percent, continuing the pattern of disappointing NASA budget requests that fail to keep pace with inflation. This year's meager increase does not remotely match the tasks confronting the agency. The budget request repeatedly defers needed funding increases to the indefinite future while downplaying the impact of those deferrals. For example:

- Funding for aeronautics R&D is once again cut, this year to one-half of its FY98 level. One impact would be NASA's inability to meet its announced 10-decibel aircraft noise reduction target by 2007.
- The Shuttle program suffers a loss of $500 million in safety upgrades, even though we will be dependent on the Shuttle for at least the fifteen years.
- No funding beyond FY03 is provided for follow-on Earth science missions pending completion of an Administration review of global change research.
- The crew capabilities and equipment needed to make the Space Station a useful research facility are eliminated.

The five-year budget request for NASA will require augmentation if NASA is to safely and successfully accomplish its missions. We would advise the Budget Committee to provide annual three percent budget increases to NASA for five years, so that it can avoid losing additional ground to inflation and begin to address its backlog of important obligations.

Department of Energy

The Federal budget picture has changed dramatically since the passage of comprehensive energy legislation (H.R. 4) in August of 2001. Therefore, we recommend that the Budget Committee adopt FY03 funding levels for functions 250 and 270 that would accommodate the funding level contained in H.R. 4 for FY02. Out-year numbers would also track the funding levels contained in H.R. 4, building on the FY02 levels as appropriate. In line with H.R. 4, we recommend that the Budget

Committee increase Function 250 by $300 million with instructions that the Office of Science receive $3.6 billion in FY03. In Function 270, H.R. 4 provided $625 million for Energy Conservation and Energy Efficiency at DOE, and $535 million for Renewable Energy—about $200 million above the FY03 request.

Conclusion

Many in the science and education community are asking whether there is an "imbalance" in our research portfolio, with an over-concentration of funding in the biomedical sciences. By freezing NSF while kicking NIH down the path towards its five-year doubling goal, the Administration exacerbates this problem. We don't pretend to know what the exact balance among science investments should be, but our intuitive sense is that there is already an imbalance, and making it worse is not a productive step.

We stand ready to engage the Administration in an ongoing dialogue about the best way to invest in the future of our nation. We hope that the Budget Committee will not wait for the Administration to understand the lesson of the Hart-Rudman Commission—that R&D, the lifeblood of innovation, underlies both economic growth and national security.

Ralph M. Hall, MC
Bart Gordon, MC
Jerry F. Costello, MC
James A. Barcia, MC
Eddie Bernice Johnson, MC
Lynn C. Woolsey, MC
Lynn N. Rivers, MC
Sheila Jackson Lee, MC
Bob Etheridge, MC
Nick Lampson, MC
John B. Larson, MC
Mark Udall, MC
Brian Baird, MC
Joseph M. Hoeffel, MC
Joe Baca, MC
Steve Israel, MC
Dennis Moore, MC
Michael M. Honda, MC

The Honorable Judy Biggert

The Honorable Sherwood Boehlert

ADDITIONAL VIEWS AND ESTIMATES OF
REPRESENTATIVE JUDY BIGGERT
and
REPRESENTATIVE SHERWOOD BOEHLERT

While we share the views of the Science Committee as outlined in its views and estimates for Fiscal Year 2003, we wanted to take this opportunity to emphasize the importance and contributions of nuclear energy research at Department of Energy (DOE) national laboratories.

Argonne National Laboratory sites in Illinois and Idaho, Idaho National Engineering and Environmental Laboratory, Lawrence Livermore National Laboratory in California, Los Alamos National Laboratory in New Mexico, and Oak Ridge National Laboratory in Tennessee have been involved in developing proliferation-resistant pyroprocessing and transmutation technologies to reduce the volume and long-term toxicity of spent nuclear fuel, enhance proliferation resistance, and increase the energy yield from uranium.

Unfortunately, the FY 2003 DOE budget proposal reduces funding for the Spent Fuel Pyroprocessing and Transmutation (SFPT) program by $58.2 million, from $76.4 million to $18.2 million. This program should be funded at its FY 2002 level for the following reasons.

1) **Spent fuel pyroprocessing and transmutation technologies have the potential to increase the storage capacity of a Yucca Mountain-sized repository by a factor of five.** The Yucca Mountain repository is an essential first step in managing nuclear waste. But Yucca can store only the spent fuel from *existing* U.S. reactors. Absent federal support for the critical nuclear energy research of SFPT, the United States will have no choice but to expand Yucca Mountain or construct another such repository in the years to come. This is especially true if we continue to rely on nuclear power for 20 percent of our nation's electricity, and if the DOE proceeds with its Nuclear Power 2010 initiative, which would deploy a new commercial nuclear power plant by 2010.

2) **The proposed reduction in funding for the SFPT program is at direct odds with the high priority the Bush Administration has articulated for this type of research**, both in the President's National Energy Policy and in the FY 2003 DOE budget proposal itself. For example, the President's National Energy Policy stated,

> "...in the context of developing advanced nuclear fuel cycles and next generation technologies for nuclear energy, the United States should reexamine its policies to allow for research development and deployment of fuel conditioning methods (such as pyroprocessing) that reduce waste streams and enhance proliferation resistance."
>
> *(Report of the National Energy Policy Development Group, Page 5-22)*

And the President's FY03 budget proposal for DOE stated that this research would:

> "Reduce the quantities of high-level nuclear wastes requiring deep geologic disposal by about 90 percent;

Reduce the period of time waste materials must be isolated from the environment and monitored from 10,000 years to only about 300 years; and

Enable the amount of energy to be obtained from uranium resources to be increased by nearly a factor of ten."

(Department of Energy FY03 Congressional Budget Request, Volume 3, Page 145)

3) **The Spent Fuel Pyroprocessing and Transmutation program also is necessary to meet the requirements of a Federal Court Order** requiring that all sodium-bonded spent fuel be treated and removed from the State of Idaho by 2035. DOE's requested funding level would limit treatment to 500 kilograms per year, and likely less. Even if the pace were maintained at 500 kilograms per year, the remaining inventory of 23,000 kilograms could not be treated and removed by 2035. Extending the treatment schedule beyond 2035 not only would increase the total cost, it would also run contrary to DOE's announced goal of accelerating cleanup and reducing costs.

4) **If this program remains underfunded, a significant number of highly-skilled staff with programmatic or institutional knowledge will be lost.** The loss of such a substantial number of specially trained scientists, engineers, and support personnel – approximately 360 at Argonne alone – would dismantle the last remaining nuclear technology development team in the United States, severely limiting the nation's ability to provide solutions and assistance for a variety of important national security and waste management issues, both now and in the future.

It is for these reasons that we believe the DOE's Spent Fuel Pyroprocessing and Transmutation program should be funded at its FY 2002 level. In so doing, Congress will ensure that DOE's national laboratories can continue developing technologies that promise to reduce the volume and toxicity of spent nuclear fuel, enhance proliferation resistance, and increase the energy yield from uranium.

We believe it is the Science Committee's responsibility, as the committee of jurisdiction over science and energy programs, to emphasize basic, fundamental science and the importance of such research in addressing energy issues, especially those associated with nuclear energy. We look forward to working with the Budget and Appropriations Committees, the administration, and the DOE to ensure adequate funding and continued oversight of the DOE's nuclear energy programs.

The Honorable Judy Biggert

The Honorable Felix Grucci

ADDITIONAL VIEWS AND ESTIMATES OF
REPRESENTATIVE JUDY BIGGERT
and
REPRESENTATIVE FELIX GRUCCI

While we share the views of the Science Committee as outlined in its views and estimates for Fiscal Year 2003, we wanted to take this opportunity to emphasize an issue of particular importance to us: funding for the Department of Energy (DOE) Office of Science, the nation's primary supporter of the physical sciences.

Scientific research may not be as politically popular as health care and education right now, but science is as important to progress in these two areas as it is to America's economic, energy, and national security. For instance, economic experts maintain that the unprecedented economic growth of the last decade would not have been possible were it not for the substantial investment in research made by the public and private sectors over the past several decades. For America to continue to benefit from this kind of investment, we must provide strong financial support for basic research across all of the scientific disciplines – including the DOE's Office of Science.

As the nation's primary supporter of the physical sciences, the Office of Science provides an important partner and key user facilities in the areas of physics, mathematics and advanced computing, chemistry, geology, biology, environmental sciences, and engineering. The Office of Science supports a unique system of programs based on large-scale, specialized user facilities and large teams of scientists focused on national priorities.

This makes the Office of Science unique among, and complementary to, the scientific programs of many other federal science agencies, including the National Institutes of Health (NIH) and the National Science Foundation (NSF). We applaud the strong support shown by Congress in recent years for research conducted within the NIH and NSF, and we commend President Bush for supporting efforts to double NIH funding by 2003.

This level of support should be extended to DOE's Office of Science because future medical breakthroughs depend on fundamental advances in the physical sciences and other research conducted by the Office of Science. One recent example is the Human Genome Project, which progressed so rapidly because of advanced computing technology and biological technology pioneered by the DOE Office of Science. Harold Varmus, former director of the NIH, said, and I quote, "Medical advances may seem like wizardry. But pull back the curtain, and sitting at the lever is a high-energy physicist, a combinational chemist, or an engineer."

Unfortunately, the reality of the situation is that while federally supported medical research like that conducted by NIH has doubled, funding for research in the physical sciences has remained stagnant. During the past decade, funding in constant dollars for the DOE Office of Science was reduced by approximately 13 percent.

It is the research itself that has been most significantly impacted, since the costs of maintaining existing facilities and their associated staffs continue to rise with inflation. Funding limitations have forced many user facilities to restrict the number of hours they are available to researchers, causing investments that have cost taxpayers billions to sit idle. This has prevented

the Office of Science from fully participating in technical areas important to DOE's statutory mission, such as high performance computing and nanotechnology.

This erosion of resources has also reduced the number of scientists and students conducting physical science research at DOE's national user facilities and America's colleges and universities. This aspect alone could have a disastrous long-term effect.

Already, doctoral candidates are choosing life sciences over physical sciences. In 1999, the number of doctorates awarded in science and engineering was the lowest figure in six years. This trend is reflected in undergraduate degrees as well, which over the past decade have declined significantly.

Doubtless this exacerbates a shortage of highly skilled labor, posing a serious dilemma for academia, business, and government leaders alike because of the potential effect it could have on America's continued economic growth.

This shift in human capital and resources to the life sciences has had a dramatic impact on America's ability to engage in cutting edge physical sciences research. It also poses a threat to our national security, but you don't have to take our word for it.

According to the Hart-Rudman Report on National Security, and we quote "...the U.S. government has seriously underfunded basic scientific research in recent years. The quality of the U.S. education system, too, has fallen well behind those of scores of other nations. **...the inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine."**

The report goes on to recommend doubling the federal government's investment in science and technology research and development by 2010. While we understand that it may not be practical to double the federal research and development budget this year, we believe Congress should take the necessary steps to move in that direction by increasing funding for research in the physical sciences. The House has already taken the first step, by authorizing $3.6 billion for the DOE Office of Science in Title V of H.R. 4, the Save America's Future Energy (SAFE) Act, which passed by a vote of 240-189 on August 2, 2001.

The Budget and Science Committees are key to taking the next step forward. By recommending that the Office of Science receive a substantial FY 2003 budget increase, these Committees can begin to reverse this troubling situation and help the DOE attract the best minds, support the maintenance and construction of modern facilities, and continue to provide the quality of scientific research that has been its trademark for so many years.

We look forward to working with the Budget and Science Committees, the administration, and the DOE to ensure adequate funding and continued oversight of the DOE Office of Science. Congress must continue to support the research that has been crucial to America's economic success, national security, and the health and education of its people.

COMMITTEE PUBLICATIONS

HEARINGS

DATE	TITLE	PUBLICATION NO.
Apr. 3, 2001	Vision 2001: Future Space (Hearing held by the Subcommittee on Space and Aeronautics.)	1.
Mar. 21, 2001	Life in the Subduction Zone: The Recent Nisqually Quake and Federal Efforts to Reduce Earthquake Hazards (Hearing held by the Subcommittee on Research.)	2.
Mar. 7, 2001	K-12th Grade Math and Science Education: The View From the Blackboard (Hearing held by the Committee on Science.)	3.
Mar. 29, 2001	H.R. 64: A Proposal to Strengthen Science at the Environmental Protection Agency (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	4.
May 3, 2001	Acid Rain: The State of the Science and Research Needs for the Future (Hearing held by the Committee on Science.)	5.
Jul. 19, 2001	Developing the Next Generation Air Traffic Management System (Hearing held by the Subcommittee on Space and Aeronautics.)	6.
May 10, 2001	Classrooms as Laboratories: The Science of Learning Meets the Practice of Teaching (Hearing held by the Subcommittee on Research.)	7.
Apr. 4, 2001	Space Station Cost Overruns (Hearing held by the Committee on Science.)	8.
May 9, 2001	A Review of Vertical Takeoff and Landing Technology in the National Airspace System (Hearing held by the Subcommittee on Space and Aeronautics.)	9.
May 15, 2001	The Aerospace Industrial Base (Hearing held by the Subcommittee on Space and Aeronautics.)	10.
Jun. 20, 2001	Space Launch Initiative: A Program Review (Hearing held by the Subcommittee on Space and Aeronautics.)	11.
Jun. 26, 2001	Space Tourism (Hearing held by the Subcommittee on Space and Aeronautics.)	12.
Mar. 14, 2001	Climate Change: The State of the Science (Hearing held by the Committee on Science.)	13.
Apr. 25, 2001	Proposed R&D Budget for Fiscal Year 2002 (Hearing held by the Committee on Science.)	14.
May 2, 2001	NASA Posture (Hearing held by the Subcommittee on Space and Aeronautics.)	15.
Jun. 6, 2001	NSF FY02 Budget Request: Research and Related Activities (Hearing held by the Subcommittee on Research.)	16.

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DATE	TITLE	PUBLICATION NO.
Jul. 12, 2001	Life in the Universe (Hearing held by the Subcommittee on Space and Aeronautics.)	17.
Jul. 31, 2001	Innovation in Information Technology: Beyond Faster Computers and Higher Bandwidth (Hearing held by the Subcommittee on Research.)	18.
May 17, 2001	Science and Technology at the Environmental Protection Agency: The FY 2002 Budget Request (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	19.
May 22, 2001	Improving Voting Technologies: The Role of Standards (Hearing held by the Committee on Science.)	20.
Jun. 28, 2001	Standards-Setting and United States Competitiveness (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	21.
Oct. 11, 2001	Space Planes and X-Vehicles (Hearing held by the Subcommittee on Space and Aeronautics.)	22.
Jun. 14, 2001	The Future of the Advanced Technology Program (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	23.
Feb. 28, 2001	The Nation's Energy Future: Role of Renewable Energy and Energy Efficiency (Hearing held by the Committee on Science.)	24.
Jul. 26, 2001	Combating the Invaders: Research on Non-Native Species (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	25.
Jul. 12, 2001	Ocean Exploration and Coastal and Ocean Observing Systems (Joint Hearing held by the Subcommittee on Environment, Technology, and Standards and the Subcommittee on Research, Committee on Science, and the Subcommittee on Fisheries Conservation, Wildlife and Oceans, Committee on Resources.)	26.
May 2, 2001	Improving Math and Science Education So That No Child Is Left Behind (Hearing held by the Subcommittee on Research.)	27.
May 9, 2001	NOAA's FY 2002 Budget: Predicting Weather and Climate (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	28.
Nov. 14, 2001	H.R. 3178 and the Development of Anti-Terrorism Tools for Water Infrastructure (Hearing held by the Committee on Science.)	29.
May 24, 2001	Energy Conservation Potential of Extended and Double Daylight Saving Time (Hearing held by the Subcommittee on Energy.)	30.
Oct. 11, 2001	Weatherproofing the U.S.: Are We Prepared for Severe Storms? (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	31.
Oct. 4, 2001	Arsenic in Drinking Water: An Update on the Science, Benefits and Cost (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	32.
Mar. 22, 2001	H.R. 723: Civil Penalties for Nuclear Safety Violations by Non-Profit Department of Energy Contractors Under the Atomic Energy Act of 1954 (Hearing held by the Subcommittee on Energy.)	33.

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DATE	TITLE	PUBLICATION NO.
Apr. 26, 2001	Department of Energy Fiscal Year 2002 Budget Request (Hearing held by the Subcommittee on Energy.)	34.
May 3, 2001	Energy Realities: Rates of Consumption, Energy Reserves, and Future Options (Hearing held by the Subcommittee on Energy.)	35.
Sept. 25, 2001	Strengthening NSF Sponsored Agricultural Biotechnology Research, H.R. 2051 and H.R. 2912 (Hearing held by the Subcommittee on Research.)	36.
May 17, 2001	Department of Energy Office of Science--Issues and Opportunities (Hearing held by the Subcommittee on Energy.)	37.
Jun. 26, 2001	Reinventing The Internet: Promoting Innovation in IT (Hearing held by the Subcommittee on Research.)	38.
Nov. 8, 2001	The Decontamination of Anthrax and Other Biological Agents (Hearing held by the Committee on Science.)	39.
Oct. 17, 2001	Cyber Terrorism: A View From The Gilmore Commission (Hearing held by the Committee on Science.)	40.
Oct. 10, 2001	Cyber Security--How Can We Protect American Computer Networks From Attack? (Hearing held by the Committee on Science.)	41.
May 23, 2001	National Energy Policy--Report of the National Energy Policy Development Group (Hearing held by the Committee on Science.)	42.
Nov. 1, 2001	U.S. Energy Security: Options to Decrease Petroleum Use in the Transportation Sector (Hearing held by the Subcommittee on Energy.)	43.
Jun. 21, 2001	National Energy Policy--Report of the National Energy Policy Development Group--Administration View (Hearing held by the Committee on Science.)	44.
Jun. 12, 14, 2001	President's National Energy Policy, Parts I and II (Hearing held by the Subcommittee on Energy.)	45.
Mar. 6, 2002	Learning From 9/11--Understanding the Collapse of the World Trade Center (Hearing held by the Committee on Science.)	46. Volume I
Feb. 28, 2002	Sea Grant: Review and Reauthorization (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	47.
Sept. 6, 2001	National Science Foundation's Major Research Facilities: Planning and Management Issues (Hearing held by the Subcommittee on Research.)	48.
Nov. 7, 2001	The Space Station Task Force Report (Hearing held by the Committee on Science.)	49.
Feb. 21, 2002	The Renewable Roadmap to Energy Independence (Field Hearing held by the Subcommittee on Energy.)	50.
Dec. 5, 2001	Science of Bioterrorism: Is the Federal Government Prepared? (Hearing held by the Committee on Science.)	51.
Mar. 7, 2002	Meeting the Demands of the Knowledge Based Economy: Strengthening Undergraduate Science, Mathematics, and Engineering Education (Hearing held by the Subcommittee on Research.)	52.

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DATE	TITLE	PUBLICATION NO.
Apr. 23, 2002	Science and Technology Programs at the Environmental Protection Agency: The FY 2003 Budget Request (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	53.
Mar. 14, 2002	Technology Administration: Review and Reauthorization	54.
Mar. 20, 2002	The 2001 Presidential Awardees for Excellence in Mathematics and Science Teaching: Views From the Blackboard (Hearing held by the Committee on Science.)	55.
Apr. 17, 2002	New Directions for Climate Research and Technology Initiatives (Hearing held by the Committee on Science.)	56.
Feb. 13, 2002	The R&D Budget for Fiscal Year 2003: An Evaluation (Hearing held by the Committee on Science.)	57.
Feb. 27, 2002	NASA's Fiscal Year 2003 Budget Request (Hearing held by the Committee on Science.)	58.
Apr. 22, 2002	Preparing the 21st Century Workforce: Strengthening and Improving K-12 and Undergraduate Science, Math, and Engineering Education (Field Hearing held by the Subcommittee on Research.)	59.
May 8, 2002	Health Effects of Particulate Air Pollution: What Does the Science Say? (Hearing held by the Committee on Science.)	60.
May 1, 2002	The Investigation of the World Trade Center Collapse: Findings, Recommendations, and Next Steps (Hearing held by the Committee on Science.)	61.
Mar. 13, 2002	The NSF Budget: How Should We Determine Future Levels? (Hearing held by the Subcommittee on Research.)	62.
May 9, 2002	H.R. 4664, The National Science Foundation Reauthorization Act of 2002 (Hearing held by the Subcommittee on Research.)	63.
May 9, 2002	NASA's Science Priorities (Hearing held by the Subcommittee on Space and Aeronautics.)	64.
May 6, 2002	Preparing First Responders: A Review of the U.S. Fire Administration Assistance to Firefighters Grant Program and Post-9/11 Challenges for Firefighters and Emergency Responders (Hearing held by the Subcommittee on Research.)	65.
Dec. 20, 2002	Markups of H.R. 2051, H.R. 2486, H.R. 2733, H.R. 3130, H.R. 3178, H.R. 3389, H.R. 3400, H.R. 3929, H.R. 4664, and H.R. 4687	66.
Mar. 7, 2002	A Review of Civil Aeronautics Research and Development (Hearing held by the Subcommittee on Space and Aeronautics.)	67.
Jun. 25, 2002	Science and Technology to Combat Terrorism (Joint Hearing held by the Committee on Science and the Subcommittee on Science, Technology, and Space, Senate Committee on Commerce, Science, and Transportation.)	68.
May 20, 2002	How Space Technology and Data Can Help Meet State and Local Needs (Field hearing held by the Subcommittee on Space and Aeronautics.)	69.
Mar. 13, 2002	H.R. 3929, Energy Pipeline Research, Development, and Demonstration Act (Hearing held by the Subcommittee on Energy.)	70.
Jun. 24, 2002	Homeland Security: The Federal and New York Response (Hearing held by the Committee on Science.)	71.

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DATE	TITLE	PUBLICATION NO.
Jun. 20, 2002	Research Priorities for Aquatic Invasive Species (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	72.
Jun. 27, 2002	Creating a Department of Homeland Security (Hearing held by the Committee on Science.)	73.
Jun. 22, 2002	Environmental Contributors to Breast Cancer: What Does the Science Say? (Field Hearing held by the Subcommittee on Environment, Technology, and Standards.)	74.
Jul. 10, 2002	The Administration's Climate Change Initiative (Hearing held by the Committee on Science.)	75.
Jun. 10, 2002	Homeland Security: The Federal and Regional Response (Field Hearing held by the Subcommittee on Environment, Technology, and Standards.)	76.
Jun. 3, 2002	Drought Prediction, Preparation, and Response (Field Hearing held by the Committee on Science.)	77.
Jun. 24, 2002	Workforce Training in a Time of Technological Change (Field Hearing held by the Subcommittee on Environment, Technology, and Standards.)	78.
Apr. 18, 2002	Space Shuttle and Space Launch Initiative (Hearing held by the Subcommittee on Space and Aeronautics.)	79.
Jul. 24, 2002	Satellite Data Management at NOAA (Hearing held by the Subcommittee on Environment, Technology, and Standards.)	80.
Nov. 14, 2002	H.R. 5395, Aquatic Invasive Species Research Act, and H.R. 5396, National Aquatic Invasive Species Act of 2002 (Joint Hearing held by the Subcommittee on Environment, Technology, and Standards, Committee on Science, and the Subcommittee on Fisheries Conservation, Wildlife and Oceans, Committee on Resources.)	81.
Feb. 7, 2002	The Future of DOE's Automotive Research Program (Hearing held by the Committee on Science.)	82.
Jun. 24, 2002	Fuel Cells: The Key to Energy Independence? (Field Hearing held by the Subcommittee on Energy.)	83.
Jun. 26, 2002	FreedomCAR: Getting New Technology into the Marketplace (Hearing held by the Subcommittee on Energy.)	84.
Jul. 18, 2002	NASA Workforce and Management Challenges (Hearing held by the Subcommittee on Space and Aeronautics.)	85.
Jul. 25, 2002	Future Direction of the Department of Energy's Office of Science (Hearing held by the Subcommittee on Energy.)	86.
Sept. 24, 2002	"The State of the Nation's Ecosystems," The Heinz Center Report and Its Implications (Hearing held by the Committee on Science.)	87.
Oct. 2, 2002	Meeting the Needs of the Fire Service: H.R. 3992 and H.R. 4548 (Hearing held by the Committee on Science.)	88.
Oct. 3, 2002	The Threat of Near-Earth Asteroids (Hearing held by the Subcommittee on Space and Aeronautics.)	89.
Oct. 10, 2002	Conducting Research During the War on Terrorism: Balancing Openness and Security (Hearing held by the Committee on Science.)	90.

COMMITTEE PUBLICATIONS

REPORTS

DATE	TITLE	PUBLICATION NO.
Jul. 11, 2001	National Science Education Act (H.R. 100)	H.Rept. 107-133, Pt. I
Jul. 11, 2001	National Mathematics and Science Partnerships Act (H.R. 1858)	H.Rept. 107-134, Pt. I
Jul. 31, 2001	Comprehensive Energy Research and Technology Act of 2001 (H.R. 2460)	H.Rept. 107-177
Oct. 31, 2001	Voting Technology Standards Act of 2001 (H.R. 2275)	H.Rept. 107-263
Nov. 30, 2001	Strengthening Science at the Environmental Protection Agency Act (H.R. 64)	H.Rept. 107-311
Feb. 4, 2002	Cyber Security Research and Development Act (H.R. 3394)	H.Rept. 107-355, Pt. I
Apr. 15, 2002	National Sea Grant College Program Act Amendments of 2002 (H.R. 3389)	H.Rept. 107-369, Pt. II
Apr. 30, 2002	Plant Genome and Biotechnology Development (H.R. 2051)	H.Rept. 107-422
May 16, 2002	Energy Pipeline Research, Development, and Demonstration (H.R. 3929)	H.Rept. 107-475, Pt. I
Jun. 4, 2002	Investing in America's Future Act of 2002 (H.R. 4664) (National Science Foundation Authorization Act of 2002)	H.Rept. 107-488
Jun. 12, 2002	Undergraduate Science, Mathematics, Engineering, and Technology Education Improvement Act (H.R. 3130)	H.Rept. 107-505, Pt. I
Jun. 18, 2002	Networking and Information Technology Research Advancement Act (H.R. 3400)	H.Rept. 107-511
Jun. 20, 2002	Enterprise Integration Act of 2002 (H.R. 2733)	H.Rept. 107-520
Jul. 10, 2002	Amendment and Views to the Select Committee on Homeland Security on H.R. 5005, Homeland Security Act of 2002 (Including Committee Markup on H.R. 5005)	A.