

HIGH-PERFORMANCE COMPUTING REVITALIZATION ACT
OF 2004

JULY 1, 2004.—Committed to the Committee of the Whole House on the State of
the Union and ordered to be printed

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

R E P O R T

[To accompany H.R. 4218]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science, to whom was referred the bill (H.R. 4218) to amend the High-Performance Computing Act of 1991, having considered the same, report favorably thereon without amendment and recommend that the bill do pass.

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I. PURPOSE OF THE BILL

The purpose of the bill is to revitalize interagency coordination and planning for the interagency program established by the High-Performance Computing Act of 1991 and to focus greater attention and resources on federal high-performance computing programs. The program includes activities at the National Science Foundation (NSF), the Department of Energy (DOE) Office of Science, the National Aeronautics and Space Administration (NASA), the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the Environmental Protection Agency (EPA).

II. BACKGROUND AND NEED FOR THE LEGISLATION

State of high-performance computing in the world today

High-performance computers (also called supercomputers or high-end computers) are an essential component of U.S. scientific, industrial, and military competitiveness. However, the fastest and most efficient supercomputer in the world today—the “Earth Simulator”—is in Japan, not the U.S.

The success of Japan’s Earth Simulator has caused a great deal of soul-searching in the high-performance computing community in the U.S. The Earth Simulator reflects a serious, sustained investment by the Japanese government in research, development, and construction of a customized computer designed to be the best in the world at tackling specific scientific and engineering tasks, including climate modeling and earthquake simulation. While Japan pursued this course, the U.S. chose to favor the use of commercially available components for constructing high-performance computers. An advantage of this approach was that it made high-performance computers more cost-effective to develop by leveraging development costs against a larger market. A disadvantage was that certain kinds of research questions are difficult to pursue on the kinds of computers that can be built with commercial components.

The role of the U.S. Government in high-performance computing

Despite the recent technical success of the Japanese, most experts still rate the U.S. as highly competitive in high-performance computing. The depth and strength of U.S. capability stems in part from the sustained research and development program carried out by federal science agencies under an interagency program codified by the High-Performance Computing Act of 1991. That Act is widely credited with reinvigorating U.S. high-performance computing capabilities after a period of relative decline during the late 1980s.

The Federal government promotes high-performance computing in several different ways. First, it funds research and development at universities, government laboratories and companies to help develop new computer hardware and software; second, it funds the purchase of high-performance computers for universities and government laboratories; and third, it provides access to high-performance computers for a wide variety of researchers by allowing them to use government-supported computers at universities and government laboratories.

According to the National Coordination Office of the National Information Technology Research and Development Program

(NITRD), 11 agencies or offices participate in the high-end computing elements of the NITRD program. The total NITRD budget for all 11 agencies in Fiscal Year 2003 (FY03) for high-performance computing was \$862.6 million. The largest research and development programs were at NSF, \$287.7 million, and the DOE Office of Science, \$135.7 million. Other major agency activities (with funding ranging between \$60 and \$115 million) were at the National Institutes of Health (NIH), the Defense Advanced Research Projects Agency, NASA, and DOE's National Nuclear Security Administration (NNSA). These budget estimates do not include the procurement costs for high-performance computers purchased by agencies such as NNSA and NOAA for computational science related to their missions. In addition to high-end computing, the NITRD program includes other program component areas, such as large scale networking.

III. SUMMARY OF HEARINGS

On May 13, 2004, the Committee on Science held a hearing to examine the current state of federal high-performance computing research and development activities. Dr. John Marburger, Director of the Office of Science and Technology Policy (OSTP), endorsed H.R. 4218 on behalf of the Administration. Dr. Marburger also released the report of OSTP's High-End Computing Revitalization Task Force, Federal Plan for High-End Computing, during his appearance before the Committee.

The other witnesses also voiced their support for the legislation. The Committee heard testimony from Dr. Irving Wladawsky-Berger, Vice President for Technology and Strategy, IBM Corporation; Dr. Daniel Reed, Director of the Renaissance Computing Institute at the University of North Carolina at Chapel Hill, and Dr. Rick Stevens, Director of the Mathematics and Computer Science Division at Argonne National Laboratory. Witnesses addressed the need for an ongoing, coordinated interagency planning process to guide federal investment in high-performance computing procurements, research, and development. The witnesses noted the importance of the federal role in high-performance computing to ensure U.S. leadership in the field, and to ensure that U.S. academic and industrial researchers have access to leadership class machines.

IV. COMMITTEE ACTIONS

On April 27, 2004, Representative Judy Biggert and Representative Lincoln Davis introduced H.R. 4218, the High-Performance Computing Revitalization Act of 2004, a bill to update the High-Performance Computing Act of 1991 and to strengthen the U.S. position in high-performance computing.

The Full Committee on Science met on Wednesday, June 16, 2004, to consider the bill.

- Mr. Sherman offered an amendment to require studies of the societal, ethical, and legal implications of creating artificial intelligence. A unanimous consent request to withdraw the amendment was agreed to.

Mr. Gordon moved that the Committee favorably report the bill, H.R. 4218, to the House with the recommendation that the bill do pass, and that the staff be instructed to make technical and con-

forming changes to the bill and prepare the legislative report and that the Chairman take all necessary steps to bring the bill before the House for consideration. With a quorum present, the motion was agreed to by a voice vote.

V. SUMMARY OF MAJOR PROVISIONS OF THE BILL

- Defines “high-performance computing” as advanced computing, communications, and information technologies, including supercomputer systems, high-capacity and high-speed networks, special purpose and experimental systems, applications and systems software, and the management of large data sets.
- Updates the authorized activities of the interagency High-Performance Computing Research and Development Program. Requires the program to provide for long-term basic and applied research on high-performance computing; sustained access by the research community in the United States to high-performance computing systems; computational science and engineering research on mathematical modeling and algorithms for applications in all fields of science and engineering; and educating and training of additional undergraduate and graduate students in fields relevant to high-performance computing.
- Updates and strengthens the coordination responsibilities of the Director of the Office of Science and Technology Policy (OSTP). Requires the Director to establish the goals and priorities for Federal high-performance computing research, development, networking, and other activities and to develop and maintain a research, development, and deployment roadmap for the provision of high-performance computing systems for use by the research community in the United States.
- Requires the President’s Information Technology Advisory Committee (PITAC) to conduct periodic evaluations of the funding, management, coordination, implementation, and activities of the Program, and to report to Congress on the findings.
- Authorizes specific responsibilities for the National Science Foundation, the Department of Energy Office of Science, the National Aeronautics and Space Administration, the National Institute of Standards and Technology, the National Oceanic and Atmospheric Administration, and the Environmental Protection Agency under the High-Performance Computing Research and Development Program. Requires NSF and the DOE Office of Science to provide U.S. researchers with access to world-class high-performance computing systems.

VI. SECTION-BY-SECTION ANALYSIS (BY TITLE AND SECTION)

Sec. 1. Short title

“High-Performance Computing Revitalization Act of 2004.”

Sec. 2. Definitions

Amends section 4 of the High-Performance Computing Act of 1991 (HPC Act) to further elaborate on, or amend, the definition of terms used in the Act:

- “Grand Challenge” means a fundamental problem in science or engineering, with broad economic and scientific impact, whose solu-

tion will require the application of high-performance computing resources and multidisciplinary teams of researchers;

- “High-performance computing” means advanced computing, communications, and information technologies, including supercomputer systems, high-capacity and high-speed networks, special purpose and experimental systems, applications and systems software, and the management of large data sets;

- “Program” means the High-Performance Computing Research and Development Program described in section 101;

- “Program Component Areas” means the major subject areas under which are grouped related individual projects and activities carried out under the Program.

Strikes the definition of “Network” because it refers to the National Research and Education Network, which no longer exists as such.

Sec. 3. High-Performance Computing Research and Development Program

Amends section 101 of the HPC Act, which describes the organization and responsibilities of the interagency research and development program originally referred to as the National High-Performance Computing Program—and renamed the High-Performance Computing Research and Development Program in this Act. Requires the program to:

- Provide for long-term basic and applied research on high-performance computing;

- Provide for research and development on, and demonstration of, technologies to advance the capacity and capabilities of high-performance computing and networking systems;

- Provide for sustained access by the research community in the United States to high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, including provision for technical support for users of such systems;

- Provide for efforts to increase software availability, productivity, capability, security, portability, and reliability;

- Provide for high-performance networks, including experimental testbed networks, to enable research and development on, and demonstration of, advanced applications enabled by such networks;

- Provide for computational science and engineering research on mathematical modeling and algorithms for applications in all fields of science and engineering;

- Provide for the technical support of, and research and development on, high-performance computing systems and software required to address Grand Challenges;

- Provide for educating and training additional undergraduate and graduate students in software engineering, computer science, computer and network security, applied mathematics, library and information science, and computational science;

- Provide for improving the security of computing and networking systems, including research required to establish security standards and practices for these systems.

Requires the Director of the Office of Science and Technology Policy (OSTP) to:

- Establish the goals and priorities for Federal high-performance computing research, development, networking, and other activities;
- Establish Program Component Areas that implement the goals established for the Program and identify the Grand Challenges that the Program should address;
- Provide for interagency coordination of Federal high-performance computing research, development, networking, and other activities undertaken pursuant to the Program;
- Develop and maintain a research, development, and deployment roadmap for the provision of high-performance computing systems for use by the research community in the United States.

Leaves substantially unchanged the provisions of the HPC Act requiring the Director of OSTP to:

- Provide an annual report to Congress, along with the annual budget request, describing the implementation of the Program, including current and proposed funding levels and programmatic changes, if any, from the previous year;
- Consult with academic, State, and other appropriate groups conducting research on and using high-performance computing.

Requires the Director of OSTP to include in his annual report to Congress:

- A detailed description of the Program Component Areas, including a description of any changes in the definition of activities under the Program Component Areas from the previous year, and the reasons for such changes, and a description of Grand Challenges supported under the Program;
- An analysis of the extent to which the Program incorporates the recommendations of the Advisory Committee established by the HPC Act—currently referred to as the President’s Information Technology Advisory Committee (PITAC).

Requires PITAC to conduct periodic evaluations of the funding, management, coordination, implementation, and activities of the Program, and to report to Congress once every two fiscal years, with the first report due within one year of enactment.

Repeals section 102 of HPC Act, the “National Research and Education Network,” which required the development of a network to link research and educational institutions, government, and industry. This network was developed but has since been supplanted by the Internet.

Repeals section 103 of the HPC Act, “Next Generation Internet,” as this program is no longer in existence.

Sec. 4. Agency activities

Amends section 201 of the HPC Act, which describes the responsibilities of the National Science Foundation (NSF) under the Program. Requires NSF to:

- Support research and development to generate fundamental scientific and technical knowledge with the potential of advancing high-performance computing and networking systems and their applications;
- Provide computing and networking infrastructure support to the research community in the United States, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, including support for advanced

software and applications development, for all science and engineering disciplines;

- Support basic research and education in all aspects of high-performance computing and networking.

Amends section 202 of the HPC Act, which describes the responsibilities of the National Aeronautics and Space Administration (NASA) under the Program. Requires NASA to conduct basic and applied research in high-performance networking, with emphasis on:

- Computational fluid dynamics, computational thermal dynamics, and computational aerodynamics;
- Scientific data dissemination and tools to enable data to be fully analyzed and combined from multiple sources and sensors;
- Remote exploration and experimentation;
- Tools for collaboration in system design, analysis, and testing.

Amends section 203 of the HPC Act, which describes the responsibilities of the Department of Energy (DOE) under the Program. Requires DOE to:

- Conduct and support basic and applied research in high-performance computing and networking to support fundamental research in science and engineering disciplines related to energy applications;
- Provide computing and networking infrastructure support, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, and including support for advanced software and applications development, for science and engineering disciplines related to energy applications.

Amends section 204 of the HPC Act, which describes the responsibilities of the Department of Commerce, including the National Institute of Standards and Technology (NIST) and the National Oceanic and Atmospheric Administration (NOAA), under the Program.

Requires NIST to:

- Conduct basic and applied metrology research needed to support high-performance computing and networking systems;
- Develop benchmark tests and standards for high-performance computing and networking systems and software;
- Develop and propose voluntary standards and guidelines, and develop measurement techniques and test methods, for the interoperability of high-performance computing systems in networks and for common user interfaces to high-performance computing and networking systems;
- Work with industry and others to develop, and facilitate the implementation of, high-performance computing applications to solve science and engineering problems that are relevant to industry.

Requires NOAA to conduct basic and applied research in high-performance computing applications, with emphasis on:

- Improving weather forecasting and climate prediction;
- Collection, analysis, and dissemination of environmental information;
- Development of more accurate models of the ocean-atmosphere system.

Amends section 205 of the HPC Act, which describes the responsibilities of the Environmental Protection Agency (EPA) under the Program. Requires EPA to conduct basic and applied research directed toward the advancement and dissemination of computational techniques and software tools with an emphasis on modeling to:

- Develop robust decision-support tools;
- Predict pollutant transport and their effects on humans and on ecosystems;
- Better understand atmospheric dynamics and chemistry.

VII. COMMITTEE VIEWS

Interagency planning and coordination

The High-Performance Computing Act of 1991 codified an inter-agency planning process that remains in place today. However, the chief product of this process in recent years has been an annual retrospective review of activities undertaken by agencies, rather than a prospective planning document. The Committee expects all of the participating agencies to engage in a forward-looking planning and coordination process led by OSTP to coordinate high-performance computing activities across the federal government. The agencies, led by OSTP, should submit a coordinated budget for federal high-performance computing activities to the Office of Management and Budget. Furthermore, the agencies, led by OSTP, should develop and periodically refine a research, development, and deployment roadmap for high-performance computing systems. In addition, in formulating plans for the Program, the Committee expects the participating agencies to take into consideration the findings and recommendations of the President's Information Technology Advisory Committee, which is required to conduct recurring reviews of the planning, implementation, and contents of the Program.

Assuring U.S. researchers sustained access to high-performance computing infrastructure

The Committee believes that the High-Performance Computing Research and Development Program, in general, and NSF and DOE's Office of Science, in particular, must provide U.S. researchers with sustained access to high-performance computers that are among the most advanced in the world in terms of performance in solving scientific and engineering problems. This is necessary in order for the U.S. to maintain its position as a world leader in scientific and engineering fields and in technology innovation. By "among the most advanced in the world," the Committee means general purpose scientific computing systems that would rank among the top few systems in existence in performance (1) on widely accepted standardized tests, such as the LINPACK Benchmark used to generate the Top 500 list; and (2) on actual production codes for solving the most demanding problems in science and engineering disciplines. The Committee intends that such computing systems be equivalent to "Leadership Systems" as described in the May 10, 2004 report of the Office of Science and Technology Policy, Federal Plan for High-End Computing.

The Committee is supportive of recent initiatives to make DOE's Office of Science high-performance computing resources more

broadly available to researchers not otherwise supported by DOE and to allocate those resources on a competitive, merit-reviewed basis. The Committee encourages DOE to increase the quantity of supercomputing resources allocated to U.S. researchers in this fashion and to provide information to the research community on the long-term availability of these resources.

The Committee is supportive of continued NSF funding of software, algorithms, networking and data storage techniques, and education and outreach activities associated with high-performance computing. However, the Committee emphasizes that significant attention and funding must also be devoted to procurement of high-performance computing hardware for high-performance computing user facilities, including the NSF supercomputer centers.

Overall, the Committee believes that for the federal government to effectively meet the scientific community's high-performance computing needs, NSF and DOE's Office of Science each must support Leadership Systems which should be available for use by researchers from academia, industry, and government laboratories. By use of the phrase "sustained access" the Committee expects NSF and DOE to develop and maintain plans and budgets to assure ongoing improvements in the capability of high-performance computing user facilities, such as the NSF supercomputer centers and DOE's Office of Science high-end (high-performance) computing user facilities, so that the computing infrastructure made available through these facilities remains among the most advanced in the world.

But the most advanced high-performance computing hardware, on its own, will not be enough to enable researchers to conduct the most advanced science. The Committee believes that the development of software, applications, networking, and data storage and management techniques, including support for the applied mathematics required to develop advanced software and algorithms, will be essential to enable researchers to make effective use of the high-performance computing resources made available under this Act.

National Information Technology Research and Development Program (NITRD)

The NITRD program includes six program component areas: High End Computing, Large Scale Networking, Software Design and Productivity, Human Computer Interaction and Information Management, High Confidence Software and Systems, and Social, Economic, and Workforce Implications of Information Technology. While the focus of this Act is on high-performance computing, the Committee recognizes that all program component areas are essential parts of the federal information technology research and development effort and expects the planning and coordination process for the NITRD program to result in an appropriate balance of resources among the program component areas. The Committee expects the annual report for the program to provide the rationale for the allocation of funding among the program component areas. The Committee expects that the allocations for the high end computing program component area will be sufficient to carry out this Act.

VIII. COST ESTIMATE

A cost estimate and comparison prepared by the Director of the Congressional Budget Office under section 402 of the Congressional Budget Act of 1974 has been timely submitted to the Committee on Science prior to the filing of this report and is included in Section IX of this report pursuant to House Rule XIII, clause 3(c)(3).

H.R. 4218 does not contain new budget authority, credit authority, or changes in revenues or tax expenditures. H.R. 4218 does not authorize additional discretionary spending, as described in the Congressional Budget Office report on the bill, which is contained in Section X of this report.

IX. CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

U.S. CONGRESS,
CONGRESSIONAL BUDGET OFFICE,
Washington, DC, July 1, 2004.

Hon. SHERWOOD L. BOEHLERT,
*Chairman, Committee on Science,
House of Representatives, Washington, DC.*

DEAR MR. CHAIRMAN: The Congressional Budget Office has prepared the enclosed cost estimate for H.R. 4218, the High-Performance Computing Revitalization Act of 2004.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is Kathleen Gramp.

Sincerely,

ELIZABETH M. ROBINSON
(For Douglas Holtz-Eakin, Director).

Enclosure.

H.R. 4218—High-Performance Computing Revitalization Act of 2004

Summary: H.R. 4218 would amend existing statutory guidelines for interagency research and development (R&D) related to high-performance computing. Approximately \$1.6 billion was appropriated for 2004 nondefense R&D on high-performance computing at six agencies: the National Science Foundation (NSF), Department of Energy (DOE), National Institutes of Health, National Aeronautics and Space Administration, Department of Commerce, and Environmental Protection Agency. This bill would realign program objectives with current R&D priorities, repeal authorizations for activities that are technologically outdated and emphasize newer issues, such as providing researchers sustained access to the most advanced computing systems in the world. In addition, the bill would direct the program's Advisory Committee to evaluate program funding, management, and effectiveness on a periodic basis.

CBO estimates that implementing H.R. 4218 would cost a total of \$200 million over the 2005–2009 period, assuming appropriation of necessary funds for the new directives in the bill. CBO estimates enacting H.R. 4218 would have no effect on direct spending or revenues.

H.R. 4218 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, and tribal governments.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 4218 is shown in the following table. For this estimate, CBO assumes that the bill will be enacted near the end of 2004 and that outlays will follow historical patterns for R&D infrastructure programs. The cost of this legislation primarily falls within budget function 250 (general science, space, and technology).

	By fiscal year, in millions of dollars—				
	2005	2006	2007	2008	2009
CHANGES IN SPENDING SUBJECT TO APPROPRIATION					
Estimated Authorization Level	35	35	35	85	85
Estimated Outlays	11	23	35	58	73

Basis of estimate: CBO expects that agencies would need to increase spending to meet the bill's new goal of providing researchers with sustained access to "high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems." For this estimate, CBO assumes that this provision would authorize appropriations to provide sustained access to leadership-class facilities. Under the bill, two agencies—NSF and DOE—would be required to provide such systems for researchers.

According to a May 2004 federal task force report on high-end computing, leadership-class facilities are high-end computers that will enable breakthroughs in challenging scientific and engineering computational problems. There are no such systems currently available for U.S. civilian researchers, but CBO expects that DOE will build one leadership-class facility under existing law based on the department's current plans.

According to DOE and NSF, such systems are typically acquired over a three-year period and would need to be replaced every three or four years. Hence, it is likely that NSF and DOE would need continuous funding for facility acquisition to provide researchers with sustained access to the most advanced computers. Based on information from these agencies, CBO expects that the cost of individual facilities could range from \$60 million to \$150 million (or an average of about \$100 million), depending on the capabilities of the facilities and the software and infrastructure needed to support them. Experience with existing systems suggests that operations and maintenance costs for each facility would cost about \$15 million a year. For this estimate, CBO assumes that NSF would build one facility over the 2005–2007 period and that both NSF and DOE would begin acquiring replacement facilities in 2008.

Intergovernmental and private-sector impact: H.R. 4218 contains no intergovernmental or private-sector mandates as defined in UMRA and would impose no costs on state, local, and tribal governments.

Estimate prepared by: Federal Costs: Kathleen Gramp. Impact on State, Local, and Tribal Governments: Greg Waring. Impact on the Private Sector: Jean Talarico.

Estimated approved by: Peter H. Fontaine, Deputy Assistant Director for Budget Analysis.

X. COMPLIANCE WITH PUBLIC LAW 104–4 (UNFUNDED MANDATES)

H.R. 4218 contains no unfunded mandates.

XI. COMMITTEE OVERSIGHT FINDINGS AND RECOMMENDATIONS

The Committee on Science’s oversight findings and recommendations are reflected in the body of this report.

XII. STATEMENT ON GENERAL PERFORMANCE GOALS AND OBJECTIVES

Pursuant to clause (3)(c) of House rule XIII, the goals of H.R. 4218 are to update the activities of the interagency High-Performance Computing Research and Development Program; to authorize specific program areas at NSF, DOE, NASA, NIST, NOAA, and EPA; and to expand the responsibilities of OSTP and PITAC in order to enhance the planning, management, and coordination of the Program.

XIII. CONSTITUTIONAL AUTHORITY STATEMENT

Article I, section 8 of the Constitution of the United States grants Congress the authority to enact H.R. 4218.

XIV. FEDERAL ADVISORY COMMITTEE STATEMENT

The functions of the advisory committee required by H.R. 4218 could be performed by one or more agencies or by enlarging the mandate of another existing advisory committee.

XV. CONGRESSIONAL ACCOUNTABILITY ACT

The Committee finds that H.R. 4218 does not relate to the terms and conditions of employment or access to public services or accommodations within the meaning of section 102(b)(3) of the Congressional Accountability Act (Public Law 104–1).

XVI. STATEMENT ON PREEMPTION OF STATE, LOCAL, OR TRIBAL LAW

This bill is not intended to preempt any state, local, or tribal law.

XVII. CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

HIGH-PERFORMANCE COMPUTING ACT OF 1991

* * * * *

SEC. 4. DEFINITIONS.

As used in this Act, the term—

(1) * * *

(2) “Grand Challenge” means a fundamental problem in science or engineering, with broad economic and scientific impact, whose solution will require the application of high-performance computing resources *and multidisciplinary teams of researchers*;

(3) “high-performance computing” means advanced computing, communications, and information technologies, includ-

ing [scientific workstations,] supercomputer systems [(including vector supercomputers and large scale parallel systems)], high-capacity and high-speed networks, special purpose and experimental systems, [and] applications and systems software, *and the management of large data sets*;

(4) “Internet” means the international computer network of both Federal and non-Federal interoperable [packet switched] data networks;

[(5) “Network” means a computer network referred to as the National Research and Education Network established under section 102; and

[(6) “Program” means the National High-Performance Computing Program described in section 101.]

(5) “Program” means the *High-Performance Computing Research and Development Program* described in section 101; and

(6) “Program Component Areas” means the major subject areas under which are grouped related individual projects and activities carried out under the Program.

TITLE I—HIGH-PERFORMANCE COMPUTING [AND THE NATIONAL RESEARCH AND EDUCATION NETWORK] RESEARCH AND DEVELOPMENT

SEC. 101. [NATIONAL HIGH-PERFORMANCE COMPUTING] HIGH-PERFORMANCE COMPUTING RESEARCH AND DEVELOPMENT PROGRAM.

(a) [NATIONAL HIGH-PERFORMANCE COMPUTING] *HIGH-PERFORMANCE COMPUTING RESEARCH AND DEVELOPMENT* PROGRAM.—[(1) The President shall implement a National High-Performance Computing Program, which shall—

[(A) establish the goals and priorities for Federal high-performance computing research, development, networking, and other activities; and

[(B) provide for interagency coordination of Federal high-performance computing research, development, networking, and other activities undertaken pursuant to the Program.

[(2) The Program shall—

[(A) provide for the development of technologies to advance the capacity and capabilities of the Internet;

[(B) provide for high performance testbed networks to enable the research, development, and demonstration of advanced networking technologies and to develop and demonstrate advanced applications made possible by the existence of such testbed networks;

[(C) promote connectivity among computer networks of Federal agencies and departments;

[(D) provide for efforts to increase software availability, productivity, capability, portability, and reliability;

[(E) provide for improved dissemination of Federal agency data and electronic information;

[(F) provide for acceleration of the development of high-performance computing systems, subsystems, and associated software;

[(G) provide for the technical support and research and development of high-performance computing software and hardware needed to address Grand Challenges;

[(H) provide for educating and training additional undergraduate and graduate students in software engineering, computer science, library and information science, and computational science; and

[(I) provide—

[(i) for the security requirements, policies, and standards necessary to protect Federal research computer networks and information resources accessible through Federal research computer networks, including research required to establish security standards for high-performance computing systems and networks; and

[(ii) that agencies and departments identified in the annual report submitted under paragraph (3)(A) shall define and implement a security plan consistent with the Program and with applicable law.] *(1) The President shall implement a High-Performance Computing Research and Development Program, which shall—*

(A) provide for long-term basic and applied research on high-performance computing;

(B) provide for research and development on, and demonstration of, technologies to advance the capacity and capabilities of high-performance computing and networking systems;

(C) provide for sustained access by the research community in the United States to high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, including provision for technical support for users of such systems;

(D) provide for efforts to increase software availability, productivity, capability, security, portability, and reliability;

(E) provide for high-performance networks, including experimental testbed networks, to enable research and development on, and demonstration of, advanced applications enabled by such networks;

(F) provide for computational science and engineering research on mathematical modeling and algorithms for applications in all fields of science and engineering;

(G) provide for the technical support of, and research and development on, high-performance computing systems and software required to address Grand Challenges;

(H) provide for educating and training additional undergraduate and graduate students in software engineering, computer science, computer and network security, applied mathematics, library and information science, and computational science; and

(I) provide for improving the security of computing and networking systems, including Federal systems, including research required to establish security standards and practices for these systems.

[(3)] (2) The Director shall—

(A) establish the goals and priorities for Federal high-performance computing research, development, networking, and other activities;

(B) establish Program Component Areas that implement the goals established under subparagraph (A), and identify the Grand Challenges that the Program should address;

(C) provide for interagency coordination of Federal high-performance computing research, development, networking, and other activities undertaken pursuant to the Program;

[(A)] *(D) submit to the Congress an annual report, along with the President's annual budget request, describing the implementation of the Program;*

(E) develop and maintain a research, development, and deployment roadmap for the provision of high-performance computing systems under paragraph (1)(C); and

[(B)] *provide for interagency coordination of the Program; and*

[(C)] *(F) consult with academic, State, industry, and other appropriate groups conducting research on and using high-performance computing.*

[(4)] (3) The annual report submitted under paragraph [(3)(A)] (2)(D) shall—

[(A)] include a detailed description of the goals and priorities established by the President for the Program;]

(A) provide a detailed description of the Program Component Areas, including a description of any changes in the definition of or activities under the Program Component Areas from the preceding report, and the reasons for such changes, and a description of Grand Challenges supported under the Program;

* * * * *

(C) describe 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 [specific activities, including education, research, hardware and software development, and support for the establishment of the Network] *each Program Component Area;*

(D) describe the levels of Federal funding for each agency and department participating in the Program *and for each Program Component 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*

[(E)] include the report of the Secretary of Energy required by section 203(d); and]

[(F)] *(E) include an analysis of the progress made toward achieving the goals and priorities established for the Program and the extent to which the Program incorporates the recommendations of the advisory committee established under subsection (b).*

(b) ADVISORY COMMITTEE.—(1) The President shall establish an advisory committee on high-performance computing consisting of non-Federal members, including representatives of the research, education, and library communities, network providers, and industry, who are specially qualified to provide the Director with advice and information on high-performance computing. The recommendations of the advisory committee shall be considered in reviewing and revising the Program. The advisory committee shall provide the Director with an independent assessment of—

[(1)] (A) progress made in implementing the Program;

[(2)] (B) the need to revise the Program;

[(3)] (C) the balance between the components of the Program, *including funding levels for the Program Component Areas*;

[(4)] (D) whether the research and development undertaken pursuant to the Program is helping to maintain United States leadership in [computing] *high-performance computing and networking technology*; and

[(5)] (E) other issues identified by the Director.

(2) *In addition to the duties outlined in paragraph (1), the advisory committee shall conduct periodic evaluations of the funding, management, coordination, implementation, and activities of the Program, and shall report not less frequently than once every two fiscal years to the Committee on Science of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate on its findings and recommendations. The first report shall be due within one year after the date of enactment of this paragraph.*

(c) OFFICE OF MANAGEMENT AND BUDGET.—(1) Each Federal agency and department participating in the Program shall, as part of its annual request for appropriations to the Office of Management and Budget, submit a report to the Office of Management and Budget which—

(A) identifies each element of its high-performance computing activities which contributes directly to the [Program or] *Program Component Areas* or benefits from the Program; and

* * * * *

[SEC. 102. NATIONAL RESEARCH AND EDUCATION NETWORK.]

[(a)] ESTABLISHMENT.—As part of the Program, the National Science Foundation, the Department of Defense, the Department of Energy, the Department of Commerce, the National Aeronautics and Space Administration, and other agencies participating in the Program shall support the establishment of the National Research and Education Network, portions of which shall, to the extent technically feasible, be capable of transmitting data at one gigabit per second or greater by 1996. The Network shall provide for the linkage of research institutions and educational institutions, government, and industry in every State.

[(b)] ACCESS.—Federal agencies and departments shall work with private network service providers, State and local agencies, libraries, educational institutions and organizations, and others, as appropriate, in order to ensure that the researchers, educators, and students have access, as appropriate, to the Network. The Network is to provide users with appropriate access to high-performance computing systems, electronic information resources, other research facilities, and libraries. The Network shall provide access, to the extent practicable, to electronic information resources maintained by libraries, research facilities, publishers, and affiliated organizations.

[(c)] NETWORK CHARACTERISTICS.—The Network shall—

[(1)] be developed and deployed with the computer, telecommunications, and information industries;

[(2) be designed, developed, and operated in collaboration with potential users in government, industry, and research institutions and educational institutions;

[(3) be designed, developed, and operated in a manner which fosters and maintains competition and private sector investment in high-speed data networking within the telecommunications industry;

[(4) be designed, developed, and operated in a manner which promotes research and development leading to development of commercial data communications and telecommunications standards, whose development will encourage the establishment of privately operated high-speed commercial networks;

[(5) be designed and operated so as to ensure the continued application of laws that provide network and information resources security measures, including those that protect copyright and other intellectual property rights, and those that control access to data bases and protect national security;

[(6) have accounting mechanisms which allow users or groups of users to be charged for their usage of copyrighted materials available over the Network and, where appropriate and technically feasible, for their usage of the Network;

[(7) ensure the interoperability of Federal and non-Federal computer networks, to the extent appropriate, in a way that allows autonomy for each component network;

[(8) be developed by purchasing standard commercial transmission and network services from vendors whenever feasible, and by contracting for customized services when not feasible, in order to minimize Federal investment in network hardware;

[(9) support research and development of networking software and hardware; and

[(10) serve as a test bed for further research and development of high-capacity and high-speed computing networks and demonstrate how advanced computers, high-capacity and high-speed computing networks, and data bases can improve the national information infrastructure.

[(d) DEFENSE ADVANCED RESEARCH PROJECTS AGENCY RESPONSIBILITY.—As part of the Program, the Department of Defense, through the Defense Advanced Research Projects Agency, shall support research and development of advanced fiber optics technology, switches, and protocols needed to develop the Network.

[(e) INFORMATION SERVICES.—The Director shall assist the President in coordinating the activities of appropriate agencies and departments to promote the development of information services that could be provided over the Network. These services may include the provision of directories of the users and services on computer networks, data bases of unclassified Federal scientific data, training of users of data bases and computer networks, access to commercial information services for users of the Network, and technology to support computer-based collaboration that allows researchers and educators around the Nation to share information and instrumentation.

[(f) USE OF GRANT FUNDS.—All Federal agencies and departments are authorized to allow recipients of Federal research grants to use grant moneys to pay for computer networking expenses.

[(g) REPORT TO CONGRESS.—Within one year after the date of enactment of this Act, the Director shall report to the Congress on—

[(1) effective mechanisms for providing operating funds for the maintenance and use of the Network, including user fees, industry support, and continued Federal investment;

[(2) the future operation and evolution of the Network;

[(3) how commercial information service providers could be charged for access to the Network, and how Network users could be charged for such commercial information services;

[(4) the technological feasibility of allowing commercial information service providers to use the Network and other federally funded research networks;

[(5) how to protect the copyrights of material distributed over the Network; and

[(6) appropriate policies to ensure the security of resources available on the Network and to protect the privacy of users of networks.

[SEC. 103. NEXT GENERATION INTERNET.]

[(a) ESTABLISHMENT.—The National Science Foundation, the Department of Energy, the National Institutes of Health, the National Aeronautics and Space Administration, and the National Institute of Standards and Technology may support the Next Generation Internet program. The objectives of the Next Generation Internet program shall be to—

[(1) support research, development, and demonstration of advanced networking technologies to increase the capabilities and improve the performance of the Internet;

[(2) develop an advanced testbed network connecting a significant number of research sites, including universities, Federal research institutions, and other appropriate research partner institutions, to support networking research and to demonstrate new networking technologies; and

[(3) develop and demonstrate advanced Internet applications that meet important national goals or agency mission needs, and that are supported by the activities described in paragraphs (1) and (2).

[(b) DUTIES OF ADVISORY COMMITTEE.—The President's Information Technology Advisory Committee (established pursuant to section 101(b) by Executive Order No. 13035 of February 11, 1997 (62 F.R. 7131), as amended by Executive Order No. 13092 of July 24, 1998), in addition to its functions under section 101(b), shall—

[(1) assess the extent to which the Next Generation Internet program—

[(A) carries out the purposes of this Act; and

[(B) addresses concerns relating to, among other matters—

[(i) geographic penalties (as defined in section 7(1) of the Next Generation Internet Research Act of 1998);

[(ii) the adequacy of access to the Internet by Historically Black Colleges and Universities, Hispanic Serving Institutions, and small colleges and universities (whose enrollment is less than 5,000) and the degree of participation of those institutions in activities described in subsection (a); and

[(iii) technology transfer to and from the private sector;

[(2) review the extent to which the role of each Federal agency and department involved in implementing the Next Generation Internet program is clear and complementary to, and non-duplicative of, the roles of other participating agencies and departments;

[(3) assess the extent to which Federal support of fundamental research in computing is sufficient to maintain the Nation's critical leadership in this field; and

[(4) make recommendations relating to its findings under paragraphs (1), (2), and (3).

[(c) REPORTS.—The Advisory Committee shall review implementation of the Next Generation Internet program and shall report, not less frequently than annually, to the President, the Committee on Commerce, Science, and Transportation, the Committee on Appropriations, and the Committee on Armed Services of the Senate, and the Committee on Science, the Committee on Appropriations, and the Committee on Armed Services of the House of Representatives on its findings and recommendations for the preceding fiscal year. The first such report shall be submitted 6 months after the date of the enactment of the Next Generation Internet Research Act of 1998 and the last report shall be submitted by September 30, 2000.

[(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated for the purposes of this section—

[(1) for the Department of Energy, \$22,000,000 for fiscal year 1999 and \$25,000,000 for fiscal year 2000;

[(2) for the National Science Foundation, \$25,000,000 for fiscal year 1999 and \$25,000,000 for fiscal year 2000, as authorized in the National Science Foundation Authorization Act of 1998;

[(3) for the National Institutes of Health, \$5,000,000 for fiscal year 1999 and \$7,500,000 for fiscal year 2000;

[(4) for the National Aeronautics and Space Administration, \$10,000,000 for fiscal year 1999 and \$10,000,000 for fiscal year 2000; and

[(5) for the National Institute of Standards and Technology, \$5,000,000 for fiscal year 1999 and \$7,500,000 for fiscal year 2000.

Such funds may not be used for routine upgrades to existing federally funded communication networks.]

TITLE II—AGENCY ACTIVITIES

SEC. 201. NATIONAL SCIENCE FOUNDATION ACTIVITIES.

[(a) GENERAL RESPONSIBILITIES.—As part of the Program described in title I—

[(1) the National Science Foundation shall provide computing and networking infrastructure support for all science and engineering disciplines, and support basic research and human resource development in all aspects of high-performance computing and advanced high-speed computer networking;

[(2) to the extent that colleges, universities, and libraries cannot connect to the Network with the assistance of the pri-

vate sector, the National Science Foundation shall have primary responsibility for assisting colleges, universities, and libraries to connect to the Network;

[(3) the National Science Foundation shall serve as the primary source of information on access to and use of the Network; and

[(4) the National Science Foundation shall upgrade the National Science Foundation funded network, assist regional networks to upgrade their capabilities, and provide other Federal departments and agencies the opportunity to connect to the National Science Foundation funded network.]

(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the National Science Foundation shall—*

(1) support research and development to generate fundamental scientific and technical knowledge with the potential of advancing high-performance computing and networking systems and their applications;

(2) provide computing and networking infrastructure support to the research community in the United States, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, and including support for advanced software and applications development, for all science and engineering disciplines; and

(3) support basic research and education in all aspects of high-performance computing and networking.

* * * * *

SEC. 202. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ACTIVITIES.

[(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the National Aeronautics and Space Administration shall conduct basic and applied research in high-performance computing, particularly in the field of computational science, with emphasis on aerospace sciences, earth and space sciences, and remote exploration and experimentation.*]

(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the National Aeronautics and Space Administration shall conduct basic and applied research in high-performance computing and networking, with emphasis on—*

(1) computational fluid dynamics, computational thermal dynamics, and computational aerodynamics;

(2) scientific data dissemination and tools to enable data to be fully analyzed and combined from multiple sources and sensors;

(3) remote exploration and experimentation; and

(4) tools for collaboration in system design, analysis, and testing.

* * * * *

SEC. 203. DEPARTMENT OF ENERGY ACTIVITIES.

[(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the Secretary of Energy shall—*

[(1) perform research and development on, and systems evaluations of, high-performance computing and communications systems;

[(2) conduct computational research with emphasis on energy applications;

[(3) support basic research, education, and human resources in computational science; and

[(4) provide for networking infrastructure support for energy-related mission activities.

[(b) COLLABORATIVE CONSORTIA.—In accordance with the Program, the Secretary of Energy shall establish High-Performance Computing Research and Development Collaborative Consortia by soliciting and selecting proposals. Each Collaborative Consortium shall—

[(1) conduct research directed at scientific and technical problems whose solutions require the application of high-performance computing and communications resources;

[(2) promote the testing and uses of new types of high-performance computing and related software and equipment;

[(3) serve as a vehicle for participating vendors of high-performance computing systems to test new ideas and technology in a sophisticated computing environment; and

[(4) be led by a Department of Energy national laboratory, and include participants from Federal agencies and departments, researchers, private industry, educational institutions, and others as the Secretary of Energy may deem appropriate.

[(c) TECHNOLOGY TRANSFER.—The results of research and development carried out under this section shall be transferred to the private sector and others in accordance with applicable law.

[(d) REPORTS.—Not later than 1 year after the date of enactment of this subsection, and thereafter as part of the report required under section 101(a)(3)(A), the Secretary of Energy shall report on activities taken to carry out this Act.]

(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the Secretary of Energy shall—*

(1) conduct and support basic and applied research in high-performance computing and networking to support fundamental research in science and engineering disciplines related to energy applications; and

(2) provide computing and networking infrastructure support, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, and including support for advanced software and applications development, for science and engineering disciplines related to energy applications.

[(e)] (b) AUTHORIZATION OF APPROPRIATIONS.—(1) * * *

* * * * *

SEC. 204. DEPARTMENT OF COMMERCE ACTIVITIES.

[(a) GENERAL RESPONSIBILITIES.—As part of the Program described in title I—

[(1) the National Institute of Standards and Technology shall—

【(A) conduct basic and applied measurement research needed to support various high-performance computing systems and networks;

【(B) develop and propose standards and guidelines, and develop measurement techniques and test methods, for the interoperability of high-performance computing systems in networks and for common user interfaces to systems; and

【(C) be responsible for developing benchmark tests and standards for high-performance computing systems and software; and

【(2) the National Oceanic and Atmospheric Administration shall conduct basic and applied research in weather prediction and ocean sciences, particularly in development of new forecast models, in computational fluid dynamics, and in the incorporation of evolving computer architectures and networks into the systems that carry out agency missions.】

(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I—*

(1) the National Institute of Standards and Technology shall—

(A) conduct basic and applied metrology research needed to support high-performance computing and networking systems;

(B) develop benchmark tests and standards for high-performance computing and networking systems and software;

(C) develop and propose voluntary standards and guidelines, and develop measurement techniques and test methods, for the interoperability of high-performance computing systems in networks and for common user interfaces to high-performance computing and networking systems; and

(D) work with industry and others to develop, and facilitate the implementation of, high-performance computing applications to solve science and engineering problems that are relevant to industry; and

(2) the National Oceanic and Atmospheric Administration shall conduct basic and applied research on high-performance computing applications, with emphasis on—

(A) improving weather forecasting and climate prediction;

(B) collection, analysis, and dissemination of environmental information; and

(C) development of more accurate models of the ocean-atmosphere system.

* * * * *

SEC. 205. ENVIRONMENTAL PROTECTION AGENCY ACTIVITIES.

【(a) *GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the Environmental Protection Agency shall conduct basic and applied research directed toward the advancement and dissemination of computational techniques and software tools which form the core of ecosystem, atmospheric chemistry, and atmospheric dynamics models.*】

(a) GENERAL RESPONSIBILITIES.—As part of the Program described in title I, the Environmental Protection Agency shall conduct basic and applied research directed toward advancement and dis-

semination of computational techniques and software tools for high-performance computing systems with an emphasis on modeling to—

- (1) develop robust decision support tools;*
- (2) predict pollutant transport and the effects of pollutants on humans and on ecosystems; and*
- (3) better understand atmospheric dynamics and chemistry.*

* * * * * *

XVIII. COMMITTEE RECOMMENDATIONS

On June 16, 2004, a quorum being present, the Committee on Science favorably reported H.R. 4218, The High-Performance Computing Revitalization Act of 2004, by a voice vote, and recommended its enactment.

XIX. PROCEEDINGS OF THE FULL COMMITTEE MARKUP ON H.R. 4218, HIGH-PERFORMANCE COMPUTING REVITALIZATION ACT OF 2004

WEDNESDAY, JUNE 16, 2004

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE,
Washington, DC.

The Committee met, pursuant to call, at 10:10 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Sherwood L. Boehlert [Chairman of the Committee] presiding.

Chairman BOEHLERT. The Committee on Science will be in order. Pursuant to notice, the Committee on Science meets today to consider the following measures: H.R. 3890, *To Reauthorize the Steel and Aluminum Conservation and Technology Competitiveness Act of 1988*; H.R. 3598, *Manufacturing Technology Competitiveness Act of 2004*; H.R. 4218, *High-Performance Computing Revitalization Act of 2004*; and H.R. 4516, *Department of Energy High-End Computing Revitalization Act of 2004*. I ask unanimous consent for the authority to recess the Committee at any point during consideration of these matters. And without objection, it is so ordered.

We will now proceed with opening statements, and I will lead off.

I am going to keep my remarks very brief, because we have a long markup ahead of us. I would simply point out that once again we have come up with a good set of bipartisan bills that prepare our nation for the future. We have Ms. Hart's metals bill, which will help our nation save energy, helping the steel and aluminum industries remain competitive by helping our nation become less dependent on foreign sources of energy, all worthy goals. We have Ms. Biggert's computing bill—bills, which will revitalize our high-performance computing efforts, enabling our scientists and computing industry to excel as they face new challenges from abroad. And we have Dr. Ehlers' manufacturing bill, which will help our smaller manufacturers stay up-to-date and competitive. All of these bills reflect significant contributions from the Minority and have lead Minority co-sponsors, whom I am sure Mr. Gordon will acknowledge.

Our debate today will be prolonged, but it won't be on fundamental goals or principles. It will be about whether to do even more in the manufacturing bill. I think we need to get this measure through before we take on additional issues. We will have lively discussion on that, but we are united on trying to do everything possible for our manufacturers.

With that, let the games begin.

Mr. Gordon.

[The prepared statement of Chairman Boehlert follows:]

PREPARED STATEMENT OF CHAIRMAN SHERWOOD BOEHLERT

I'm going to keep my remarks very brief because we have a long markup ahead of us.

I would simply point out that once again we've come with a good set of bipartisan bills that prepare our nation for the future. We have Ms. Hart's metals bill, which will help our nation save energy, helping the steel and aluminum industry remain competitive while helping our nation become less dependent on foreign sources of energy. We have Ms. Biggert's computing bills, which will revitalize our high-performance computing efforts, enabling our scientists and computing industry to excel as they face new challenges from abroad. And we have Mr. Ehlers manufacturing bill, which will help our smaller manufacturers stay up-to-date and competitive.

All these bills reflect significant contributions from the Minority and have lead Minority co-sponsors, whom I'm sure Mr. Gordon will acknowledge.

Our debate today will be prolonged, but it won't be on fundamental goals or first principles. It will be about whether to do even more in the manufacturing bill. I think we need to get this measure through before we take on additional issues. We'll have lively discussion on that, but we are united on trying to do everything possible for our manufacturers.

With that, let the games begin.

Mr. Gordon.

Mr. GORDON. Thank you, Mr. Chairman. Let me say that we are pleased at the bipartisan cooperation we have experienced in the development of three of the bills considered today: H.R. 3890, *To Reauthorize the Steel and Aluminum Energy Conservation and Technology Competitiveness Act of 1988*; H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*; and H.R. 4218, the *High-Performance Computing Revitalization Act of 2004*.

With regard to H.R. 4218 and H.R. 4516, we believe the Committee is making a major contribution to reinvigorating high-end computing at a time when traditional U.S. lead is under vigorous challenge. We are depending on this program to increase ability to understand huge data sets across a wide spectrum of programs ranging from advanced manufacturing to weather prediction.

The steel industry is one of several industrial sectors that are heavy users of energy and benefit from cooperative research with the Federal Government. We support not only continuing the Department of Energy's program with the steel industry as set out in H.R. 3890, but also strengthening the entire Industries of the Future Program.

Unfortunately, though, however, the same level of cooperation did not occur on H.R. 3598 in developing our manufacturing policy. This is particularly disturbing in light of the battering this sector has endured over the last three years. We have no problem with the tentative first steps taken in H.R. 3598, but we do not think it is an adequate response to the problems that have cost the jobs of two million Americans. I will have further comments on this bill when it is called up for consideration.

Thank you.

[The prepared statement of Mr. Gordon follows:]

PREPARED STATEMENT OF REPRESENTATIVE BART GORDON

We are pleased at the bipartisan cooperation we have experienced in the development of three bills to be considered today: H.R. 3890, *TO REAUTHORIZE THE STEEL*

AND ALUMINUM ENERGY CONSERVATION AND TECHNOLOGY COMPETITIVENESS ACT OF 1988; H.R. 4516, The *Department of Energy High-End Computing Revitalization Act of 2004*; and H.R. 4218, The *High-Performance Computing Revitalization Act of 2004*.

With regard to H.R. 4218 and H.R. 4516, we believe the Committee is making a major contribution to reinvigorating high-end computing at a time when the traditional U.S. lead is under vigorous challenge. We are depending on this program to increase our ability to understand huge data sets across a wide spectrum of problems ranging from advanced manufacturing to weather prediction. The steel industry is one of several industrial sectors that are heavy users of energy that benefit from cooperative research with the Federal Government. We support, not only continuing the Department of Energy's program with the steel industry as set out in H.R. 3890, but also strengthening the entire Industries of the Future Program.

Unfortunately, the same level of cooperation did not occur on the H.R. 3598, The *Manufacturing Competitiveness Act of 2004*, in developing our manufacturing policy. This is particularly disturbing in light of the battering this sector has endured over the past three years. We have no problem with the tentative first steps taken in H.R. 3598, but we do not think it is an adequate response to the problems that have cost the jobs of two million Americans. I will have further comments on this bill when it is called up for consideration.

Chairman BOEHLERT. Thank you very much, Mr. Gordon.

Without objection, all Members may place opening statements in the record at this point.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you, Chairman for calling this markup on High-Performance Computing. There has been much discussion on whether the United States is losing ground to foreign competitors in the production and use of supercomputers and whether federal agencies' proposed paths for advancing our supercomputing capabilities are adequate to maintain or regain the U.S. lead.

As we all know, a high-performance computer, also called a supercomputer, is a broad term for one of the fastest computers currently available. Such computers are typically used for number crunching including scientific simulations, (animated) graphics, analysis of geological data (e.g., in petrochemical prospecting), structural analysis, computational fluid dynamics, physics, chemistry, electronic design, nuclear energy research, and meteorology.

Supercomputers are state-of-the-art, extremely powerful computers capable of manipulating massive amounts of data in a relatively short time. They are very expensive and are employed for specialized scientific and engineering applications that must handle very large databases or do a great amount of computation, among them meteorology, animated graphics, fluid dynamic calculations, nuclear energy research and weapon simulation, and petroleum exploration.

High-performance computers are gaining popularity in all corners of corporate America. They are used to analyze vehicle crash test by auto manufacturers, evaluate human diseases and develop treatments by the pharmaceutical industry and test aircraft engines by the aero-space engineers.

It quite evident that supercomputing will become more important to America's commerce in the future. I look forward to working with this committee on its advancement. Mr. Chair, I yield back my time.

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF REPRESENTATIVE LINCOLN DAVIS

Mr. Chairman, I want to thank you for calling up H.R. 4218, the *High-Performance Computing Revitalization Act of 2004*, which Congresswoman Biggert and I introduced. I also want to thank Ms. Biggert for working with me to help develop this legislation.

H.R. 4218 amends the *High-Performance Computing Act of 1991*, which established a major federal research and development program in computing and networking that now involves seven agencies and is funded at about \$2 billion per year. The bill seeks to reverse what I would characterize as a weakening of the planning mechanisms for the R&D program established by the 1991 Act.

High-performance computing and communications technology is key to the Nation's economic competitiveness and security, and it is important to prioritize and

effectively coordinate activities among the performing agencies. The bill requires formal biennial reviews of the interagency program by the President's Information Technology Advisory Committee in order to provide outside advice for sharpening program priorities and improving program implementation.

H.R. 4218 also attempts to focus more effort by the interagency program on high-end computing. The key requirement is for the Office of Science and Technology Policy to develop and maintain a roadmap for developing and deploying high-end systems necessary to ensure that the U.S. research community has sustained access to the most capable computing systems. In addition, NSF is explicitly required to provide for access by researchers to such computing systems. These requirements are designed to ensure the research community has access to the most powerful computing systems.

Mr. Chairman, the interagency research program launched by the 1991 Act has been largely a success. It has helped provide the computing and networking infrastructure required to support leading edge research and to drive information technology forward for the benefit of society at large.

H.R. 4218 will serve to strengthen the research program and deserves the approval of the Committee. I ask my colleagues for their support in reporting the bill favorably to the House.

The next bill on the roster is H.R. 4218, *High-Performance Computing Revitalization Act of 2004*. We will now proceed with opening remarks. Since I have already discussed the bill in my opening statement, I will now recognize Mr. Gordon for five minutes to present his opening remarks.

Mr. GORDON. Thank you, Mr. Chairman. I want to commend Congresswoman Biggert and Congressman Lincoln Davis for their leadership on the High-Performance Computing policy, and for the work on developing H.R. 4218. And I would like to now yield the balance of my time to my neighbor, Congressman Davis.

Mr. DAVIS. Mr. Gordon, thank you, and Mr. Chairman, I want to thank you for calling up House Resolution 4218, the *High-Performance Computing Revitalization Act of 2004*, which Congresswoman Biggert and I have introduced. I would also like to thank Mrs. Biggert for her work in helping to develop this legislation. House Resolution 4218 amends the *High-Performance Computing Act of 1991*, which established a major federal research and development program in computing and networking, that now involves seven agencies, and is funded at about \$2 billion per year.

This bill seeks to reverse what I would characterize as a weakening of the planning mechanisms for the R&D program established by the 1991 Act. High-performance computing and communications technology is key to the Nation's economic competitiveness and security. It is important to prioritize an effectively coordinated activity among the performing agencies.

The bill requires formal, biannual reviews of the interagency program by the President's Information Technology Advisory Committee in order to provide outstanding advice for sharpening program priorities, and improving program implementation. This resolution also attempts to focus more effort by the interagency program on high-end computing.

The key requirements is for the Office of Science and Technology Policy to develop and maintain a roadmap for developing and deploying high-end systems necessary to ensure that the U.S. research community has sustained access to the most capable computing systems. In addition, NSF is explicitly required to provide for access by researchers to such computing systems.

These requirements are designed to ensure the research community has access to the most powerful computing systems. Mr. Chairman, the interagency research program launched by the 1991 Act has largely been a success. It has helped provide the computing and network infrastructure required to support leading edge research, and to drive information technology forward for the benefit of society at large.

This resolution will serve to strengthen the research program, and deserves the approval of this committee. I ask my colleagues for their support in reporting the bill favorably to the House. Thank you, Mr. Chairman. I yield back the rest of my time.

Chairman BOEHLERT. Mrs. Biggert is recognized.

Mrs. BIGGERT. Thank you, Mr. Chairman, and I appreciate the opportunity to say a few words about the bill. I would like to start by thanking the bill's chief co-sponsor, Congressman Lincoln Davis, and also by thanking the other co-sponsors of this important legislation, including you, Mr. Chairman, Mr. Johnson, Mr. Ehlers, and Ms. Woolsey, and thank you all for your support.

Let me just say that there—the bill does four things. First, it requires that federal agencies provide the U.S. research community access to the most advanced, high-performance computing systems, and technical support for their users. Second, the bill requires federal agencies to support all aspects of high-performance computing for scientific and engineering applications, and third, the bill directs an interagency planning process to develop and maintain a research, development, and deployment roadmap for the provision of high-performance computing resources for the U.S. research community, and finally, the bill clarifies the mission of each of the federal agencies that have a role in developing or using high-performance computing.

I believe that this bill will guide federal agencies in providing needed support to high-performance computing and its user community. Our nation's scientific enterprise and our economy will be stronger for it. And I yield back.

Chairman BOEHLERT. Thank you very much. Without all—without objection, all Members may place opening statements in the record at this point. I ask unanimous consent that the bill is considered as read and open to amendment at any point, and that the Members proceed with the amendments in the order of the roster. Without objection, so ordered.

The first amendment on the roster is amendment number 1, amendment offered by the gentleman from California, Mr. Sherman. Are you ready to proceed?

Mr. SHERMAN. Yes, I am. Thank you, Mr. Chairman.

This is an issue I have addressed this Committee—

Chairman BOEHLERT. The Clerk will report.

Ms. TESSIERI. Amendment to H.R. 4218 offered by Mr. Sherman.

[*Note: See the Appendix for the Amendment offered by Mr. Sherman.*]

Chairman BOEHLERT. The gentleman is recognized.

Mr. SHERMAN. Thank you. We have heard testimony in this committee that we are within roughly 25 years of artificial intelligence matching or exceeding human cognitive abilities.

We cannot ignore that fact and plunge forward with computers as if they are simply tools, without reflecting that we are within a generation of, perhaps, another cognitive life form, or at least intelligence on this planet. Two bills will come before this committee dealing with supercomputing. A third agency of government is also dealing with that issue, DARPA, which is not under the jurisdiction of this committee. Their mission statement, on their webpage, which I will ask permission to enter into the record, states that it is their mission to develop a computer which will learn from its experience, be aware of themselves, and able to reflect on their own behavior. It is DARPA, not I, that uses human pronouns to describe that which DARPA is trying to create. Yet, they don't mention, certainly if you are working for the Defense Department and able to reflect on your own behavior, shouldn't you at least get veteran's benefits? I wonder.

Now, we deal with two other agencies. We have been told, in this very room, that we don't know whether we are creating Data from *The Next Generation*, or HAL from *2001: A Space Odyssey*. But we are moving in that direction. I at first thought that I would propose an amendment saying that we are not going to authorize research designed to create this human level cognitive ability. I have decided to water down my amendment in the hope that it might be accepted, and that is to simply require a study or series of studies before we go down this road.

I have—I point out that on the nanotechnology bill, that is exactly what this committee did. And so, what my amendment would do—and we might need to clarify in the report language, and I would work with the Chair, with the Ranking Member, on the report language—is state that before you go forward with research designed to meet or exceed human cognitive ability, and we would define that in report language, we need to see studies as to the ethical and legal implications of the creation of artificial intelligence.

The United States, of course, as it competes with the rest of the world, we want the strongest computers, the fastest computers, and we would like to think that we are only making a tool. That may be the case, but we cannot go forward along this line without at least looking at the issues that come before us.

Now, I know this sounds like science fiction. In fact, I alluded to two works of science, one involving Data, the other HAL. But as one panel testified before us, if you are describing the future, and it sounds like science fiction, then it is possible that description of the future is false. But if you are describing the future and it doesn't sound like science fiction, you know that description of the future is false. The future is—tomorrow is today's science fiction. We just don't know which of the science fiction movies models the future.

We should not rush headlong into the creation of a second cognitive intelligence on this planet without at least studying the implications. At that point, I will yield back, and hope that this amendment can be accepted.

Chairman BOEHLERT. Thank you very much. I appreciate the gentleman's intent, and I must admit being intrigued by your statement, but this amendment is so broadly written that it could bring computer science to a halt.

What do the terms in the amendment mean? Does a computer that can beat a human at chess qualify? Does a computer that can calculate and model far beyond human capabilities qualify? I don't know what we are banning here. This threatens a ban on research, even though there is no known threat, and the ban is ill-defined. That is a dangerous road to go down. I urge my colleagues to oppose the amendment.

Now, let me tell you what has happened. We have a general agreement. We have been through many hours of spirited debate, productive debate, and some of the Members have just had to go elsewhere, and I am not going to drag everybody back here to vote on this amendment.

I hope the gentleman would accept sort of a show of hands in support, opposition, and be guided by the sentiments of the majority here. Would you be willing to do that, Mr. Sherman?

Mr. SHERMAN. I may not require a recorded vote on this amendment, Mr. Chairman.

Chairman BOEHLERT. Thank you.

Mr. SHERMAN. But if you will yield.

Chairman BOEHLERT. I would certainly yield.

Mr. SHERMAN. My original amendment could have been viewed as a threat to research, since it indicated we didn't authorize certain research. My goal now is, as we did with the nanotechnology bill, to require that the agencies that are funding this research also fund studies of the legal and ethical implications. So, there is no bar to further research. And just as we did not bar the development of nanotechnology, but rather, required a look at the societal implications.

If there is a need to redraft my amendment, I would be happy to work with you after these hearings, with an understanding that we are going to require a look at these societal, ethical, and legal implications of this creation of supercomputing.

Chairman BOEHLERT. Well, thank you very much for one, indicating that you probably were unlikely to call for a roll call vote. That shows you are considerate of other Members, both sides, time and effort. Two, I think everything we should do should consider societal impact, ethical impact. So I will be glad to work with you directly, have staff talk this thing through, and see if we can't accomplish some of your original intent to focus on the issue, without being proscriptive and preventing any research going forward absent such a study.

Is that fair enough?

Mr. SHERMAN. That is fair enough, and I think our work on the nanotechnology bill achieved that goal, and had overwhelming support on the—

Chairman BOEHLERT. Well, we called for studies.

Mr. SHERMAN. Right.

Chairman BOEHLERT. But absent the studies, we didn't halt anything.

Mr. SHERMAN. Exactly.

Chairman BOEHLERT. Okay.

Mr. SHERMAN. And I think we can achieve something that you are describing, rather than what could—we can do a better job of drafting.

Chairman BOEHLERT. Got it.

Mr. SHERMAN. Mr. Chairman.

Chairman BOEHLERT. In the spirit of comity, then, do you ask unanimous consent that your amendment be withdrawn?

Mr. SHERMAN. I do indeed.

Chairman BOEHLERT. Well, thank you very much. The gentleman's amendment is withdrawn. Without objection, so ordered. Are there—where are we? Are there any further amendments? Then hearing none, the question is on the bill, H.R. 4218, *High-Performance Computing Revitalization Act of 2004*. All those in favor will say aye. Aye. Those opposed, no. In the opinion of the Chair, the ayes have it. I will now recognize Mr. Gordon to offer a motion.

Mr. GORDON. Mr. Chairman, I move that the Committee favorably report H.R. 4218 to the House with the recommendation that the bill do pass. Furthermore, I move that staff be instructed to prepare the legislative report, and make necessary technical and conforming changes, and that the Chairman take all necessary steps to bring the bill before the House for consideration.

Chairman BOEHLERT. The question is on the motion to report the bill favorably. Those in favor of the motion will signify by saying aye. Aye. Opposed, no. In the opinion of the Chair, the ayes have it, and the bill is favorably reported. Without objection, the motion to reconsider is laid upon the table. I move that Members have two subsequent calendar days in which to submit supplemental, minority, or additional views on the measure. I move, pursuant to Clause 1 of Rule 22 of the Rules of the House of Representatives that the Committee authorize the Chairman to offer such motions as may be necessary in the House to adopt and pass H.R. 4218, and go to conference with the Senate on H.R. 4218, or a similar Senate bill. Without objection, so ordered.

This concludes our Committee markup, and I want to thank those who indulged all of us for so many hours. I want to thank the staff on a bipartisan basis for their outstanding input, that makes these success stories possible.

This Committee is adjourned.

[Whereupon, at 2:15 p.m., the Committee was adjourned.]

Appendix:

H.R. 4218, HIGH-PERFORMANCE COMPUTING REVITALIZATION ACT
OF 2004; SECTION-BY-SECTION ANALYSIS OF H.R. 4218; AMEND-
MENT ROSTER

108TH CONGRESS
2D SESSION

H. R. 4218

To amend the High-Performance Computing Act of 1991.

IN THE HOUSE OF REPRESENTATIVES

APRIL 27, 2004

Mrs. BIGGERT (for herself, Mr. DAVIS of Tennessee, Mr. BOEHLERT, and Mr. JOHNSON of Illinois) introduced the following bill; which was referred to the Committee on Science

A BILL

To amend the High-Performance Computing Act of 1991.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “High-Performance
5 Computing Revitalization Act of 2004”.

6 **SEC. 2. DEFINITIONS.**

7 Section 4 of the High-Performance Computing Act
8 of 1991 (15 U.S.C. 5503) is amended—

9 (1) in paragraph (2), by inserting “and multi-
10 disciplinary teams of researchers” after “high-per-
11 formance computing resources”;

1 (2) in paragraph (3)—

2 (A) by striking “scientific workstations,”;

3 (B) by striking “(including vector super-
4 computers and large scale parallel systems)”;

5 (C) by striking “and applications” and in-
6 serting “applications”; and

7 (D) by inserting “, and the management of
8 large data sets” after “systems software”;

9 (3) in paragraph (4), by striking “packet
10 switched”; and

11 (4) by amending paragraphs (5) and (6) to
12 read as follows:

13 “(5) ‘Program’ means the High-Performance
14 Computing Research and Development Program de-
15 scribed in section 101; and

16 “(6) ‘Program Component Areas’ means the
17 major subject areas under which are grouped related
18 individual projects and activities carried out under
19 the Program.”.

20 **SEC. 3. HIGH-PERFORMANCE COMPUTING RESEARCH AND**
21 **DEVELOPMENT PROGRAM.**

22 Title I of the High-Performance Computing Act of
23 1991 (15 U.S.C. 5511 et seq.) is amended—

24 (1) in the title heading, by striking “**AND**
25 **THE NATIONAL RESEARCH AND EDU-**

1 **CATION NETWORK”** and inserting **“RE-**
 2 **SEARCH AND DEVELOPMENT”**;

3 (2) in section 101—

4 (A) the section heading, by striking **“NA-**
 5 **TIONAL HIGH-PERFORMANCE COM-**
 6 **PUTING”** and inserting **“HIGH-PERFORM-**
 7 **ANCE COMPUTING RESEARCH AND DEVEL-**
 8 **OPMENT”**;

9 (B) in subsection (a)—

10 (i) in the subsection heading, by strik-
 11 ing **“NATIONAL . HIGH-PERFORMANCE**
 12 **COMPUTING”** and inserting **“HIGH-PER-**
 13 **FORMANCE COMPUTING RESEARCH AND**
 14 **DEVELOPMENT”**;

15 (ii) by striking paragraphs (1) and (2)
 16 and inserting the following: **“(1) The**
 17 **President shall implement a High-Perform-**
 18 **ance Computing Research and Develop-**
 19 **ment Program, which shall—**

20 **“(A) provide for long-term basic and ap-**
 21 **plied research on high-performance computing;**

22 **“(B) provide for research and development**
 23 **on, and demonstration of, technologies to ad-**
 24 **vance the capacity and capabilities of high-per-**
 25 **formance computing and networking systems;**

1 “(C) provide for sustained access by the
2 research community in the United States to
3 high-performance computing systems that are
4 among the most advanced in the world in terms
5 of performance in solving scientific and engi-
6 neering problems, including provision for tech-
7 nical support for users of such systems;

8 “(D) provide for efforts to increase soft-
9 ware availability, productivity, capability, secu-
10 rity, portability, and reliability;

11 “(E) provide for high-performance net-
12 works, including experimental testbed networks,
13 to enable research and development on, and
14 demonstration of, advanced applications enabled
15 by such networks;

16 “(F) provide for computational science and
17 engineering research on mathematical modeling
18 and algorithms for applications in all fields of
19 science and engineering;

20 “(G) provide for the technical support of,
21 and research and development on, high-per-
22 formance computing systems and software re-
23 quired to address Grand Challenges;

24 “(H) provide for educating and training
25 additional undergraduate and graduate students

1 in software engineering, computer science, com-
2 puter and network security, applied mathe-
3 matics, library and information science, and
4 computational science; and

5 “(I) provide for improving the security of
6 computing and networking systems, including
7 Federal systems, including research required to
8 establish security standards and practices for
9 these systems.”;

10 (iii) by redesignating paragraphs (3)
11 and (4) as paragraphs (2) and (3), respec-
12 tively;

13 (iv) in paragraph (2), as so redesign-
14 ated by clause (iii) of this subpara-
15 graph—

16 (I) by striking subparagraph (B);

17 (II) by redesignating subpara-
18 graphs (A) and (C) as subparagraphs
19 (D) and (F), respectively;

20 (III) by inserting before subpara-
21 graph (D), as so redesignated by sub-
22 clause (II) of this clause, the following
23 new subparagraphs:

1 “(A) establish the goals and priorities for Fed-
 2 eral high-performance computing research, develop-
 3 ment, networking, and other activities;

4 “(B) establish Program Component Areas that
 5 implement the goals established under subparagraph
 6 (A), and identify the Grand Challenges that the Pro-
 7 gram should address;

8 “(C) provide for interagency coordination of
 9 Federal high-performance computing research, devel-
 10 opment, networking, and other activities undertaken
 11 pursuant to the Program;” and

12 (IV) by inserting after subparagraph
 13 (D), as so redesignated by subclause (II)
 14 of this clause, the following new subpara-
 15 graph:

16 “(E) develop and maintain a research, develop-
 17 ment, and deployment roadmap for the provision of
 18 high-performance computing systems under para-
 19 graph (1)(C); and” and

20 (v) in paragraph (3), as so redesign-
 21 nated by clause (iii) of this subpara-
 22 graph—

23 (I) by striking “paragraph
 24 (3)(A)” and inserting “paragraph
 25 (2)(D)”;

1 (II) by amending subparagraph
2 (A) to read as follows:

3 “(A) provide a detailed description of the Pro-
4 gram Component Areas, including a description of
5 any changes in the definition of or activities under
6 the Program Component Areas from the preceding
7 report, and the reasons for such changes, and a de-
8 scription of Grand Challenges supported under the
9 Program;”;

10 (III) in subparagraph (C), by
11 striking “specific activities” and all
12 that follows through “the Network”
13 and inserting “each Program Compo-
14 nent Area”;

15 (IV) in subparagraph (D), by in-
16 serting “and for each Program Com-
17 ponent Area” after “participating in
18 the Program”;

19 (V) in subparagraph (D), by
20 striking “applies;” and inserting “ap-
21 plies; and”;

22 (VI) by striking subparagraph
23 (E) and redesignating subparagraph
24 (F) as subparagraph (E); and

- 1 (VII) in subparagraph (E), as so
2 redesignated by subclause (VI) of this
3 clause, by inserting “and the extent to
4 which the Program incorporates the
5 recommendations of the advisory com-
6 mittee established under subsection
7 (b)” after “for the Program”;
- 8 (C) in subsection (b)—
- 9 (i) by redesignating paragraphs (1)
10 through (5) as subparagraphs (A) through
11 (E), respectively;
- 12 (ii) by inserting “(1)” after “ADVI-
13 SORY COMMITTEE.—”;
- 14 (iii) in paragraph (1)(C), as so redес-
15 ignated by clauses (i) and (ii) of this sub-
16 paragraph, by inserting “, including fund-
17 ing levels for the Program Component
18 Areas” after “of the Program”;
- 19 (iv) in paragraph (1)(D), as so redес-
20 ignated by clauses (i) and (ii) of this sub-
21 paragraph, by striking “computing” and
22 inserting “high-performance computing
23 and networking”; and
- 24 (v) by adding at the end the following
25 new paragraph:

1 “(2) In addition to the duties outlined in paragraph
 2 (1), the advisory committee shall conduct periodic evalua-
 3 tions of the funding, management, coordination, imple-
 4 mentation, and activities of the Program, and shall report
 5 not less frequently than once every two fiscal years to the
 6 Committee on Science of the House of Representatives
 7 and the Committee on Commerce, Science, and Transpor-
 8 tation of the Senate on its findings and recommendations.
 9 The first report shall be due within one year after the date
 10 of enactment of this paragraph.”; and

11 (D) in subsection (c)(1)(A), by striking
 12 “Program or” and inserting “Program Compo-
 13 nent Areas or”; and

14 (3) by striking sections 102 and 103.

15 **SEC. 4. AGENCY ACTIVITIES.**

16 Title II of the High-Performance Computing Act of
 17 1991 (15 U.S.C. 5521 et seq.) is amended—

18 (1) by amending subsection (a) of section 201
 19 to read as follows:

20 “(a) GENERAL RESPONSIBILITIES.—As part of the
 21 Program described in title I, the National Science Foun-
 22 dation shall—

23 “(1) support research and development to gen-
 24 erate fundamental scientific and technical knowledge
 25 with the potential of advancing high-performance

1 computing and networking systems and their appli-
2 cations;

3 “(2) provide computing and networking infra-
4 structure support to the research community in the
5 United States, including the provision of high-per-
6 formance computing systems that are among the
7 most advanced in the world in terms of performance
8 in solving scientific and engineering problems, and
9 including support for advanced software and applica-
10 tions development, for all science and engineering
11 disciplines; and

12 “(3) support basic research and education in all
13 aspects of high-performance computing and net-
14 working.”;

15 (2) by amending subsection (a) of section 202
16 to read as follows:

17 “(a) GENERAL RESPONSIBILITIES.—As part of the
18 Program described in title I, the National Aeronautics and
19 Space Administration shall conduct basic and applied re-
20 search in high-performance computing and networking,
21 with emphasis on—

22 “(1) computational fluid dynamics, computa-
23 tional thermal dynamics, and computational aero-
24 dynamics;

1 “(2) scientific data dissemination and tools to
2 enable data to be fully analyzed and combined from
3 multiple sources and sensors;

4 “(3) remote exploration and experimentation;
5 and

6 “(4) tools for collaboration in system design,
7 analysis, and testing.”;

8 (3) in section 203—

9 (A) by striking subsections (a) through (d)
10 and inserting the following:

11 “(a) GENERAL RESPONSIBILITIES.—As part of the
12 Program described in title I, the Secretary of Energy
13 shall—

14 “(1) conduct and support basic and applied re-
15 search in high-performance computing and net-
16 working to support fundamental research in science
17 and engineering disciplines related to energy applica-
18 tions; and

19 “(2) provide computing and networking infra-
20 structure support, including the provision of high-
21 performance computing systems that are among the
22 most advanced in the world in terms of performance
23 in solving scientific and engineering problems, and
24 including support for advanced software and applica-

1 tions development, for science and engineering dis-
2 ciplines related to energy applications.”; and

3 (B) by redesignating subsection (e) as sub-
4 section (b);

5 (4) by amending subsection (a) of section 204
6 to read as follows:

7 “(a) GENERAL RESPONSIBILITIES.—As part of the
8 Program described in title I—

9 “(1) the National Institute of Standards and
10 Technology shall—

11 “(A) conduct basic and applied metrology
12 research needed to support high-performance
13 computing and networking systems;

14 “(B) develop benchmark tests and stand-
15 ards for high-performance computing and net-
16 working systems and software;

17 “(C) develop and propose voluntary stand-
18 ards and guidelines, and develop measurement
19 techniques and test methods, for the interoper-
20 ability of high-performance computing systems
21 in networks and for common user interfaces to
22 high-performance computing and networking
23 systems; and

24 “(D) work with industry and others to de-
25 velop, and facilitate the implementation of,

1 high-performance computing applications to
2 solve science and engineering problems that are
3 relevant to industry; and

4 “(2) the National Oceanic and Atmospheric Ad-
5 ministration shall conduct basic and applied research
6 on high-performance computing applications, with
7 emphasis on—

8 “(A) improving weather forecasting and
9 climate prediction;

10 “(B) collection, analysis, and dissemination
11 of environmental information; and

12 “(C) development of more accurate models
13 of the ocean-atmosphere system.”; and

14 (5) by amending subsection (a) of section 205
15 to read as follows:

16 “(a) GENERAL RESPONSIBILITIES.—As part of the
17 Program described in title I, the Environmental Protec-
18 tion Agency shall conduct basic and applied research di-
19 rected toward advancement and dissemination of computa-
20 tional techniques and software tools for high-performance
21 computing systems with an emphasis on modeling to—

22 “(1) develop robust decision support tools;

23 “(2) predict pollutant transport and the effects
24 of pollutants on humans and on ecosystems; and

- 1 “(3) better understand atmospheric dynamics
- 2 and chemistry.”.

○

SECTION-BY-SECTION ANALYSIS OF H.R. 4218, HIGH-PERFORMANCE COMPUTING
REVITALIZATION ACT OF 2004

Sec. 1. Short Title

“High-Performance Computing Revitalization Act of 2004.”

Sec. 2. Definitions

Amends section 4 of the *High-Performance Computing Act of 1991* (HPC Act) to further elaborate on, or amend, the definition of terms used in the Act:

- “Grand Challenge” means a fundamental problem in science or engineering, with broad economic and scientific impact, whose solution will require the application of high-performance computing resources and multidisciplinary teams of researchers
- “high-performance computing” means advanced computing, communications, and information technologies, including supercomputer systems, high-capacity and high-speed networks, special purpose and experimental systems, applications and systems software, and the management of large data sets
- “Program” means the High-Performance Computing Research and Development Program described in section 101
- “Program Component Areas” means the major subject areas under which are grouped related individual projects and activities carried out under the Program.

Strikes the definition of “Network” that refers to the National Research and Education Network, which no longer exists as such.

Sec. 3. High-Performance Computing Research and Development Program

Amends section 101 of the HPC Act, which describes the organization and responsibilities of the interagency research and development (R&D) program originally referred to as the National High-Performance Computing Program—and renamed the High-Performance Computing Research and Development Program in this Act. Requires the program to:

- Provide for long-term basic and applied research on high-performance computing
- Provide for research and development on, and demonstration of, technologies to advance the capacity and capabilities of high-performance computing and networking systems
- Provide for sustained access by the research community in the United States to high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, including provision for technical support for users of such systems
- Provide for efforts to increase software availability, productivity, capability, security, portability, and reliability
- Provide for high-performance networks, including experimental testbed networks, to enable research and development on, and demonstration of, advanced applications enabled by such networks
- Provide for computational science and engineering research on mathematical modeling and algorithms for applications in all fields of science and engineering
- Provide for the technical support of, and research and development on, high-performance computing systems and software required to address Grand Challenges
- Provide for educating and training additional undergraduate and graduate students in software engineering, computer science, computer and network security, applied mathematics, library and information science, and computational science
- Provide for improving the security of computing and networking systems, including research required to establish security standards and practices for these systems.

Requires the Director of the Office of Science and Technology Policy (OSTP) to:

- Establish the goals and priorities for federal high-performance computing research, development, networking, and other activities

- Establish Program Component Areas that implement the goals established for the Program and identify the Grand Challenges that the Program should address
- Provide for interagency coordination of federal high-performance computing research, development, networking, and other activities undertaken pursuant to the Program
- Develop and maintain a research, development, and deployment roadmap for the provision of high-performance computing systems for use by the research community in the United States.

Leaves substantially unchanged the provisions of the HPC Act requiring the Director of OSTP to:

- Provide an annual report to Congress, along with the annual budget request, describing the implementation of the Program, including current and proposed funding levels and programmatic changes, if any, from the previous year
- Consult with academic, State, and other appropriate groups conducting research on and using high-performance computing.

Requires the Director of OSTP to include in his annual report to Congress:

- A detailed description of the Program Component Areas, including a description of any changes in the definition of activities under the Program Component Areas from the previous year, and the reasons for such changes, and a description of Grand Challenges supported under the Program
- An analysis of the extent to which the Program incorporates the recommendations of the Advisory Committee established by the HPC Act—currently referred to as the President’s Information Technology Advisory Committee (PITAC).

Requires PITAC to conduct periodic evaluations of the funding, management, coordination, implementation, and activities of the Program, and to report to Congress once every two fiscal years, with the first report due within one year of enactment.

Repeals section 102 of HPC Act, the “National Research and Education Network,” which requires the development of a network to link research and educational institutions, government, and industry. This network was developed but has since been supplanted by the Internet.

Repeals section 103 of the HPC Act, “Next Generation Internet,” as this program is no longer in existence.

Sec. 4. Agency Activities

Amends section 201 of the HPC Act, which describes the responsibilities of the National Science Foundation (NSF) under the Program. Requires NSF to:

- Support research and development to generate fundamental scientific and technical knowledge with the potential of advancing high-performance computing and networking systems and their applications
- Provide computing and networking infrastructure support to the research community in the United States, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, including support for advanced software and applications development, for all science and engineering disciplines
- Support basic research and education in all aspects of high-performance computing and networking.

Amends section 202 of the HPC Act, which describes the responsibilities of the National Aeronautics and Space Administration (NASA) under the Program. Requires NASA to conduct basic and applied research in high-performance networking, with emphasis on:

- Computational fluid dynamics, computational thermal dynamics, and computational aerodynamics
- Scientific data dissemination and tools to enable data to be fully analyzed and combined from multiple sources and sensors
- Remote exploration and experimentation
- Tools for collaboration in system design, analysis, and testing.

Amends section 203 of the HPC Act, which describes the responsibilities of the Department of Energy (DOE) under the Program. Requires DOE to:

- Conduct and support basic and applied research in high-performance computing and networking to support fundamental research in science and engineering disciplines related to energy applications
- Provide computing and networking infrastructure support, including the provision of high-performance computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems, and including support for advanced software and applications development, for science and engineering disciplines related to energy applications.

Amends section 204 of the HPC Act, which describes the responsibilities of the Department of Commerce, including the National Institute of Standards and Technology (NIST) and the National Oceanic and Atmospheric Administration (NOAA), under the Program.

Requires NIST to:

- Conduct basic and applied metrology research needed to support high-performance computing and networking systems
- Develop benchmark tests and standards for high-performance computing and networking systems and software
- Develop and propose voluntary standards and guidelines, and develop measurement techniques and test methods, for the inter-operability of high-performance computing systems in networks and for common user interfaces to high-performance computing and networking systems
- Work with industry and others to develop, and facilitate the implementation of, high-performance computing applications to solve science and engineering problems that are relevant to industry.

Requires NOAA to conduct basic and applied research in high-performance computing applications, with emphasis on:

- Improving weather forecasting and climate prediction
- Collection, analysis, and dissemination of environmental information
- Development of more accurate models of the ocean-atmosphere system.

Amends section 205 of the HPC Act, which describes the responsibilities of the Environmental Protection Agency (EPA) under the Program. Requires EPA to conduct basic and applied research directed toward the advancement and dissemination of computational techniques and software tools with an emphasis on modeling to:

- Develop robust decision support tools
- Predict pollutant transport and their effects on humans and on ecosystems
- Better understand atmospheric dynamics and chemistry.

**COMMITTEE ON SCIENCE
FULL COMMITTEE MARKUP**

June 16, 2004

AMENDMENT ROSTER**H.R. 4218, High-Performance Computing Revitalization Act of 2004.**

--Motion to adopt the bill, without amendment: agreed to by a voice vote.
--Motion to report the bill, without amendment: agreed to by a voice vote.

No.	Sponsor	Description	Results
1.	Mr. Sherman	Amendment would restrict research on artificial intelligence.	--Withdrawn by unanimous consent.

AMENDMENT TO H.R. 4218
OFFERED BY MR. SHERMAN

Page 14, after line 2, insert the following new section:

1 SEC. 5. ARTIFICIAL INTELLIGENCE LIMITATION.

2 Nothing in this Act or the amendments made by this
3 Act authorizes research that is likely to or designed to fa-
4 cilitate the creation of artificial intelligence that meets or
5 surpasses human cognitive ability before appropriate stud-
6 ies are conducted into the societal, ethical, and legal impli-
7 cations of the creation of such artificial intelligence.