

DOMENICI and I receive literally thousands of requests for water projects in all fifty States. We work hard to accommodate as many of them as possible each year.

I am pleased to report that total funding for the Corps of Engineers is nearly \$4.6 billion—a total that is \$375 million above an utterly insufficient request from the Administration. I wish we were able to do more, but, I feel we were able to keep many very important projects moving forward this year and have been able to begin some new ones.

Total funding for the Bureau of Reclamation is set at \$986 million, a total that is \$64 million above the President's request and \$15 million above the current year. As a Western Senator I had hoped this would be the year that we got the Bureau up to \$1 billion, but we came up just short. However, I am very pleased that we are pushing the Bureau's budget in the right direction.

The conferees were able to provide total funding of \$22 billion for the Department of Energy. The Senate was able to convince the House to restore most of the nearly \$300 million in cuts to DOE programs, but we are still nearly \$120 million below the President's request. We are, however, \$1.2 billion above the current year. The overall increase has allowed the conferees to provide solid funding for the Office of Science, renewable energy projects, and the very important environmental management clean-up projects nationwide.

As most of you know, Senator DOMENICI is a fierce defender of two nuclear weapons labs in his home State, two institutions that do world class research and have helped to keep our Nation safe and secure for over 50 years. The House cut nearly \$200 million from the President's budget request for Los Alamos and Sandia, a move that would have had very negative ramifications for our Nation's science-based stockpile stewardship program. I am pleased to report that we were able to restore most of these ill-advised cuts. The people of New Mexico are very lucky to have a Senator as skilled and determined as PETE DOMENICI working for them.

Frankly, given the battle we were in with the House this year over our bill, I am glad he was also fighting for me and the other 98 Members of the Senate.

I am very grateful to Chairman DOMENICI and his new clerk, Tammy Perrin, for being so dogged in their defense of the Senate position on so many issues. I have worked with his previous clerks, Alex Flint and Clay Sell, and have found them both to be outstanding. In Tammy, he has found another terrific clerk.

As always, thanks to Drew Willison, Roger Cockrell, and Nancy Olkewicz of my subcommittee staff. I appreciate everything they do for me and all of the Members of the Senate.

Mr. FRIST. Mr. President, I ask unanimous consent that the conference

report be adopted and that the motion to reconsider be laid upon the table.

The PRESIDING OFFICER. Without objection, it is so ordered.

The conference report was agreed to.

#### MEASURE PLACED ON THE CALENDAR—S. 1875

Mr. FRIST. Mr. President, I understand there is a bill at the desk due its second reading.

The PRESIDING OFFICER. The clerk will report the title of the bill for the second time.

The legislative clerk read as follows:

A bill (S. 1875) to amend the Employee Retirement Income Security Act of 1974, the Public Health Service Act, and the Internal Revenue Code of 1986 to extend the mental health benefits parity provisions for an additional year.

Mr. FRIST. Mr. President, I object to further proceedings.

The PRESIDING OFFICER. Objection is heard. The bill will be placed on the calendar.

#### MEASURES INDEFINITELY POSTPONED—S. 1415, S. 1671, AND S. 1746

Mr. FRIST. Mr. President, I ask unanimous consent that the following bills be indefinitely postponed: Calendar No. 326, S. 1415; Calendar No. 327, S. 1671, Calendar No. 328, S. 1746.

The PRESIDING OFFICER. Without objection, it is so ordered.

#### DEATHS OF ITALIAN CITIZENS IN IRAQ

Mr. FRIST. Mr. President, I ask unanimous consent that the Senate now proceed to the consideration of S. Res. 268 introduced earlier today by Senator GRAHAM.

The PRESIDING OFFICER. The clerk will report the resolution by title.

The legislative clerk read as follows:

A resolution (S. Res. 268) to express the sense of the Senate regarding the deaths of 19 citizens of Italy in Iraq.

There being no objection, the Senate proceeded to consider the resolution.

Mr. FRIST. Mr. President, I ask unanimous consent that the resolution be agreed to, the preamble be agreed to, the motion to reconsider be laid upon the table en bloc, and any statements relating to the resolution be printed in the RECORD.

The PRESIDING OFFICER. Without objection, it is so ordered.

The resolution (S. Res. 268) was agreed to.

The preamble was agreed to.

The resolution, with its preamble, reads as follows:

#### S. RES. 268

Whereas the people of Italy are long-time and resolute allies of the United States;

Whereas the people of Italy sent 2,700 of their finest citizens in contribution to the international effort to stabilize Iraq; and

Whereas on Wednesday November 12, 2003, 19 Italians including 12 Carabinieri, 5 army

soldiers, and 2 civilians were brutally murdered through cowardly acts of terrorism while on duty in Nassiriya, Iraq; Now, therefore, be it

*Resolved*, That the Senate—

(1) mourns with the people of Italy on their National Day of Mourning for these 19 brave souls;

(2) acknowledges the sacrifices of the Italian people; and

(3) recognizes the significant contributions that Italy continues to make towards stability and democracy around the world.

#### 21ST CENTURY NANOTECHNOLOGY RESEARCH AND DEVELOPMENT ACT

Mr. FRIST. Mr. President, I ask unanimous consent that the Senate proceed to the immediate consideration of calendar No. 280, S. 189.

The PRESIDING OFFICER. The clerk will state the bill by title.

The legislative clerk read as follows:

A bill (S. 189) to authorize appropriations for nanoscience, nanoengineering, and nanotechnology research, and for other purposes.

There being no objection, the Senate proceeded to consider the bill, which had been reported from the Committee on Commerce, Science, and Transportation, with an amendment to strike all after the enacting clause and inserting in lieu thereof the following:

[Strike the part shown in black brackets and insert the part shown in italic.]

#### S. 189

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

#### SECTION 1. SHORT TITLE.

[This Act may be cited as the "21st Century Nanotechnology Research and Development Act".]

#### SEC. 2. FINDINGS.

[The Congress makes the following findings:

(1) The emerging fields of nanoscience and nanoengineering (collectively, "nanotechnology"), in which matter is manipulated at the atomic level (i.e., atom-by-atom or molecule-by-molecule) in order to build materials, machines, and devices with novel properties or functions, are leading to unprecedented scientific and technological opportunities that will benefit society by changing the way many things are designed and made.

(2) Long-term nanoscale research and development leading to potential breakthroughs in areas such as materials and manufacturing, electronics, medicine and healthcare, environment, energy, chemicals, biotechnology, agriculture, information technology, and national security could be as significant as the combined influences of microelectronics, biotechnology, and information technology on the 20th century. Nanotechnology could lead to things such as—

(A) new generations of electronics where the entire collection of the Library of Congress is stored on devices the size of a sugar cube;

(B) manufacturing that requires less material, pollutes less, and is embedded with sophisticated sensors that will internally detect signs of weakness and automatically respond by releasing chemicals that will prevent damage;

[(C) prosthetic and medical implants whose surfaces are molecularly designed to interact with the cells of the body;

[(D) materials with an unprecedented combination of strength, toughness, and lightness that will enable land, sea, air, and space vehicles to become lighter and more fuel efficient;

[(E) selective membranes that can fish out specific toxic or valuable particles from industrial waste or that can inexpensively desalinate sea water; and

[(F) tiny robotic spacecraft that will cost less, consume very little power, adapt to unexpected environments, change its capabilities as needed, and be completely autonomous.

[(3) Long-term, high-risk research is necessary to create breakthroughs in technology. Such research requires government funding since the benefits are too distant or uncertain for industry alone to support. Current Federal investments in nanotechnology research and development are not grounded in any specifically authorized statutory foundation. As a result, there is a risk that future funding for long-term, innovative research will be tentative and subject to instability which could threaten to hinder future United States technological and economic growth.

[(4) The Federal government can play an important role in the development of nanotechnology, as this science is still in its infancy, and it will take many years of sustained investment for this field to achieve maturity.

[(5) Many foreign countries, companies and scientists believe that nanotechnology will be the leading technology of the 21st century and are investing heavily into its research. According to a study of international nanotechnology research efforts sponsored by the National Science and Technology Council, the United States is at risk of falling behind its international competitors, including Japan, South Korea, and Europe if it fails to sustain broad based funding in nanotechnology. The United States cannot afford to fall behind our competitors if we want to maintain our economic strength.

[(6) Advances in nanotechnology stemming from Federal investments in fundamental research and subsequent private sector development likely will create technologies that support the work and improve the efficiency of the Federal government, and contribute significantly to the efforts of the government's mission agencies.

[(7) According to various estimates, including those of the National Science Foundation, the market for nanotech products and services in the United States alone could reach over \$1 trillion later this century.

[(8) Nanotechnology will evolve from modern advances in chemical, physical, biological, engineering, medical, and materials research, and will contribute to cross-disciplinary training of the 21st century science and technology workforce.

[(9) Mastering nanotechnology will require a unique skill set for scientists and engineers that combine chemistry, physics, material science, and information science. Funding in these critical areas has been flat for many years and as a result fewer young people are electing to go into these areas in graduate schools throughout the United States. This will have to reverse if we hope to develop the next generation of skilled workers with multi-disciplinary perspectives necessary for the development of nanotechnology.

[(10) Research on nanotechnology creates unprecedented capabilities to alter ourselves and our environment and will give rise to a host of novel social, ethical, philosophical, and legal issues. To appropriately address these issues will require wide reflection and

guidance that are responsive to the realities of the science, as well as additional research to predict, understand, and alleviate anticipated problems.

[(11) Nanotechnology will provide structures to enable the revolutionary concept of quantum computing, which uses quantum mechanical properties to do calculation. Quantum computing permits a small number of atoms to potentially store and process enormous amounts of information. Just 300 interacting atoms in a quantum computer could store as much information as a classical electronic computer that uses all the particles in the universe, and today's complex encryption algorithms, which would take today's best super computer 20 billion years, could be cracked in 30 minutes.

[(12) The Executive Branch has previously established a National Nanotechnology Initiative to coordinate Federal nanotechnology research and development programs. This initiative has contributed significantly to the development of nanotechnology. Authorizing legislation can serve to establish new technology goals and research directions, improve agency coordination and oversight mechanisms, help ensure optimal returns to investment, and simplify reporting, budgeting, and planning processes for the Executive Branch and the Congress.

[(13) The private sector technology innovations that grow from fundamental nanotechnology research are dependent on a haphazard, expensive, and generally inefficient technology transition path. Strategies for accelerating the transition of fundamental knowledge and innovations in commercial products or to support mission agencies should be explored, developed, and when appropriate, executed.

[(14) Existing data on the societal, ethical, educational, legal, and workforce implications and issues related to nanotechnology are lacking. To help decision-makers and affected parties better anticipate issues likely to arise with the onset and maturation of nanotechnology, research and studies on these issues must be conducted and disseminated.

[(15) Many States and regions have begun nanotechnology programs. These programs have developed expertise, particularly with regard to providing infrastructure and preparing the nanotechnology workforce. The Federal nanotechnology program should leverage these existing State and local institutions to best provide a coordinated and comprehensive nanotechnology research portfolio.

[(16) In "Small Wonders, Endless Frontiers" the National Academy of Sciences' National Research Council recommends increased investment in nanotechnology, particularly at the intersection of nanotechnology and biology. Such investments will allow significant advancements in biotechnology and medicine.

#### **[SEC. 3. PURPOSE.]**

[It is the purpose of this Act to authorize a coordinated inter-agency program that will support long-term nanoscale research and development leading to potential breakthroughs in areas such as materials and manufacturing, nanoelectronics, medicine and healthcare, environment, energy, chemicals, biotechnology, agriculture, information technology, and national and homeland security.]

#### **[SEC. 4. NATIONAL NANOTECHNOLOGY RESEARCH PROGRAM.]**

[(a) NATIONAL NANOTECHNOLOGY RESEARCH PROGRAM.—The President shall establish a National Nanotechnology Research Program. Through appropriate agencies, councils, and the National Coordination Office, the program shall—

[(1) establish the goals, priorities, grand challenges, and metrics for evaluation for Federal nanotechnology research, development, and other activities;

[(2) invest in Federal research and development programs in nanotechnology and related sciences to achieve those goals; and

[(3) provide for interagency coordination of Federal nanotechnology research, development, and other activities undertaken pursuant to the program.

[(b) GOALS OF THE NATIONAL NANOTECHNOLOGY RESEARCH PROGRAM.—The goals of the program are as follows:

[(1) The coordination of long-term fundamental nanoscience and engineering research to build a fundamental understanding of matter enabling control and manipulation at the nanoscale.

[(2) The assurance of continued United States global leadership in nanotechnology to meet national goals and to support national economic, health, national security, educational, and scientific interests.

[(3) The advancement of United States productivity and industrial competitiveness through stable, consistent, and coordinated investments in long-term scientific and engineering research in nanotechnology.

[(4) The development of a network of shared academic facilities and technology centers, including State supported centers, that will play a critical role in accomplishing the other goals of the program, foster partnerships, and develop and utilize next generation scientific tools.

[(5) The development of enabling infrastructural technologies that United States industry can use to commercialize new discoveries and innovations in nanoscience.

[(6) The acceleration of the deployment and transition of advanced and experimental nanotechnology and concepts into the private sector.

[(7) The establishment of a program designed to provide effective education and training for the next generation of researchers and professionals skilled in the multi-disciplinary perspectives necessary for nanotechnology.

[(8) To ensure that philosophical, ethical, and other societal concerns will be considered alongside the development of nanotechnology.

[(c) RESEARCH AND DEVELOPMENT AREAS.—Through its participating agencies, the National Nanotechnology Research Program shall develop, fund, and manage Federal research programs in the following areas:

[(1) LONG-TERM FUNDAMENTAL RESEARCH.—The program shall undertake long-term basic nanoscience and engineering research that focuses on fundamental understanding and synthesis of nanometer-size building blocks with potential for breakthroughs in areas such as materials and manufacturing, nanoelectronics, medicine and healthcare, environment, energy, chemical and pharmaceuticals industries, biotechnology and agriculture, computation and information technology, and national security. Funds made available from the appropriate agencies under this paragraph shall be used—

[(A) to provide awards of less than \$1,000,000 each to single investigators and small groups to provide sustained support to individual investigators and small groups conducting fundamental, innovative research; and

[(B) to fund fundamental research and the development of university-industry-laboratory and interagency (including State-led) partnerships.

[(2) GRAND CHALLENGES.—The program shall support grand challenges that are essential for the advancement of the field and interdisciplinary research and education

teams, including multidisciplinary nanotechnology research centers, that work on major long-term objectives. This funding area will fund, through participating agencies, interdisciplinary research and education teams that aim to achieve major, long-term objectives, such as the following:

[(A) Nanomaterials by design which are stronger, lighter, harder, self-repairing, and safer.

[(B) Nanoelectronics, optoelectronics, and magnetics.

[(C) Healthcare applications.

[(D) Nanoscale processes and environment.

[(E) Energy and energy conservation.

[(F) Microspacecraft.

[(G) Bio-nanodevices for detection and mitigation of biotreatments to humans.

[(H) Economical, efficient, and safe transportation.

[(I) National and homeland security.

[(J) Other appropriate challenges.

[(3) INTERDISCIPLINARY NANOTECHNOLOGY RESEARCH CENTERS.—The Program, through the appropriate agencies, shall fund, on a competitive merit reviewed basis, research centers in the range of \$3,000,000 to \$5,000,000 per year each for 5 years. A grant under this paragraph to a center may be renewed for 1 5-year term on the basis of that center's performance, determined after a review. The program, through its participating agencies, shall encourage research networking among centers and researchers and require access to facilities to both academia and industry. The centers shall assist in reaching other initiative priorities, including fundamental research, grand challenges, education, development and utilization of specific research tools, and promoting partnerships with industry. To the greatest extent possible, agencies participating in the program shall establish geographically diverse centers including at least one center in a State participating in the National Science Foundation's (NSF) Experimental Program, to Stimulate Competitive Research (EPSCoR), established under section 113 of the NSF Authorization Act of 1988 (42 U.S.C. 1862(g)) and shall encourage the participation of minority serving institutions at these centers.

[(4) RESEARCH INFRASTRUCTURE.—The program, through its participating agencies, shall ensure adequate research infrastructure and equipment for rapid progress on program goals, including the employment of underutilized manufacturing facilities in areas of high unemployment as production engineering and research testbeds for micron-scale technologies. Major research equipment and instrumentation shall be an eligible funding purpose under the program.

[(5) SOCIETAL, ETHICAL, EDUCATIONAL, LEGAL, AND WORKFORCE ISSUES RELATED TO NANOTECHNOLOGY.—The Director of the National Science Foundation shall establish a new Center for Societal, Ethical, Educational, Legal, and Workforce Issues Related to Nanotechnology at \$5,000,000 per year to encourage, conduct, coordinate, commission, collect, and disseminate research on the societal, ethical, educational, legal, and workforce issues related to nanotechnology. The Center shall also conduct studies and provide input and assistance to the Director of the National Science Foundation in completing the annual report required under paragraph 7(b)(3) of this Act.

[(6) TRANSITION OF TECHNOLOGY.—The program, through its participating agencies, shall ensure cooperation and collaboration with United States industry in all relevant research efforts and develop mechanisms to assure prompt technology transition.

[(7) GAP FUNDING.—The program shall address research areas identified by the Council under section 5(a)(9) of this Act through a program of competitive grants to be award-

ed in such areas by the Director of the National Science Foundation using the Foundation's funds and any funds contributed to the Foundation by other participating agencies for this purpose. Such grants may be made to government or non-government awardees. Where appropriate, such grants may encourage interagency partnerships or leverage the expertise of State-supported nanotechnology programs.

#### [(SEC. 5. PROGRAM COORDINATION AND MANAGEMENT.

[(a) IN GENERAL.—The National Science and Technology Council shall oversee the planning, management, and coordination of the Federal nanotechnology research and development program. The Council, itself or through an appropriate subgroup it designates or establishes, shall—

[(1) establish a set of broad applications of nanotechnology research and development, or grand challenges, to be met by the results and activities of the program, based on national needs;

[(2) submit to the Congress through the Senate Committee on Commerce, Science, and Transportation, and the House of Representatives Committee on Science, an annual report, along with the President's annual budget request, describing the implementation of the program under section 4;

[(3) provide for interagency coordination of the program, including with the Department of Defense;

[(4) coordinate the budget requests of each of the agencies involved in the program with the Office of Management and Budget to ensure that a balanced research portfolio is maintained in order to ensure the appropriate level of research effort;

[(5) provide guidance each year to the participating departments and agencies concerning the preparation of appropriations requests for activities related to the program;

[(6) consult with academic, industry, State and local government (including State and regional nanotechnology programs), and other appropriate groups conducting research on and using nanotechnology;

[(7) establish an Information Services and Applications Council to promote access to and early application of the technologies, innovations, and expertise derived from nanotechnology research and development program activities to agency missions and systems across the Federal government, and to United States industry;

[(8) in cooperation with the Advisory Panel established under subsection (b), develop and apply measurements using appropriate metrics for evaluating program performance and progress toward goals; and

[(9) identify research areas which are not being adequately addressed by the agencies' current research programs.

[(b) PRESIDENT'S NANOTECHNOLOGY ADVISORY PANEL.—

[(1) ESTABLISHMENT.—The President shall establish a National Nanotechnology Advisory Panel.

[(2) SELECTION PROCEDURES.—The President shall establish procedures for the selection of individuals not employed by the Federal government who are qualified in the science of nanotechnology and other appropriate fields and may, pursuant to such procedures, select up to 20 individuals, one of whom shall be designated Chairman, to serve on the Advisory Panel. Selection of individuals for the Advisory Panel shall be based solely on established records of distinguished fundamental and applied scientific service, and the panel shall contain a reasonable cross-section of views and expertise, including those regarding the societal, ethical, educational, legal, and workforce issues related to nanotechnology. In selecting individuals to serve on the Advisory Panel, the

President shall seek and give due consideration to recommendations from the Congress, industry, the scientific community (including the National Academy of Sciences), scientific professional societies, academia, the defense community, the education community, State and local governments, and other appropriate organizations.

[(3) MEETINGS.—The Advisory Panel shall meet no less than twice annually, at such times and places as may be designated by the Chairman in consultation with the National Nanotechnology Coordination Office established under subsection 5(c) of this Act.

[(4) DUTIES.—The Advisory Panel shall advise the President and the National Science and Technology Council, and inform the Congress, on matters relating to the National Nanotechnology Program, including goals, roles, and objectives within the program, its capabilities and research needs, guidance on achieving major objectives, and establishing and measuring performance goals using appropriate metrics. The Advisory Panel shall issue an annual report, containing the information required by subsection (d) of this section, to the President, the Council, the heads of each agency involved in the program, the Senate Committee on Commerce, Science, and Transportation, and the House of Representatives Committee on Science, on or before September 30 of each year.

[(c) NATIONAL NANOTECHNOLOGY COORDINATION OFFICE.—The President shall establish a National Nanotechnology Coordination Office, with full-time staff, to provide day-to-day technical and administrative support to the Council and the Advisory Panel, and to be the point of contact on Federal nanotechnology activities for government organizations, academia, industry, professional societies, State nanotechnology programs, and others to exchange technical and programmatic information. The Office shall promote full coordination of research efforts between agencies, scientific disciplines, and United States industry.

[(d) PROGRAM PLANS AND REPORTS.—

[(1) ANNUAL EVALUATION OF NANOTECHNOLOGY RESEARCH DEVELOPMENT PROGRAM.—The report by the Advisory Panel, required pursuant to subsection (b)(4), shall include—

[(A) a review of the program's technical success in achieving the stated goals and grand challenges according to the metrics established by the program and Advisory Panel;

[(B) a review of the program's management and coordination;

[(C) a review of the funding levels by each agency for the program's activities and their ability to achieve the program's stated goals and grand challenges;

[(D) a review of the balance in the program's portfolio and components across agencies and disciplines;

[(E) an assessment of the degree of participation in the program by minority serving institutions and institutions located in States participating in NSF's EPSCoR program;

[(F) a review of policy issues resulting from advancements in nanotechnology and its effects on the scientific enterprise, commerce, workforce, competitiveness, national security, medicine, and government operations;

[(G) recommendations for new program goals and grand challenges;

[(H) recommendations for new research areas, partnerships, coordination and management mechanisms, or programs to be established to achieve the program's stated goals and grand challenges;

[(I) recommendations for new investments by each participating agency in each program funding area for the 5-year period following the delivery of the report;

[(J) reviews and recommendations regarding other issues deemed pertinent or specified by the panel; and

[(K) a technology transition study which includes an evaluation of the Federal nanotechnology research and development program's success in transitioning its research, technologies, and concepts into commercial and military products, including—

[(i) examples of successful transition of research, technologies, and concepts from the Federal nanotechnology research and development program into commercial and military products;

[(ii) best practices of universities, government, and industry in promoting efficient and rapid technology transition in the nanotechnology sector;

[(iii) barriers to efficient technology transition in the nanotechnology sector, including, but not limited to, standards, pace of technological change, qualification and testing of research products, intellectual property issues, and Federal funding; and

[(iv) recommendations for government sponsored activities to promote rapid technology transition in the nanotechnology sector.

[(2) OFFICE OF MANAGEMENT AND BUDGET REVIEW.—

[(A) BUDGET REQUEST REVIEW.—Each Federal agency and department participating in the program shall, as part of its annual request for appropriations, submit information to the Office of Management and Budget including—

[(i) each element of its nanotechnology research and development activities that contributes directly to the program or benefits from the program;

[(ii) the portion of its request for appropriations that is allocated to each such element; and

[(iii) the portion of its request for appropriations that is allocated to each program funding area.

[(B) OMB REVIEW AND ALLOCATION STATEMENT.—The Office of Management and Budget shall review the information provided under subparagraph (A) in light of the goals, priorities, grand challenges, and agency and departmental responsibilities set forth in the annual report of the Council under paragraph (3), and shall include in the President's annual budget estimate, a statement delineating the amount and portion of each appropriate agency's or department's annual budget estimate relating to its activities undertaken pursuant to the program.

[(3) ANNUAL NSTC REPORT TO CONGRESS ON THE NANOTECHNOLOGY RESEARCH DEVELOPMENT PROGRAM.—The National Science and Technology Council shall submit an annual report to the Congress that—

[(A) includes a detailed description of the goals, grand challenges, and program funding areas established by the President for the program;

[(B) sets forth the relevant programs and activities, for the fiscal year with respect to which the budget submission applies, of each Federal agency and department, participating in the program, as well as such other agencies and departments as the President or the Director considers appropriate;

[(C) describes the levels of Federal funding for the fiscal year during which such report is submitted, and the levels proposed for the fiscal year with respect to which the budget submission applies, for each of the program funding areas of the program;

[(D) describes the levels of Federal funding for each agency and department participating in the program and each program

funding area for the fiscal year during which such report is submitted, and the levels proposed for the fiscal year with respect to which the budget submission applies, and compare these levels to the most recent recommendations of the Advisory Panel and the external review of the program;

[(E) describes coordination and partnership activities with State, local, international, and private sector efforts in nanotechnology research and development, and how they support the goals of the program;

[(F) describes mechanisms and efforts used by the program to assist in the transition of innovative concepts and technologies from Federally funded programs into the commercial sector, and successes in these transition activities;

[(G) describes coordination between the military and civilian portions, as well as the life science and non-life science portions, of the program in technology development, supporting the goals of the program, and supporting the mission needs of the departments and agencies involved;

[(H) analyzes the progress made toward achieving the goals, priorities, and grand challenges designated for the program according to the metrics established by the program and the Advisory Panel; and

[(I) recommends new mechanisms of coordination, program funding areas, partnerships, or activities necessary to achieve the goals, priorities, and grand challenges established for the program.

[(4) TRIENNIAL EXTERNAL REVIEW OF NANOTECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM.—

[(A) IN GENERAL.—The Director of the National Science Foundation shall enter into an arrangement with the National Research Council of the National Academy of Sciences to conduct a triennial evaluation of the Federal nanotechnology research and development program, including—

[(i) a review of the technical success of the program in achieving the stated goals and grand challenges under the metrics established by the program and the nanotechnology Advisory Panel, and under other appropriate measurements;

[(ii) a review of the program's management and coordination across agencies and disciplines;

[(iii) a review of the funding levels by each agency for the program's activities and their ability with such funding to achieve the program's stated goals and grand challenges;

[(iv) recommendations for new or revised program goals and grand challenges;

[(v) recommendations for new research areas, partnerships, coordination and management mechanisms, or programs to be established to achieve the program's stated goals and grand challenges;

[(vi) recommendations for investment levels in light of goals by each participating agency in each program funding area for the 5-year period following the delivery of the report;

[(vii) recommendations on policy, program, and budget changes with respect to nanotechnology research and development activities;

[(viii) recommendations for improved metrics to evaluate the success of the program in accomplishing its stated goals;

[(ix) a review of the performance of the Information Services and Applications Council and its efforts to promote access to and early application of the technologies, innovations, and expertise derived from program activities to agency missions and systems across the Federal government and to United States industry; and

[(x) an analysis of the relative position of the United States compared to other nations

with respect to nanotechnology research and development, including the identification of any critical research areas where the United States should be the world leader to best achieve the goals of the program.

[(B) EVALUATION TO BE TRANSMITTED TO CONGRESS.—The Director of the National Science Foundation shall transmit the results of any evaluation for which it made arrangements under subparagraph (A) to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science upon receipt. The first such evaluation shall be transmitted no later than June 10, 2005, with subsequent evaluations transmitted to the Committees every 3 years thereafter.

[(SEC. 6. AUTHORIZATION OF APPROPRIATIONS.

[(a) NATIONAL SCIENCE FOUNDATION.—

[(1) GENERAL AUTHORIZATION.—There are authorized to be appropriated to the Director of the National Science Foundation to carry out the Director's responsibilities under this Act \$346,150,000 for fiscal year 2004.

[(2) SPECIFIC ALLOCATIONS.—

[(A) INTERDISCIPLINARY NANOTECHNOLOGY RESEARCH CENTERS.—Of the amounts described in paragraph (1), \$50,000,000 for fiscal year 2004, shall be available for grants of up to \$5,000,000 each for multidisciplinary nanotechnology research centers.

[(B) CENTER FOR SOCIETAL, ETHICAL, EDUCATIONAL, LEGAL, AND WORKFORCE ISSUES RELATED TO NANOTECHNOLOGY.—Of the sums authorized for the National Science Foundation each fiscal year, \$5,000,000 shall be used to establish a university-based Center for Societal, Ethical, Educational, Legal, and Workforce Issues Related to Nanotechnology.

[(C) NATIONAL NANOTECHNOLOGY COORDINATION OFFICE.—Of the sums authorized for the National Science Foundation each fiscal year, \$5,000,000 shall be used for the activities of the Nanotechnology Coordination Office.

[(D) GAP FUNDING.—Of the sums authorized for the National Science Foundation each fiscal year, \$5,000,000 shall be for use in competitive grants as described in section 4(c)(7) of this Act.

[(b) DEPARTMENT OF ENERGY.—There are authorized to be appropriated to the Secretary of Energy to carry out the Secretary's responsibilities under this Act \$160,195,000 for fiscal year 2004.

[(c) NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.—There are authorized to be appropriated to the Administrator of the National Aeronautics and Space Administration to carry out the Administrator's responsibilities under this Act \$58,650,000 for fiscal year 2004.

[(d) NATIONAL INSTITUTES OF HEALTH.—There are authorized to be appropriated to the Director of the National Institutes to carry out the Director's responsibilities under this Act \$49,680,000 for fiscal year 2004.

[(e) NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.—There are authorized to be appropriated to the Director of the National Institute of Standards and Technology to carry out the Director's responsibilities under this Act \$50,600,000 for fiscal year 2004.

[(f) ENVIRONMENTAL PROTECTION AGENCY.—There are authorized to be appropriated to the Administrator of the Environmental Protection Agency to carry out the Administrator's responsibilities under this Act \$5,750,000 for fiscal year 2004.

[(g) DEPARTMENT OF JUSTICE.—There are authorized to be appropriated to the Director of the National Institute of Justice to carry out the Director's responsibilities under this Act \$1,610,000 for fiscal year 2004.

[(h) DEPARTMENT OF TRANSPORTATION.—There are authorized to be appropriated to

the Secretary of Transportation to carry out the Secretary's responsibilities under this Act \$2,300,000 for fiscal year 2004.

[(i) DEPARTMENT OF AGRICULTURE.—There are authorized to be appropriated to the Secretary of Agriculture to carry out the Secretary's responsibilities under this Act \$2,870,000 for fiscal year 2004.

**[SEC. 7. SOCIETAL, ETHICAL, EDUCATIONAL, LEGAL, AND WORKFORCE ISSUES RELATED TO NANOTECHNOLOGY.**

[(a) STUDIES.—The Director of the National Science Foundation shall encourage, conduct, coordinate, commission, collect, and disseminate studies on the societal, ethical, educational, and workforce implications of nanotechnology through the Center for Societal, Ethical, Educational, Legal, and Workforce Issues established under section 4(c)(5). The studies shall identify anticipated issues and problems, as well as provide recommendations for preventing or addressing such issues and problems.

[(b) DATA COLLECTION.—The Director of the National Science Foundation shall collect data on the size of the anticipated nanotechnology workforce need by detailed occupation, industry, and firm characteristics, and assess the adequacy of the trained talent pool in the United States to fill such workforce needs.

[(c) ANNUAL REPORT.—The Director of the National Science Foundation shall compile the studies required by paragraph (2) and, with the assistance of the Center for Societal, Ethical, Educational, Legal, and Workforce Issues Related to Nanotechnology established under section 4(c)(5) of this Act, shall complete a report that includes a description of the Center's activities, which shall be submitted to the President, the Council, the Senate Committee on Commerce, Science, and Transportation, and the House of Representatives Committee on Science not later than 18 months after the date of enactment of this Act.

**[SEC. 8. DEFINITIONS.**

[In this Act:

[(1) ADVISORY PANEL.—The term "Advisory Panel" means the President's National Nanotechnology Panel.

[(2) FUNDAMENTAL RESEARCH.—The term "fundamental research" means research that builds a fundamental understanding and leads to discoveries of the phenomena, processes, and tools necessary to control and manipulate matter at the nanoscale.

[(3) GRAND CHALLENGE.—The term "grand challenge" means a fundamental problem in science or engineering, with broad economic and scientific impact, whose solution will require the application of nanotechnology.

[(4) INTERDISCIPLINARY NANOTECHNOLOGY RESEARCH CENTER.—The term "interdisciplinary nanotechnology research center" means a group of 6 or more researchers collaborating across scientific and engineering disciplines on large-scale long-term research projects that will significantly advance the science supporting the development of nanotechnology or the use of nanotechnology in addressing scientific issues of national importance, consistent with the goals set forth in section 4(b).

[(5) NANOTECHNOLOGY.—The term "nanotechnology" means the ability to work at the molecular level, atom-by-atom, to create large structures with fundamentally new molecular organization.

[(6) PROGRAM.—The term "program" means the national nanotechnology research program established under section 4.

[(7) RESEARCH INFRASTRUCTURE.—The term "research infrastructure" means the measurement science, instrumentation, modeling and simulation, and user facilities needed to develop a flexible and enabling infrastruc-

ture so that United States industry can rapidly commercialize new discoveries in nanotechnology.]

**SECTION 1. SHORT TITLE.**

This Act may be cited as the "21st Century Nanotechnology Research and Development Act".

**SEC. 2. NATIONAL NANOTECHNOLOGY PROGRAM.**

(a) NATIONAL NANOTECHNOLOGY PROGRAM.—The President shall implement a National Nanotechnology Program. Through appropriate agencies, councils, and the National Nanotechnology Coordination Office established in subsection (d), the Program shall—

(1) Establish the goals, priorities, grand challenges, and metrics for evaluation for Federal nanotechnology research, development, and other activities;

(2) Invest in Federal research and development programs in nanotechnology and related sciences to achieve those goals; and

(3) Provide for interagency coordination of Federal nanotechnology research, development, and other activities undertaken pursuant to the Program.

(b) GOALS.—The goals of the National Nanotechnology Program shall include:

(1) Developing a fundamental understanding of matter that enables control and manipulation at the nanoscale.

(2) Ensuring United States global leadership in the development and application of nanotechnology.

(3) Advancing the United States productivity and industrial competitiveness through stable, consistent, and coordinated investments in long-term scientific and engineering research in nanotechnology.

(4) Developing a network of shared facilities and centers to foster partnerships among researchers in nanotechnology.

(5) Accelerating the deployment and application in the private sector, including startup companies, of nanoscale-related research and development.

(6) Providing effective education and training for researchers and professionals skilled in the multidisciplinary perspectives necessary for nanotechnology so that a true interdisciplinary research culture for nanoscale science, engineering, and technology can emerge.

(7) Ensuring that ethical, legal, environmental, and other appropriate societal concerns are considered during the development of nanotechnology, including safer sustainable nanoscience products and processing.

(c) PROGRAM MANAGEMENT.—The National Science and Technology Council shall oversee the planning, management, and coordination of the National Nanotechnology Program. The Council, itself or through an appropriate subgroup it designates or establishes, shall—

(1) establish a set of broad applications of nanotechnology research and development, or grand challenges, to be met by the results and activities of the Program, based on national needs;

(2) provide for interagency coordination of the Program, including with the activities of the Defense Nanotechnology Research and Development Program established under section 246 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314);

(3) develop, within 12 months after the date of enactment of this Act, and update every 4 years thereafter, a strategic plan to meet the goals and priorities established under subsection (b) and to guide the activities and anticipated outcomes of the participating agencies, including a description of how the Program will move results out of the laboratory and into application for the benefit of society, support for long-term funding for multidisciplinary research and development in technology, and dedication of funding for interagency nanotechnology projects;

(4) coordinate the budget requests of each of the agencies involved in the Program with the

Office of Management and Budget to ensure that a balanced nanotechnology research portfolio is maintained in order to ensure the appropriate level of research effort;

(5) exchange information with academic, industry, State and local government (including State and regional nanotechnology programs), and other appropriate groups conducting research on and using nanotechnology;

(6) develop a plan to utilize Federal programs, such as the Small Business Innovation Research Program and the Small Business Technology Transfer Research Program, in support of the goal stated in subsection (b)(5);

(7) identify research areas that are not being adequately addressed by the agencies' current research programs;

(8) encourage progress on Program goals through the utilization of existing manufacturing facilities and industrial infrastructures such as, but not limited to, the employment of underutilized manufacturing facilities in areas of high unemployment as production engineering and research testbeds; and

(9) provide for, on a merit-reviewed, competitive basis, interdisciplinary nanotechnology research centers, which to the greatest extent possible, shall be established in geographically diverse centers including at least one center in a State participating in the National Science Foundation's (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR), established under section 113 of the NSF Authorization Act of 1988 (42 U.S.C. 1862(g)) and shall encourage the participation of minority serving institutions at these centers.

(d) PROGRAM COORDINATION.—The President shall establish a National Nanotechnology Coordination Office, with full-time staff, which shall—

(1) provide technical and administrative support to the Council and the Advisory Panel;

(2) serve as the point of contact on Federal nanotechnology activities for government organizations, academia, industry, professional societies, State nanotechnology programs, interested citizen groups, and others to exchange technical and programmatic information;

(3) conduct public outreach, including dissemination of findings and recommendations of the Advisory Panel, as appropriate; and

(4) establish an office to promote access to and early application of the technologies, innovations, and expertise derived from Program activities to agency missions and systems across the Federal Government, and to United States industry, including startup companies.

(e) ANNUAL REPORT.—The Council shall prepare an annual report, to be submitted to the House of Representatives Committee on Science and the Senate Committee on Commerce, Science, and Transportation at the time of the President's budget request to Congress, that includes—

(1) the Program budget, for the current fiscal year, for each agency that participates in the Program, including a breakout of spending for the development and acquisition of research facilities and instrumentation, for each program component area, and for all activities pursuant to subsection (b)(7), which shall be submitted by December 31st of such year;

(2) the proposed Program budget for the next fiscal year, for each agency that participates in the Program, including a breakout of spending for the development and acquisition of research facilities and instrumentation, for each program component area, and for all activities pursuant to subsection (b)(7);

(3) an analysis of the progress made toward achieving the goals and priorities established for the Program;

(4) an analysis of the extent to which the Program has incorporated the recommendations of the Advisory Panel and the Center, established in section 7 of this Act; and

(5) an assessment of how Federal agencies are implementing the plan described in section

(c)(7), and a description of the amount of Small Business Innovative Research and Small Business Technology Transfer Research funds supporting the plan.

### SEC. 3. ADVISORY PANEL.

(a) *IN GENERAL.*—The President shall establish or designate a National Nanotechnology Advisory Panel.

(b) *QUALIFICATIONS.*—The Panel established or designated by the President under subsection (a) shall consist primarily of individuals who are non-Federal members and shall include representatives of academia and industry. Members of such Panel shall be qualified to provide advice and information on nanotechnology research, development, demonstrations, education, technology transfer, commercial application, or societal and ethical concerns. In selecting or designating an Advisory Panel, the President may also seek and give consideration to recommendations from the Congress, industry, the scientific community (including the National Academy of Sciences), scientific professional societies, academia, the defense community, State and local governments, regional nanotechnology programs, and other appropriate organizations.

(c) *DUTIES.*—The Panel shall advise the President and the Council on matters relating to the Program, including assessing—

(1) trends and developments in nanotechnology science and engineering;

(2) progress made in implementing the Program;

(3) the need to revise the Program;

(4) the balance among the components of the Program, including funding levels for the program component areas;

(5) whether the Program component areas, priorities, and technical goals developed by the Council are helping to maintain United States leadership in nanotechnology;

(6) the management, coordination, implementation, and activities of the Program; and

(7) whether societal, ethical, environmental, and workforce concerns are adequately addressed by the Program.

(d) *REPORTS.*—The Advisory Panel shall report, not less frequently than once every 2 fiscal years, to the President, the Senate Committee on Commerce, Science, and Technology, and the House of Representatives Committee on Science on its assessments under subsection (c) and its recommendations for ways to improve the Program. The first report under this subsection shall be submitted within 1 year after the date of enactment of this Act.

(e) *TRAVEL EXPENSES OF NON-FEDERAL MEMBERS.*—Non-Federal members of the Panel, while attending meetings of the Panel or while otherwise serving at the request of the head of the Panel away from their homes or regular places of business, may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code, for individuals in the Government serving without pay. Nothing in this subsection shall be construed to prohibit members of the Panel who are officers or employees of the United States from being allowed travel expenses, including per diem in lieu of subsistence, in accordance with existing law.

### SEC. 4. TRIENNIAL EXTERNAL REVIEW OF NANOTECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM.

(a) *IN GENERAL.*—The Director of the National Science Foundation shall enter into an arrangement with the National Research Council of the National Academy of Sciences to conduct a triennial evaluation of the National Nanotechnology Program, including—

(1) a review of the technical success of the Program in achieving the stated goals under the metrics established by the Program and the Advisory Panel, and under other appropriate measurements;

(2) a review of the Program's management and coordination across agencies and disciplines;

(3) a review of the funding levels by each agency for the Program's activities and their ability with such funding to achieve the Program's stated goals;

(4) recommendations for new or revised Program goals;

(5) recommendations for new research areas, partnerships, coordination and management mechanisms, or programs to be established to achieve the Program's stated goals;

(6) recommendations for investment levels by each participating agency in each Program funding area for the 5-year period following the delivery of the report;

(7) recommendations on policy, program, and budget changes with respect to nanotechnology research and development activities;

(8) recommendations for improved metrics to evaluate the success of the Program in accomplishing its stated goals;

(9) a review of the performance of the National Nanotechnology Coordination Office and its efforts to promote access to and early application of the technologies, innovations, and expertise derived from program activities to agency missions and systems across the Federal Government and to United States industry; and

(10) an analysis of the relative position of the United States compared to other nations with respect to nanotechnology research and development, including the identification of any critical research areas where the United States should be the world leader to best achieve the goals of the Program.

(b) *EVALUATION TO BE TRANSMITTED TO CONGRESS.*—The Director of the National Science Foundation shall transmit the results of any evaluation for which it made arrangements under subsection (a) to the Advisory Panel, the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science upon receipt. The first such evaluation shall be transmitted no later than June 10, 2005, with subsequent evaluations transmitted to the Committees every 3 years thereafter.

### SEC. 5. AUTHORIZATION OF APPROPRIATIONS.

(a) *NATIONAL SCIENCE FOUNDATION.*—

(1) *IN GENERAL.*—There are authorized to be appropriated to the Director of the National Science Foundation to carry out the Director's responsibilities under this Act—

(A) \$350,000,000 for fiscal year 2004;

(B) \$385,000,000 for fiscal year 2005;

(C) \$424,000,000 for fiscal year 2006;

(D) \$449,000,000 for fiscal year 2007; and

(E) \$476,000,000 for fiscal year 2008.

(2) *SPECIFIC ALLOCATIONS.*—

(A) *INTERDISCIPLINARY NANOTECHNOLOGY RESEARCH CENTERS.*—Of the amounts authorized by paragraph (1) for each fiscal year, \$50,000,000 for each fiscal year shall be available for grants of up to \$5,000,000 each for multidisciplinary nanotechnology research centers.

(B) *AMERICAN NANOTECHNOLOGY PREPAREDNESS CENTER.*—Of the amounts authorized by paragraph (1) for each fiscal year, \$5,000,000 shall be used to establish and maintain a university-based American Nanotechnology Preparedness Center.

(C) *NATIONAL NANOTECHNOLOGY COORDINATION OFFICE.*—Of the sums authorized by paragraph (1) for each fiscal year, \$5,000,000 shall be used for the activities of the Nanotechnology Coordination Office.

(D) *MANUFACTURING TECHNOLOGIES FOR NANOMATERIALS.*—Of the sums authorized by paragraph (1) for each fiscal year, \$5,000,000 shall be used for the activities of the Center for Nanomaterials Manufacturing.

(b) *DEPARTMENT OF ENERGY.*—

(1) *IN GENERAL.*—There are authorized to be appropriated to the Secretary of Energy to carry out the Secretary's responsibilities under this Act—

(A) \$265,000,000 for fiscal year 2004;

(B) \$292,000,000 for fiscal year 2005;

(C) \$321,000,000 for fiscal year 2006;

(D) \$340,000,000 for fiscal year 2007; and

(E) \$360,000,000 for fiscal year 2008.

(2) *ALLOCATION.*—Of the sums authorized by paragraph (1) for each fiscal year, \$25,000,000 shall be used on a merit-reviewed and competitive basis to support consortia that integrate newly developed nanotechnology and microfluidic tools with systems biology, immunology, and molecular imaging, of which at least 1 such consortium shall be provided with at least \$10,000,000 for each fiscal year.

(c) *NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.*—There are authorized to be appropriated to the Administrator of the National Aeronautics and Space Administration to carry out the Administrator's responsibilities under this Act—

(1) \$31,000,000 for fiscal year 2004;

(2) \$34,100,000 for fiscal year 2005;

(3) \$37,500,000 for fiscal year 2006;

(4) \$40,000,000 for fiscal year 2007; and

(5) \$42,300,000 for fiscal year 2008.

(d) *NATIONAL INSTITUTES OF HEALTH.*—There are authorized to be appropriated to the Director of the National Institutes to carry out the Director's responsibilities under this Act—

(1) \$70,000,000 for fiscal year 2004;

(2) \$77,000,000 for fiscal year 2005;

(3) \$85,000,000 for fiscal year 2006;

(4) \$90,000,000 for fiscal year 2007; and

(5) \$95,000,000 for fiscal year 2008.

(e) *NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.*—There are authorized to be appropriated to the Director of the National Institute of Standards and Technology to carry out the Director's responsibilities under this Act—

(1) \$62,000,000 for fiscal year 2004;

(2) \$68,200,000 for fiscal year 2005;

(3) \$75,000,000 for fiscal year 2006;

(4) \$80,000,000 for fiscal year 2007; and

(5) \$84,000,000 for fiscal year 2008.

(f) *ENVIRONMENTAL PROTECTION AGENCY.*—There are authorized to be appropriated to the Administrator of the Environmental Protection Agency to carry out the Administrator's responsibilities under this Act—

(1) \$5,000,000 for fiscal year 2004;

(2) \$5,500,000 for fiscal year 2005;

(3) \$6,050,000 for fiscal year 2006;

(4) \$6,413,000 for fiscal year 2007; and

(5) \$6,800,000 for fiscal year 2008.

(g) *DEPARTMENT OF JUSTICE.*—There are authorized to be appropriated to the Director of the National Institute of Justice to carry out the Director's responsibilities under this Act—

(1) \$1,000,000 for fiscal year 2004;

(2) \$1,100,000 for fiscal year 2005;

(3) \$1,210,000 for fiscal year 2006;

(4) \$1,283,000 for fiscal year 2007; and

(5) \$1,360,000 for fiscal year 2008.

(h) *DEPARTMENT OF HOMELAND SECURITY.*—There are authorized to be appropriated to the Secretary of Homeland Security to carry out the Secretary's responsibilities under this Act—

(1) \$2,000,000 for fiscal year 2004;

(2) \$2,200,000 for fiscal year 2005;

(3) \$2,420,000 for fiscal year 2006;

(4) \$2,570,000 for fiscal year 2007; and

(5) \$2,720,000 for fiscal year 2008.

(i) *DEPARTMENT OF AGRICULTURE.*—There are authorized to be appropriated to the Secretary of Agriculture to carry out the Secretary's responsibilities under this Act—

(1) \$10,000,000 for fiscal year 2004;

(2) \$11,000,000 for fiscal year 2005;

(3) \$12,100,000 for fiscal year 2006;

(4) \$12,830,000 for fiscal year 2007; and

(5) \$13,600,000 for fiscal year 2008.

### SEC. 6. AMERICAN NANOTECHNOLOGY PREPAREDNESS CENTER.

(a) *IN GENERAL.*—The Director of the National Science Foundation shall, on a merit-reviewed and competitive basis, establish a new American Nanotechnology Preparedness Center to encourage, conduct, coordinate, commission, collect, and disseminate research on the educational, legal, workforce, societal, and ethical issues related to nanotechnology.

(b) *STUDIES.*—The Director of the National Science Foundation, through the Center, shall conduct, coordinate, commission, collect, and disseminate studies on the educational, legal, workforce, societal, and ethical implications of nanotechnology. The studies shall identify anticipated issues and problems, as well as provide recommendations for preventing or addressing such issues and problems.

(c) *WORKFORCE DATA.*—The Director of the National Science Foundation shall collect data on the size of the anticipated nanotechnology workforce need by detailed occupation, industry, and firm characteristics, and assess the adequacy of the trained talent pool in the United States to fill such workforce needs.

(d) *ANNUAL REPORT.*—The Director of the National Science Foundation shall compile the studies required by paragraph (b) and, with the assistance of the Center, shall complete a report that includes a description of the Center's activities, which shall be submitted to the President, the Council, the Advisory Panel, the Senate Committee on Commerce, Science, and Transportation, and the House of Representatives Committee on Science not later than 18 months after the date of enactment of this Act.

**SEC. 7. COMMERCIALIZATION ISSUES RELATED TO NANOSCIENCE AND NANOTECHNOLOGY.**

(a) *IN GENERAL.*—The Director of the National Institute of Standards and Technology shall establish a center within NIST's Manufacturing Engineering Laboratory for issues relating to the commercialization of nanoscience and nanotechnology research. The program shall—

(1) conduct basic research on issues related to the development and manufacture of nanotechnology including—

(A) metrology;  
 (B) reliability and quality assurance;  
 (C) processes control; and  
 (D) manufacturing best practices; and  
 (2) in consultation with the National Technical Information Service and the National Nanotechnology Coordination Office, act as a clearinghouse for information related to commercialization of nanoscience and nanotechnology research, including—

(A) information relating activities by regional, state, and local commercial nanotechnology initiatives;

(B) transition of research, technologies, and concepts from Federal nanotechnology research and development programs into commercial and military products;

(C) best practices by government, university and private sector laboratories transitioning technology to commercial use;

(D) examples of ways to overcome barriers and challenges to technology deployment; and

(E) use of existing manufacturing infrastructure and workforce.

(b) *USE OF MANUFACTURING EXTENSION PARTNERSHIP PROGRAM.*—The Director of the National Institute of Standards and Technology shall utilize the manufacturing extension partnership program to the extent possible to reach small and medium sized manufacturing companies.

(c) *MANUFACTURING TECHNOLOGIES FOR NANOMATERIALS.*—The Director of the National Science Foundation shall establish, on a merit-reviewed, competitive basis, a new Center for Nanomaterials Manufacturing to encourage the development and transfer of technologies for the manufacture of nanomaterials. The Center will encourage, conduct, coordinate, commission, collect, and disseminate research on new manufacturing technologies for materials with unprecedented combinations of strength, toughness, lightness, flame resistance, and membrane separation characteristics, and develop mechanisms to transfer such manufacturing technologies to United States industries.

**SEC. 8. DEFINITIONS.**

In this Act:

(1) *ADVISORY PANEL.*—The term "Advisory Panel" means the President's National Nanotechnology Panel established or designated under section 3.

(2) *FUNDAMENTAL RESEARCH.*—The term "fundamental research" means research that builds a fundamental understanding and leads to discoveries of the phenomena, processes, and tools necessary to control and manipulate matter at the nanoscale.

(3) *NANOTECHNOLOGY.*—The term "nanotechnology" means the ability to work at the molecular level, atom-by-atom, to create large structures with fundamentally new molecular organization.

(4) *PROGRAM.*—The term "Program" means the National Nanotechnology Program established under section 2.

(5) *COUNCIL.*—The term "Council" means the National Science and Technology Council or an appropriate subgroup designated by the Council under section 2(c).

(6) *GRAND CHALLENGE.*—The term "grand challenge" means a fundamental problem in science or engineering, with broad potential economic and scientific impact, the solution to which will require the application of nanotechnology research.

Mr. MCCAIN. Mr. President, I am pleased to join my colleagues, Senators ALLEN, WYDEN, HOLLINGS, and STEVENS in sponsoring this substitute amendment to S. 189, the 21st Century Nanotechnology Research and Development Act. I commend Senators ALLEN and WYDEN for their leadership on this important legislation, and also thank Senators STEVENS, LOTT, and SUNUNU and Chairman BOEHLERT and Ranking Member HALL of the House Science Committee, for their work on this issue.

Nanotechnology is a truly revolutionary field of science. Scientists have been able to develop materials and systems with dramatic new properties by manipulating structures and systems at the scale of  $10^{-9}$  meters, or 1/100,000 the width of a human hair. This basic research has the potential to benefit virtually every sector of our economy, including biotechnology, telecommunications, national security, manufacturing, and computers. Some experts have projected that sales of products based on nanotechnology will reach \$1 trillion by 2015. Many of our international economic competitors have begun to focus on this field. For example, the European Union budgeted \$1.2 billion for nanotechnology research in 2003 and 2004.

This bill is designated to highlight the United States' interest and efforts in this emerging technology. The bill would authorize a coordinated research program across the Federal Government through a National Nanotechnology Program. In addition, it would authorize funding for nanotechnology research at the National Science Foundation, the National Aeronautics and Space Administration, the National Institute of Standards and Technology (NIST), the Department of Energy, and the Environmental Protection Agency from fiscal year 2005 through fiscal year 2008. I think that this multiyear authorization is important, because it signals to the Federal agencies, the States, and private industry our commitment to this important cutting-edge research.

In addition, it is important to point out that the legislation deals with more than just basic research. The bill includes provisions that will ensure

that social, ethical, environmental, educational, legal, and workforce issues will be analyzed, including the creation of a new center on a merit-reviewed, competitive basis to study these issues. The bill also would establish a program at NIST to conduct basic research on metrology and other issues relating to nanotechnology-based manufacturing. In addition, the bill would authorize the Secretary of Commerce, or his designee, to establish a clearinghouse of information for issues relating to nanotechnology commercialization. It is important that the private sector has access to this basic research in nanotechnology, so that United States can attain a competitive edge in this new field.

I thank my colleagues for their support of this important legislation.

Mr. HOLLINGS. Mr. President, I am proud to cosponsor S. 189, the 21st Century Nanotechnology Research and Development Act. With this legislation, the Senate recognizes the emerging field of nanotechnology and its importance to the United States economy. I thank my colleagues for their efforts. I particularly thank Senator WYDEN for his leadership and maturity in guiding this bill to the floor. There were several times when this bill was going to be derailed and each time Senator WYDEN stepped in to get us back on track.

Nanotechnology has been described as the next Industrial Revolution that will drastically alter the way products are manufactured. Yet we are not alone as other countries are competing to push the boundaries of this technical frontier. Countries such as Japan and the European Union are already spending hundreds of millions of dollars on nanotechnology research. The United States cannot afford to fall behind if we want to maintain our economic strength. This legislation is one step towards ensuring America's leadership and economic competitiveness in nanotechnology.

This legislation is an affirmation that the United States will continue to play a leading role in the development of nanotechnology. It authorizes \$784 million for fiscal year 2005 for five Federal agencies involved in nanotechnology research. Although other agencies were not included in this bill, I am hopeful that they will contribute to the National Nanotechnology Program. The legislation provides interagency coordination to the Federal Government's nanotechnology research and development efforts. The establishment of a National Nanotechnology Coordination Office will infuse an organized, structured, and collaborative approach to this research. The legislation also calls for the development of a strategic plan that will provide a roadmap for the country's research and development future.

Nanotechnology is a new frontier and we want to ensure that it is developed

responsibly. That is why I pushed for the creation of the American Nanotechnology Preparedness Center. This Center is charged with ensuring that societal, ethical, and environmental concerns surrounding nanotechnology are properly addressed as research progresses. This is vital as we see more and more of nanotechnology in everyday life, we need to assure citizens that this new technology is safe and non-threatening.

In addition to the American Nanotechnology Preparedness Center, this legislation also establishes a Nanotechnology Advisory Panel. The National Academies of Sciences recommended an Advisory Panel in its review of the National Nanotechnology Initiative. I am proud to support its creation in this legislation. I think that it is vital that the President receive advice from dedicated experts directly involved in this field, from the scientists and researchers who are at the forefront of this technology, rather than from advisors who are appointed to serve other technical advisory roles.

One of this country's main strengths is our ability to innovate. Nanotechnology will be the next test as to whether we can continue to move forward. There remains a tremendous amount of basic research that needs to be undertaken in order to fully understand the science behind it all. This is exactly the role that Federal Government should play: to promote scientific knowledge that will benefit our society and our economic competitiveness. This bill does exactly that and I am proud to support it.

I thank the House Science Committee for their cooperation. I also thank the other cosponsors, particularly Senators LIEBERMAN and CLINTON as well as Senators ALLEN, MCCAIN, STEVENS, MIKULSKI, LANDRIEU, LEVIN, BAYH, CANTWELL, CORZINE, HUTCHINSON, KERRY, LAUTENBERG, BAUCUS, ROCKEFELLER, ALEXANDER, and WARNER for their support. In particular, I would also like to thank the staff who put this bill together. In addition to my staff, we enjoyed the hard work of Ruchi Bhowmik with Senator WYDEN, Liz Connell with Senator STEVENS, Ken La Sala with the Senate Commerce Committee, Frank Cavaliere with Senator ALLEN, Mike O'Reilly with Senator SUNUNU, and Michael Yentzen with Senator LOTT.

Mr. WYDEN. Mr. President, I am pleased to introduce a substitute text for S. 189, the 21st Century Nanotechnology Research and Development Act. I thank Commerce Committee Chairman MCCAIN, Ranking Member HOLLINGS, and my colleagues Senators ALLEN, CLINTON and LIEBERMAN for their tremendous bipartisan assistance and cooperation. With this bill, we pave the way for greater discoveries and applications in an area that will soon become a major economic driver for this country.

The 21st Century Nanotechnology Research and Development Act will

provide a smart, accelerated, and organized approach to nanotechnology research, development, and education. This legislation will marshal America's nanotechnology efforts that are spread out across the State and Federal levels into one driving force. This bill will develop much needed strategic inter-agency cooperation and coordination through a National Nanotechnology Program. A National Nanotechnology Advisory Panel will advise the President on nanotechnology matters and the American Nanotechnology Preparedness Center will evaluate important workforce and ethical issues to ensure that societal and citizen concerns about nanotechnology are addressed now—at the outset of this science—and will support, not hinder, the development of this important science.

As I have said before, nanotechnology has the potential to change America on a scale equal to, if not greater than, the computer revolution. Nanoparticles and nanodevices will become the building blocks of our health care, agriculture, manufacturing, environmental cleanup, and even national security. By getting behind nanotechnology now with organized, goal-oriented support, the Federal Government will play a pivotal role in keeping the United States at the forefront of this discipline.

It is estimated that nanotechnology will become a trillion-dollar industry over the next 10 years. With the Nation's unemployment still high and real economic recovery still out of reach, nanotechnology holds the promise of new trade and jobs needed to jump start the economy. As the nanotechnology industry grows, the ranks of skilled workers needed to discover and apply its capabilities must grow too. In the nanotechnology revolution, areas of high unemployment could become magnets for domestic production, engineering and research for nanotechnology applications. I am determined that the United States will mine the opportunities of nanotechnology and this legislation will ensure that the United States takes full advantage of the opportunities nanotechnology presents.

Our Nation's current National Nanotechnology Initiative is a step in the right direction. This nation has already committed substantial funds to nanotechnology research and development in the coming years. But funding is not enough. There must be careful planning to make sure that money is used for sound science over the long-term. That is the reason for the substitute amendment to S. 189 I introduce today. The strategic planning it prescribes will ensure that scientists get the support they need to realize nanotechnology's greatest potential.

With this bill, Congress is challenging the government to accept new responsibilities in promoting and developing nanotechnology. Again, I thank the House Science Committee

and House Science Chairman BOEHLERT for their cooperation and I thank the other cosponsors, Senators ALEXANDER, WARNER, MIKULSKI, LANDRIEU, LEVIN, BAYH, CANTWELL, CORZINE, HUTCHISON, KERRY, LAUTENBERG, BAUCUS, and ROCKEFELLER, for their valuable assistance. I am also pleased to report that this amendment has the support of nanotechnology industry members, such as the Nano Business Alliance. This amended version is the work of bipartisan and bi-cameral cooperation and I look forward to working with my colleagues to get this to the President's desk.

#### INCLUSION OF BIOTECHNOLOGY

Mr. WYDEN. Mr. President, I rise to clarify the legislative intent of S. 189, the 21st Century Nanotechnology Research and Development Act. In reviewing the section of the substitute text dealing with the purpose and definitions of fundamental research in nanotechnology that our bill references, I believe that they are not intended to limit research and development to the physical sciences and are intended to include a wide variety of research, including the biotechnology-nanotechnology interface. Senator STEVENS, is that your reading of this legislation?

Mr. STEVENS. I agree with the Senator from Oregon. It is our intention to include research into the biotechnology-nanotechnology interface. We did not mention specific areas or research because we did not intend to be overly restrictive.

Mr. WYDEN. I would just like to take a moment to clarify some of the types of nanotechnology applications that are possible through the research involving biotechnology at the nano-level, which are encompassed by this legislation. These examples include applications ranging from industrial manufacturing to advances in medicine to breakthroughs in defense against bioterrorism.

For instance, biotechnology is spurring the development of proteins that will be capable of manufacturing biological structures on the nano-scale. This technology will allow the development of nano-electronics such as micro-transistors and silicon chips. In the area of photonics there is potential for developing new micro-optical switches and optical micro-processing platforms.

Researchers recently discovered a first of its kind carbon-silicon compound in freshwater diatoms. This discovery promises to open the door to understanding the molecular process of biosilicification, or the ways plants and animals build natural structures. This understanding may lead to applications ranging from low cost synthesis of advanced biomaterials to new treatments for osteoporosis.

These are only a few examples of advances made through the interface between biotechnology and nanotechnology. I just want to confirm this legislation should help facilitate

the synergy between the biological sciences and material sciences.

Mr. STEVENS. These examples are exactly the type of research that we have intended to cover in this legislation. Beyond industrial applications there are many health care applications of nano-biotechnology.

I am particularly excited about the potential for nanotechnology in the area of systems biology and molecular imaging. Systems biology analyzes all of the elements in a system, rather than an individual cell, gene or protein. By applying nanotechnology to systems biology and using molecular imaging, it will be possible to achieve ultra-rapid diagnostic results by analyzing on a molecular level the signatures of thousands of genes and proteins. Moreover, the systems approach in combination with nanotechnology will speed up and greatly reduce the cost of discovering new drugs. This will lead to the advancement of predictive medicine generating revolutions in the diagnosis, treatment and prevention of disease.

Given nanotechnology's tremendous potential in health care, I want to encourage the National Institutes of Health (NIH) to be proactive participants in the nanotechnology revolution. Although a specific authorization of appropriations for NIH is not included in this bill at the request of our House colleagues, it is expected that NIH will be an active participant in the National Nanotechnology Program.

Mr. WYDEN. I thank the distinguished Senator from Alaska for clarification of this matter and I wholeheartedly agree with him regarding the potential benefits of nanotechnology in the field of health care.

Mr. SUNUNU. Mr. President, this legislation is the product of many, many hours of debate and discussion. I appreciate the commitment of the Chairman of the Commerce Committee, Senator McCAIN, and the sponsors of the bill, Senators WYDEN and ALLEN, to try to address my concerns and accommodate my views on this bill. I appreciate the indulgence of the Ranking Member, Senator HOLLINGS, for his understanding and assistance on this bill. Through persistence and thoughtful consideration by a handful of interested Members in both bodies, an agreement was reached on a legislative package that has brought us to this stage of the process. While I still have significant reservations, I am willing to allow the bill to proceed forward.

Nanotechnology is a burgeoning field of inquiry that has captured the interest of many of our nation's brightest scientific minds. While the concepts behind the study of nanotechnology are not necessarily new, recent successes have highlighted its enormous potential. If early experiences are an indication of things to come, nanotechnology has the capability to dramatically change our approach to a wide range of complex scientific problems. By under-

standing materials and compounds at the molecular or atomic level, scientists can develop techniques to improve the properties of everything from medicines to metals; machines to microchips.

S. 189 is meant to complement, rather than restrain, the work that the Bush administration is already doing on the issue of nanotechnology. This administration is deeply committed to expending the resources and conducting research on critical areas of nanotechnology and nanoscale science and engineering. The administration's "National Nanotechnology Initiative" is on track to commit almost \$900 million in FY 2004 for nanotechnology research within appropriate Federal agencies. In addition, the administration has already established a National Nanotechnology Coordination Office to facilitate and coordinate the multi-agency effort. It is essential that S. 189 not infringe on the good work already being done by the administration on this issue or on the near- or mid-term plans for further work in this area.

Despite this progress, I have several concerns about the underlying text of the managers' amendment, and for that matter, the original version of S. 189. I firmly believe that oversight is an important function of the Senate, and an important part of that oversight is to ensure that Federal funds are spent appropriately. However the Managers' Amendment creates redundant reporting requirements for various agencies within the Administration. By my count, the bill includes annual, biennial and triennial reporting obligations by the National Science and Technology Council, the National Nanotechnology Advisory Panel, and the National Academy of Sciences, respectively. These reports have a number of overlapping components that will result in the checking and re-checking of similar questions and issues. It is important to note that Congressional studies and reporting requirements impose very significant costs on the reporting agencies, thereby draining funds from the very projects and research we are trying to fund.

S. 189 also authorizes the establishment of several interdisciplinary and specialized research centers on nanotechnology. The language of the bill requires that the process for establishing these centers be on a merit-reviewed and competitive basis. Let me serve notice to those involved in the establishment of these centers: I will work to ensure that any center established pursuant to this bill be placed at the most appropriate setting possible. I know this sentiment is shared by the Chairman of the Commerce Committee and other Members of the Senate, and I look forward to working with them to ensure that the principles of merit-review and competitive basis are upheld.

Finally, let me mention that there are concerns expressed by individuals within the academic and scientific

communities and by general citizens that research and development of nanotechnology could possibly spiral out of control leading to the harmful impacts on humans. Some people have expressed concern that nanotechnology will lead to a super-race of humans or a situation where nano-machines attack or even dominate human beings. Others argue that there are uncertainties about the impact of nanotechnologies on important aspects of our daily lives, including our society, environment, ethics, educational systems, legal structure or workforce. While I do not dismiss the possible negative ramifications of the study and realization of nanotechnology, I believe those possible dangers are remote and avoidable. Almost all scientific research or new technology can be used for mischievous purposes. Moreover, there are potential implications by the use of nanotechnology that should be examined as part of research projects and development stages of nanotechnology. However, the emphasis that S. 189 provides to these issues is more than I would have considered necessary. We cannot and should not fear the technological future; we should pay it proper respect and plan for it accordingly.

In closing, it is my understanding that the product of today's Senate work on this bill will likely be taken up and passed by the House and sent to the President for his consideration. I look forward to the multiple advances that will occur from the statutory framework provided under this bill. Our action today will signal to the research community the importance and significance we place on this field of study, and this will spur further investment by the private sector and hopefully lead to the technological breakthrough that will ignite further innovation and economic growth.

Mr. LIEBERMAN. Mr. President, the emerging field of nanotechnology constitutes an opportunity for the U.S. to claim global leadership in a new frontier in science and technology that has the potential to transform every aspect of our lives. By manipulating matter at a molecular scale, nanotechnology will allow us to develop new materials and devices that have unique properties currently beyond the realm of conventional technology. Nanotechnology is what scientists and technologists often call an enabling technology—a tool that opens the door to new possibilities constrained only by physics and the limits of our imaginations. This field has the great potential to affect our economy and quality of life since it has such broad prospective applications in so many different areas including medicine, electronics, energy, telecommunications, computing, and manufacturing. It has been estimated that the impact of nanotechnology on existing and new manufacturing will be in the trillions of dollars. In addition to creating new job opportunities, this exciting new initiative has the potential

to provide novel therapeutic treatments and a fundamental understanding of diseases including cancer. For example, research in building innovative tools to study biology at the nanometer scale will unlock mysteries and shed light on the vast number of biological processes. The new authorizing legislation the Senate is passing today, which I am pleased to have played a role in, should be an important step in this effort.

Yet, despite the enormous potential that nanotechnology offers, it is not an area in which we have assumed uncontested leadership. From an international perspective, the United States faces the danger of falling behind its Asian and European counterparts in supporting the pace of nanotechnological advancement. While our Nation certainly possesses the raw resources and talent to lead the world in developing this technology, it is also clear that a long-term focus and sustained commitment, as well as new collaboration between Government, academia, and industry, will be needed to ensure our place at the head of the next wave of innovation.

In recognition of the need to support ongoing nanotechnology efforts and to spur new ones, I was pleased to join Senator RON WYDEN in cosponsoring the original "21st Century Nanotechnology Research and Development Act" last year, which was reintroduced this year S. 189. My staff worked with the Commerce Committee on the initial drafting of this bill, and I was able to assist in including parallel legislation in last year's defense authorization P.L. 107-314, section 246 to help assure that Department of Defense research and development in nanotechnology works in concert with the civilian agencies covered by this bill. Much of the original Senate bill is retained in this final legislation. The revised S. 189 legislation we act on today, which we anticipate will also soon be approved by the House, will build on the efforts of the National Nanotechnology Initiative NNI, which was started under President Clinton and has received continued support under President Bush, to establish a comprehensive, intelligently coordinated program for addressing the full spectrum of challenges confronting a successful national science and technology effort, including those related to funding, coordination, infrastructure development, technology transition, and social issues.

The time is now ripe to elevate the U.S. nanotechnology effort beyond the level of an Executive Branch initiative. Funding for nanotechnology will soon reach \$1 billion a year, and the NNI currently attempts to coordinate programs across a wide range of Federal agencies and departments. This level of funding and the major coordination challenges that arise with so many diverse participants require having a program that is based in statute, provided with greater support and coordination

mechanisms, afforded a higher profile, and subjected to constructive Congressional oversight and support.

The final legislation closely tracks many of the recommendations of the National Research Council, NRC, which completed a thorough review of the NNI in 2002. The NRC report commended the leadership and multi-agency involvement of the NNI, and its recommendations included the establishment of an independent advisory panel. As the field of nanotechnology covers a wide variety of disciplines including engineering, physics, chemistry and life sciences, guidance is needed from a panel composed of experts from each of the disciplines. A comprehensive perspective is necessary for helping to set the directions and goals of the national program, including advice on the focus of research that should be conducted in the academia sector, as well as assistance in the transition of technology from academic into the private sector that will ensure the competitiveness of U.S. industry. Although members of the Presidents Council of Advisors on Science and Technology, PCAST, which the President is likely to select as the advisory body under section 4 in the final bill, are highly accomplished and esteemed, they are not necessarily steeped in the field of nanotechnology. Therefore, our expectation is that PCAST will set up its own nanotechnology panel composed of experts from both academia and industry representing the key nanotechnology disciplines. This independent panel should work in coordination with the National Science and Technology Council and the new Program Office, particularly across stove piped agency boundaries to better assure a fully integrated, crosscutting, interdisciplinary research effort. Otherwise, the promise of this research will not be realized.

To ensure that the United States takes the lead in this new and promising field of science and technology, we must provide for the organization and guidance necessary to foster interaction between Government, academia, and industry, so as to maximize the potential benefits of nanotechnology to our economy. This legislation provides a strong foundation and comprehensive framework that elicits contributions from all three sectors of our society in pushing nanotechnology research and development to the next level. I hope that we may all work together in a bipartisan fashion on implementing this bill to set the stage for U.S. economic growth over the next century.

Mrs. CLINTON. Mr. President, as an original co-sponsor of S. 189, the 21st Century Nanotechnology Research and Development Act, I am delighted that the Senate is acting on this important legislation. I want to thank my Senate colleagues, particularly Senator HOLLINGS and Senator WYDEN. Senator HOLLINGS' leadership on the Senate Commerce, Science and Transportation Committee was essential in winning

the passage of this legislation, which has so much promise for New Yorkers and Americans generally. Senator WYDEN has helped to shepherd this legislation through the Senate with his customary vision, determination and skill.

In ten or twenty years, we may well view this legislation as one of the most important bills passed by the 108th Congress. The bill provides multi-year authorization for increased Federal research and development investment in nanotechnology. Experts believe that nanotechnology could have an impact on our economy and society as significant as the impact of the steam engine, electricity, the Internet, and the computer chip. Researchers and high-tech start-ups have already identified many potential benefits and applications of nanotechnology in health, energy and the environment, information and communications technology, advanced materials, manufacturing, and national security. It is possible that nanotechnology could lead to solar energy that is competitive with fossil fuels. Medical researchers are already working on using nanotechnology to develop tools for the diagnosis and therapy of cancer.

In addition to funding research in nanoscale science and engineering, the legislation also supports exploration of the ethical and social dimensions of nanotechnology. I want to underline the importance of this component of the legislation. These provisions are intended to help ensure that we use this information to make intelligent decisions about the benefits and risks of this powerful new technology. We have a responsibility to ensure that appropriate safeguards are placed on the exploration of nanoscience and technology and that Congress exercises effective oversight of this process. I will work hard with my colleagues to ensure that Congress does its part.

I am proud to say that New York is playing a leading role in the development of nanotechnology, and is already seeing concrete benefits from the National Nanotechnology Initiative. Three of the six university-based centers of nanotechnology funded by the National Science Foundation in 2001 are located at New York's world-class research centers at Cornell University, Columbia University and Rennselaer Polytechnic Institute. Long Island's Brookhaven National Laboratory is the future home of the Center for Functional Nanomaterials, supported by the Department of Energy. The State of New York and International SEMATECH and its member companies are planning to provide approximately \$400 million in support to create a next-generation computer chip research and development facility at the University at Albany-SUNY. All of these investments are creating the foundations for future economic growth and the creation of high-tech, high-wage jobs, including in upstate New York.

The 21st Century Nanotechnology Research and Development Act shows what this Nation is capable of when we come together and set aside partisan differences. The National Nanotechnology Initiative was launched by President Clinton in January 2000, and has continued to enjoy bipartisan support from President Bush and members of Congress.

I urge my colleagues to continue to pay attention to nanotechnology after this legislation is passed. In many respects, this legislation is only the first step. As President Clinton noted when unveiling the National Nanotechnology Initiative, realizing the full promise of this technology may take twenty years of sustained investment. America's lead in this critical technology is by no means assured. Moreover, this legislation will not result in an extra dime being devoted to nanotechnology research, unless the legislation is followed by steadfast support for federal research and development in the budget and appropriations process.

I hope that the Administration and the Congress look for ways to build on and strengthen the current initiative. I believe that there are many such opportunities. The National Institutes of Health have targeted a relatively modest amount of funding for the NNI, despite the broad range of nanotechnology applications for health and biology. In addition, I hope we can increase the Environmental Protection Agency's budget for nanotechnology because it has a role to play in a variety of settings, including pollution prevention. We should also explore ways to respond to calls for the development of clean sources of energy using nanotechnology.

This legislation is a bold step in the direction of creating a brighter and more prosperous future for all Americans. In the years ahead, I look forward to continue working with my colleagues on both sides of the aisle to ensure the full development of this important initiative.

Mr. BINGAMAN. Mr. President, I rise to support the passage of S. 189, the 21st Century Nanotechnology Research and Development Act. I appreciate Senator WYDEN's leadership on this issue and the cooperation of him and the other sponsors of this legislation in responding to a number of concerns I had with the original bill, and in particular with the provisions of the bill authorizing programs at the U.S. Department of Energy. In the last Congress, I introduced legislation on this topic, S. 90, which was referred to the Committee on Energy and Natural Resources. That bill provided authorizations for nanotechnology programs in the Department of Energy which are now incorporated, in a streamlined form, in this bill. This is a good bill for our country's high technology future, and I urge that it be passed.

Mr. REID. Mr. President, I make the following parliamentary inquiry: This bill, which deals with nanotechnology

programs across the Federal Government, was referred to the Committee on Commerce, Science and Transportation. It is not true the Senate procedures provide for a case in which a future bill amending a particular public law might be referred to a different committee than the one originally assigned the public law, if that future bill consisted of amendments to parts of the public law that were in the jurisdiction of the different committee; is that true?

The PRESIDING OFFICER. That is correct.

Mr. REID. I thank the Chair.

Mr. FRIST. Mr. President, I ask unanimous consent that the Allen-Wyden amendment at the desk be agreed to, the committee-reported substitute amendment, as amended, be agreed to, the bill, as amended, be read the third time and passed, the motions to reconsider be laid upon the table en bloc, and that any statements relating to the bill be printed in the RECORD.

The PRESIDING OFFICER. Without objection, it is so ordered.

The amendment (No. 2202) was agreed to.

(The amendment is printed in today's RECORD under "Text of Amendments".)

The committee amendment, as amended, was agreed to.

The bill (S. 189), as amended, was read the third time and passed, as follows:

#### S. 189

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

#### SECTION 1. SHORT TITLE.

This Act may be cited as the "21st Century Nanotechnology Research and Development Act".

#### SEC. 2. NATIONAL NANOTECHNOLOGY PROGRAM.

(a) NATIONAL NANOTECHNOLOGY PROGRAM.—The President shall implement a National Nanotechnology Program. Through appropriate agencies, councils, and the National Nanotechnology Coordination Office established in section 3, the Program shall—

(1) establish the goals, priorities, and metrics for evaluation for Federal nanotechnology research, development, and other activities;

(2) invest in Federal research and development programs in nanotechnology and related sciences to achieve those goals; and

(3) provide for interagency coordination of Federal nanotechnology research, development, and other activities undertaken pursuant to the Program.

(b) PROGRAM ACTIVITIES.—The activities of the Program shall include—

(1) developing a fundamental understanding of matter that enables control and manipulation at the nanoscale;

(2) providing grants to individual investigators and interdisciplinary teams of investigators;

(3) establishing a network of advanced technology user facilities and centers;

(4) establishing, on a merit-reviewed and competitive basis, interdisciplinary nanotechnology research centers, which shall—

(A) interact and collaborate to foster the exchange of technical information and best practices;

(B) involve academic institutions or national laboratories and other partners, which may include States and industry;

(C) make use of existing expertise in nanotechnology in their regions and nationally;

(D) make use of ongoing research and development at the micrometer scale to support their work in nanotechnology; and

(E) to the greatest extent possible, be established in geographically diverse locations, encourage the participation of Historically Black Colleges and Universities that are part B institutions as defined in section 322(2) of the Higher Education Act of 1965 (20 U.S.C. 1061(2)) and minority institutions (as defined in section 365(3) of that Act (20 U.S.C. 1067k(3))), and include institutions located in States participating in the Experimental Program to Stimulate Competitive Research (EPSCoR);

(5) ensuring United States global leadership in the development and application of nanotechnology;

(6) advancing the United States productivity and industrial competitiveness through stable, consistent, and coordinated investments in long-term scientific and engineering research in nanotechnology;

(7) accelerating the deployment and application of nanotechnology research and development in the private sector, including startup companies;

(8) encouraging interdisciplinary research, and ensuring that processes for solicitation and evaluation of proposals under the Program encourage interdisciplinary projects and collaborations;

(9) providing effective education and training for researchers and professionals skilled in the interdisciplinary perspectives necessary for nanotechnology so that a true interdisciplinary research culture for nanoscale science, engineering, and technology can emerge;

(10) ensuring that ethical, legal, environmental, and other appropriate societal concerns, including the potential use of nanotechnology in enhancing human intelligence and in developing artificial intelligence which exceeds human capacity, are considered during the development of nanotechnology by—

(A) establishing a research program to identify ethical, legal, environmental, and other appropriate societal concerns related to nanotechnology, and ensuring that the results of such research are widely disseminated;

(B) requiring that interdisciplinary nanotechnology research centers established under paragraph (4) include activities that address societal, ethical, and environmental concerns;

(C) insofar as possible, integrating research on societal, ethical, and environmental concerns with nanotechnology research and development, and ensuring that advances in nanotechnology bring about improvements in quality of life for all Americans; and

(D) providing, through the National Nanotechnology Coordination Office established in section 3, for public input and outreach to be integrated into the Program by the convening of regular and ongoing public discussions, through mechanisms such as citizens' panels, consensus conferences, and educational events, as appropriate; and

(11) encouraging research on nanotechnology advances that utilize existing processes and technologies.

(c) PROGRAM MANAGEMENT.—The National Science and Technology Council shall oversee the planning, management, and coordination of the Program. The Council, itself or through an appropriate subgroup it designates or establishes, shall—

(1) establish goals and priorities for the Program, based on national needs for a set of broad applications of nanotechnology;

(2) establish program component areas, with specific priorities and technical goals, that reflect the goals and priorities established for the Program;

(3) oversee interagency coordination of the Program, including with the activities of the Defense Nanotechnology Research and Development Program established under section 246 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314) and the National Institutes of Health;

(4) develop, within 12 months after the date of enactment of this Act, and update every 3 years thereafter, a strategic plan to guide the activities described under subsection (b), meet the goals, priorities, and anticipated outcomes of the participating agencies, and describe—

(A) how the Program will move results out of the laboratory and into application for the benefit of society;

(B) the Program's support for long-term funding for interdisciplinary research and development in nanotechnology; and

(C) the allocation of funding for interagency nanotechnology projects;

(5) propose a coordinated interagency budget for the Program to the Office of Management and Budget to ensure the maintenance of a balanced nanotechnology research portfolio and an appropriate level of research effort;

(6) exchange information with academic, industry, State and local government (including State and regional nanotechnology programs), and other appropriate groups conducting research on and using nanotechnology;

(7) develop a plan to utilize Federal programs, such as the Small Business Innovation Research Program and the Small Business Technology Transfer Research Program, in support of the activity stated in subsection (b)(7);

(8) identify research areas that are not being adequately addressed by the agencies' current research programs and address such research areas;

(9) encourage progress on Program activities through the utilization of existing manufacturing facilities and industrial infrastructures such as, but not limited to, the employment of underutilized manufacturing facilities in areas of high unemployment as production engineering and research testbeds; and

(10) in carrying out its responsibilities under paragraphs (1) through (9), take into consideration the recommendations of the Advisory Panel, suggestions or recommendations developed pursuant to subsection (b)(10)(D), and the views of academic, State, industry, and other appropriate groups conducting research on and using nanotechnology.

(d) ANNUAL REPORT.—The Council shall prepare an annual report, to be submitted to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science, and other appropriate committees, at the time of the President's budget request to Congress, that includes—

(1) the Program budget, for the current fiscal year, for each agency that participates in the Program, including a breakout of spending for the development and acquisition of research facilities and instrumentation, for each program component area, and for all activities pursuant to subsection (b)(10);

(2) the proposed Program budget for the next fiscal year, for each agency that participates in the Program, including a breakout of spending for the development and acquisition of research facilities and instrumentation, for each program component

area, and for all activities pursuant to subsection (b)(10);

(3) an analysis of the progress made toward achieving the goals and priorities established for the Program;

(4) an analysis of the extent to which the Program has incorporated the recommendations of the Advisory Panel; and

(5) an assessment of how Federal agencies are implementing the plan described in subsection (c)(7), and a description of the amount of Small Business Innovative Research and Small Business Technology Transfer Research funds supporting the plan.

### SEC. 3. PROGRAM COORDINATION.

(a) IN GENERAL.—The President shall establish a National Nanotechnology Coordination Office, with a Director and full-time staff, which shall—

(1) provide technical and administrative support to the Council and the Advisory Panel;

(2) serve as the point of contact on Federal nanotechnology activities for government organizations, academia, industry, professional societies, State nanotechnology programs, interested citizen groups, and others to exchange technical and programmatic information;

(3) conduct public outreach, including dissemination of findings and recommendations of the Advisory Panel, as appropriate; and

(4) promote access to and early application of the technologies, innovations, and expertise derived from Program activities to agency missions and systems across the Federal Government, and to United States industry, including startup companies.

(b) FUNDING.—The National Nanotechnology Coordination Office shall be funded through interagency funding in accordance with section 631 of Public Law 108-7.

(c) REPORT.—Within 90 days after the date of enactment of this Act, the Director of the Office of Science and Technology Policy shall report to the Senate Committee on Commerce, Science, and Transportation, and the House of Representatives Committee on Science on the funding of the National Nanotechnology Coordination Office. The report shall include—

(1) the amount of funding required to adequately fund the Office;

(2) the adequacy of existing mechanisms to fund this Office; and

(3) the actions taken by the Director to ensure stable funding of this Office.

### SEC. 4. ADVISORY PANEL.

(a) IN GENERAL.—The President shall establish or designate a National Nanotechnology Advisory Panel.

(b) QUALIFICATIONS.—The Advisory Panel established or designated by the President under subsection (a) shall consist primarily of members from academic institutions and industry. Members of the Advisory Panel shall be qualified to provide advice and information on nanotechnology research, development, demonstrations, education, technology transfer, commercial application, or societal and ethical concerns. In selecting or designating an Advisory Panel, the President may also seek and give consideration to recommendations from the Congress, industry, the scientific community (including the National Academy of Sciences, scientific professional societies, and academia), the defense community, State and local governments, regional nanotechnology programs, and other appropriate organizations.

(c) DUTIES.—The Advisory Panel shall advise the President and the Council on matters relating to the Program, including assessing—

(1) trends and developments in nanotechnology science and engineering;

(2) progress made in implementing the Program;

(3) the need to revise the Program;

(4) the balance among the components of the Program, including funding levels for the program component areas;

(5) whether the program component areas, priorities, and technical goals developed by the Council are helping to maintain United States leadership in nanotechnology;

(6) the management, coordination, implementation, and activities of the Program; and

(7) whether societal, ethical, legal, environmental, and workforce concerns are adequately addressed by the Program.

(d) REPORTS.—The Advisory Panel shall report, not less frequently than once every 2 fiscal years, to the President on its assessments under subsection (c) and its recommendations for ways to improve the Program. The first report under this subsection shall be submitted within 1 year after the date of enactment of this Act. The Director of the Office of Science and Technology Policy shall transmit a copy of each report under this subsection to the Senate Committee on Commerce, Science, and Technology, the House of Representatives Committee on Science, and other appropriate committees of the Congress.

(e) TRAVEL EXPENSES OF NON-FEDERAL MEMBERS.—Non-Federal members of the Advisory Panel, while attending meetings of the Advisory Panel or while otherwise serving at the request of the head of the Advisory Panel away from their homes or regular places of business, may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code, for individuals in the government serving without pay. Nothing in this subsection shall be construed to prohibit members of the Advisory Panel who are officers or employees of the United States from being allowed travel expenses, including per diem in lieu of subsistence, in accordance with existing law.

(f) EXEMPTION FROM SUNSET.—Section 14 of the Federal Advisory Committee Act shall not apply to the Advisory Panel.

### SEC. 5. TRIENNIAL EXTERNAL REVIEW OF THE NATIONAL NANOTECHNOLOGY PROGRAM.

(a) IN GENERAL.—The Director of the National Nanotechnology Coordination Office shall enter into an arrangement with the National Research Council of the National Academy of Sciences to conduct a triennial evaluation of the Program, including—

(1) an evaluation of the technical accomplishments of the Program, including a review of whether the Program has achieved the goals under the metrics established by the Council;

(2) a review of the Program's management and coordination across agencies and disciplines;

(3) a review of the funding levels at each agency for the Program's activities and the ability of each agency to achieve the Program's stated goals with that funding;

(4) an evaluation of the Program's success in transferring technology to the private sector;

(5) an evaluation of whether the Program has been successful in fostering interdisciplinary research and development;

(6) an evaluation of the extent to which the Program has adequately considered ethical, legal, environmental, and other appropriate societal concerns;

(7) recommendations for new or revised Program goals;

(8) recommendations for new research areas, partnerships, coordination and management mechanisms, or programs to be established to achieve the Program's stated goals;

(9) recommendations on policy, program, and budget changes with respect to

nanotechnology research and development activities;

(10) recommendations for improved metrics to evaluate the success of the Program in accomplishing its stated goals;

(11) a review of the performance of the National Nanotechnology Coordination Office and its efforts to promote access to and early application of the technologies, innovations, and expertise derived from Program activities to agency missions and systems across the Federal Government and to United States industry;

(12) an analysis of the relative position of the United States compared to other nations with respect to nanotechnology research and development, including the identification of any critical research areas where the United States should be the world leader to best achieve the goals of the Program; and

(13) an analysis of the current impact of nanotechnology on the United States economy and recommendations for increasing its future impact.

(b) **STUDY ON MOLECULAR SELF-ASSEMBLY.**—As part of the first triennial review conducted in accordance with subsection (a), the National Research Council shall conduct a one-time study to determine the technical feasibility of molecular self-assembly for the manufacture of materials and devices at the molecular scale.

(c) **STUDY ON THE RESPONSIBLE DEVELOPMENT OF NANOTECHNOLOGY.**—As part of the first triennial review conducted in accordance with subsection (a), the National Research Council shall conduct a one-time study to assess the need for standards, guidelines, or strategies for ensuring the responsible development of nanotechnology, including, but not limited to—

- (1) self-replicating nanoscale machines or devices;
- (2) the release of such machines in natural environments;
- (3) encryption;
- (4) the development of defensive technologies;
- (5) the use of nanotechnology in the enhancement of human intelligence; and
- (6) the use of nanotechnology in developing artificial intelligence.

(d) **EVALUATION TO BE TRANSMITTED TO CONGRESS.**—The Director of the National Nanotechnology Coordination Office shall transmit the results of any evaluation for which it made arrangements under subsection (a) to the Advisory Panel, the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science upon receipt. The first such evaluation shall be transmitted no later than June 10, 2005, with subsequent evaluations transmitted to the Committees every 3 years thereafter.

#### SEC. 6. AUTHORIZATION OF APPROPRIATIONS.

(a) **NATIONAL SCIENCE FOUNDATION.**—There are authorized to be appropriated to the Director of the National Science Foundation to carry out the Director's responsibilities under this Act—

- (1) \$385,000,000 for fiscal year 2005;
- (2) \$424,000,000 for fiscal year 2006;
- (3) \$449,000,000 for fiscal year 2007; and
- (4) \$476,000,000 for fiscal year 2008.

(b) **DEPARTMENT OF ENERGY.**—There are authorized to be appropriated to the Secretary of Energy to carry out the Secretary's responsibilities under this Act—

- (1) \$317,000,000 for fiscal year 2005;
- (2) \$347,000,000 for fiscal year 2006;
- (3) \$380,000,000 for fiscal year 2007; and
- (4) \$415,000,000 for fiscal year 2008.

(c) **NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.**—There are authorized to be appropriated to the Administrator of the National Aeronautics and Space Administra-

tion to carry out the Administrator's responsibilities under this Act—

- (1) \$34,100,000 for fiscal year 2005;
- (2) \$37,500,000 for fiscal year 2006;
- (3) \$40,000,000 for fiscal year 2007; and
- (4) \$42,300,000 for fiscal year 2008.

(d) **NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.**—There are authorized to be appropriated to the Director of the National Institute of Standards and Technology to carry out the Director's responsibilities under this Act—

- (1) \$68,200,000 for fiscal year 2005;
- (2) \$75,000,000 for fiscal year 2006;
- (3) \$80,000,000 for fiscal year 2007; and
- (4) \$84,000,000 for fiscal year 2008.

(e) **ENVIRONMENTAL PROTECTION AGENCY.**—There are authorized to be appropriated to the Administrator of the Environmental Protection Agency to carry out the Administrator's responsibilities under this Act—

- (1) \$5,500,000 for fiscal year 2005;
- (2) \$6,050,000 for fiscal year 2006;
- (3) \$6,413,000 for fiscal year 2007; and
- (4) \$6,800,000 for fiscal year 2008.

#### SEC. 7. DEPARTMENT OF COMMERCE PROGRAMS.

(a) **NIST PROGRAMS.**—The Director of the National Institute of Standards and Technology shall—

(1) as part of the Program activities under section 2(b)(7), establish a program to conduct basic research on issues related to the development and manufacture of nanotechnology, including metrology; reliability and quality assurance; processes control; and manufacturing best practices; and

(2) utilize the Manufacturing Extension Partnership program to the extent possible to ensure that the research conducted under paragraph (1) reaches small- and medium-sized manufacturing companies.

(b) **CLEARINGHOUSE.**—The Secretary of Commerce or his designee, in consultation with the National Nanotechnology Coordination Office and, to the extent possible, utilizing resources at the National Technical Information Service, shall establish a clearinghouse of information related to commercialization of nanotechnology research, including information relating to activities by regional, State, and local commercial nanotechnology initiatives; transition of research, technologies, and concepts from Federal nanotechnology research and development programs into commercial and military products; best practices by government, universities and private sector laboratories transitioning technology to commercial use; examples of ways to overcome barriers and challenges to technology deployment; and use of manufacturing infrastructure and workforce.

#### SEC. 8. DEPARTMENT OF ENERGY PROGRAMS.

(a) **RESEARCH CONSORTIA.**—

(1) **DEPARTMENT OF ENERGY PROGRAM.**—The Secretary of Energy shall establish a program to support, on a merit-reviewed and competitive basis, consortia to conduct interdisciplinary nanotechnology research and development designed to integrate newly developed nanotechnology and microfluidic tools with systems biology and molecular imaging.

(2) **AUTHORIZATION OF APPROPRIATIONS.**—Of the sums authorized for the Department of Energy under section 6(b), \$25,000,000 shall be used for each fiscal year 2005 through 2008 to carry out this section. Of these amounts, not less than \$10,000,000 shall be provided to at least 1 consortium for each fiscal year.

(b) **RESEARCH CENTERS AND MAJOR INSTRUMENTATION.**—The Secretary of Energy shall carry out projects to develop, plan, construct, acquire, operate, or support special equipment, instrumentation, or facilities for investigators conducting research and development in nanotechnology.

#### SEC. 9. ADDITIONAL CENTERS.

(a) **AMERICAN NANOTECHNOLOGY PREPAREDNESS CENTER.**—The Program shall provide for the establishment, on a merit-reviewed and competitive basis, of an American Nanotechnology Preparedness Center which shall—

(1) conduct, coordinate, collect, and disseminate studies on the societal, ethical, environmental, educational, legal, and workforce implications of nanotechnology; and

(2) identify anticipated issues related to the responsible research, development, and application of nanotechnology, as well as provide recommendations for preventing or addressing such issues.

(b) **CENTER FOR NANOMATERIALS MANUFACTURING.**—The Program shall provide for the establishment, on a merit-reviewed and competitive basis, of a center to—

(1) encourage, conduct, coordinate, commission, collect, and disseminate research on new manufacturing technologies for materials, devices, and systems with new combinations of characteristics, such as, but not limited to, strength, toughness, density, conductivity, flame resistance, and membrane separation characteristics; and

(2) develop mechanisms to transfer such manufacturing technologies to United States industries.

(c) **REPORTS.**—The Council, through the Director of the National Nanotechnology Coordination Office, shall submit to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science—

(1) within 6 months after the date of enactment of this Act, a report identifying which agency shall be the lead agency and which other agencies, if any, will be responsible for establishing the Centers described in this section; and

(2) within 18 months after the date of enactment of this Act, a report describing how the Centers described in this section have been established.

#### SEC. 10. DEFINITIONS.

In this Act:

(1) **ADVISORY PANEL.**—The term "Advisory Panel" means the President's National Nanotechnology Advisory Panel established or designated under section 4.

(2) **NANOTECHNOLOGY.**—The term "nanotechnology" means the science and technology that will enable one to understand, measure, manipulate, and manufacture at the atomic, molecular, and supramolecular levels, aimed at creating materials, devices, and systems with fundamentally new molecular organization, properties, and functions.

(3) **PROGRAM.**—The term "Program" means the National Nanotechnology Program established under section 2.

(4) **COUNCIL.**—The term "Council" means the National Science and Technology Council or an appropriate subgroup designated by the Council under section 2(c).

(5) **ADVANCED TECHNOLOGY USER FACILITY.**—The term "advanced technology user facility" means a nanotechnology research and development facility supported, in whole or in part, by Federal funds that is open to all United States researchers on a competitive, merit-reviewed basis.

(6) **PROGRAM COMPONENT AREA.**—The term "program component area" means a major subject area established under section 2(c)(2) under which is grouped related individual projects and activities carried out under the Program.