National Science Board
Strategic Plan

National Science Board

National
Science
Foundation

November 19, 1998

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TOWARD THE 21ST CENTURY
THE AGE OF SCIENCE AND ENGINEERING

The 20th century will be remembered for ushering in an era of dazzling advances in science and engineering. In an extraordinary chronicle of scientific and technological progress, the systematic pursuit and exploitation of new knowledge during the last half-century has, through small steps and transcendent leaps, created vast new areas of economic activity, supported economic prosperity and growth, and improved the quality of life.

The microelectronics industry alone, enabled by condensed matter physics and materials science, accounts for well over a quarter of a million jobs in the United States today. Agriculture has been made unimaginably productive. The understanding of the structure and properties of DNA has opened up totally new opportunities to address health issues and provide the basis for a new and dynamic biotechnology industry. Information technology, from the Internet to bar code scanners in supermarkets, is in the process of transforming all sectors of life, leisure, and the economy. Among the many contributions of science and technology to national security, the atomic clock provided a basis for the Global Positioning System.[1]

These achievements have been made possible by national policies assuring that discovery in science and engineering serves national goals to promote economic growth, improve the quality of life, and insure national security. In laying the foundation of this policy after the Second World War, Vannevar Bush wrote in his seminal report to the President of the United States: "Without scientific progress the national health would deteriorate; without scientific progress we could not hope for improvement in our standard of living or for an increased number of jobs for our citizens; and without scientific progress we could not have maintained our liberties against tyranny."[2] Arguing for a "national policy for science," he asserted that, as the hope for the future, science must be "...brought to the center of the stage," and that government must assume responsibility for its promotion.[3] The National Science Foundation, established to provide sustained investment for research and education, was a major expression of this policy.

"It is the great beauty of our science that advancement in it, whether in a degree great or small, instead of exhausting the subject of research, opens the doors to further and more abundant knowledge, overflowing with beauty and utility."

Michael Faraday

Systematic and thoughtful national investment in science and engineering, espoused around the world, has become the norm, reflecting the conviction that new knowledge is perhaps the single most important driver of economic growth and the most precious and fully renewable resource available to individuals and societies to advance their material well-being. Economic advantage rests increasingly on the ability to exploit new scientific and technological advances. Robust support for basic research assures a deep reservoir of knowledge and provides flexibility and choices for addressing future needs.

This conviction has crystallized within a framework that demands not just a national commitment of resources to the advancement of knowledge, but one that recognizes the global, interactive framework within which discovery takes place. The benefits of new knowledge and technology are available to all nations, regardless of where they originate. And in many areas, both because of the intrinsically global character of the research effort, such as in global change or biocomplexity, and because of the high cost of facilities such as accelerators, the costs and responsibilities must be shared.

The Promise and Opportunity of the 21st century

If in the 20th century science and technology moved to the center of the stage, in the 21st century they will command it. Quality of life will depend in large measure on the generation of new wealth, on safeguarding the health of our planet, and on opportunities for enlightenment and individual development. The contributions of research and education in science and engineering make possible advances in all these areas.

". . .[S]imply imagine the new century, full of its promise, molded by science, shaped by technology, powered by knowledge. These potent transforming forces can give us lives fuller and richer than we have ever known."

President William Jefferson Clinton

With enormous pressures on governments and on the environment stemming from population growth and rising expectations, economic and quality of life improvements made possible by science and technology can play a critical role in generating environmentally responsible global growth. Furthermore, in contrast to the toll taken on the environment by 19th and 20th century industrial development, the knowledge-driven industries and processes of the 21st century offer the potential for sustainable development on a global scale, and may allow developing countries to leap over longer and more environmentally destructive stages of economic infrastructure development. Through communication systems and data networks, information technology will knit the world and increase opportunities for cooperation, enabling the emergence of a global culture that bridges the centrifugal and often conflicting forces of national and ethnic identities.

Challenges

How positive and effective the role of science will be hinges on the ability of scientific communities, working through institutions, to act with a sense of civic and social responsibility in a world experiencing profound change, often generated by products and processes resulting from discovery and the application of new knowledge.

Ironically, as science and technology have assumed a core economic importance as a source of quality of life improvements, the long-term prospects for sustained, balanced, and visionary investments in research and education are unclear. Industry's dominant role in R&D is governed by a short-term perspective; and even in a positive economic environment, Federal R&D funding has flattened.[4]

We have won the Cold War and, with this victory, we have lost the convenient simplicity of justifying Federal support of science and engineering largely on grounds of national security. Public support for science and technology remains high.[5] But the multifaceted rationale for the investment in discovery is not well articulated by the science and engineering community and even less well understood, not just by the general public, but by political decision makers as well.

> *"What we are seeking is a free and open global society, within which we can harness the power of science and technology for innovation and global economic gain. But that economic activity must be sustainable over the long run.... In order to be sustainable, it must be equitable and just and avoid alienation or polarization of society."*
>
> *Congressman George Brown*

In parallel with the public's high levels of support for science, a public debate has arisen about how much investment in science is enough, what tools we have to measure the returns on this investment, and how we evaluate the programs, processes, and support mechanisms of science and education in the context of national goals and needs. A related debate has emerged about how we invest in the people who will be the creators and users of knowledge, including the effectiveness of the processes of training and instruction at all levels for the workforce and living skills needed in the 21st century.

These questions regarding the domestic agenda are emerging against a background of increasing scientific and technological competence on the part of other nations that are simultaneously our partners and our competitors. The global scale of science, its cost, and the need for open communication as the surest road to accelerating and validating discovery underscore the need for deliberate and thoughtful policies to support international cooperation in science and engineering.

"AN ACT To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense . . . ."

The National Science Foundation Act of 1950

THE MISSION OF THE NATIONAL SCIENCE BOARD

The National Science Foundation Act of 1950 created the National Science Foundation and the National Science Board "To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…."[6] The Act confers two responsibilities on the Board to support this objective. Stating that the National Science Foundation created by this Act "…shall consist of the National Science Board and the Director,"[7] The Act makes the Board responsible for establishing the policies of the Foundation and serving as its board of governors. The Act also directs the Board to advise the President and Congress, whether on their request or on its own initiative, "...regarding policy matters related to science and engineering and education in science and engineering...."[8]

GOALS AND PRIORITIES

This strategic plan describes goals and priorities of the National Science Board within the context of its dual mission.

I. OVERSIGHT OF THE NATIONAL SCIENCE FOUNDATION

The National Science Board serves as the governing board of the National Science Foundation, establishing its policies and approving its budgets and priorities. Through its review and approval of programs and awards, the Board provides oversight for the implementation of the Foundation's priorities and for insuring the excellence of its standards and processes.

> *"Over the years NSF's investments in research and education have helped the Nation achieve an unmatched capability in scientific and technical fields…."*
>
> *National Science Foundation*

Vision and Strategic Goals

The vision, goals, and strategies of the National Science Foundation have been articulated in the NSF strategic plan, *NSF in a Changing World*.[9] The National Science Board participated in the articulation, oversight, and approval of this strategic plan, which establishes the following goals:

- *Enable the U.S. to uphold a position of world leadership in all aspects of science and engineering;*
- *Promote the discovery, integration, dissemination, and employment of new knowledge in service to society; and*
- *Achieve excellence in U.S. science, mathematics, engineering, and technology education.*

To achieve these goals, NSF develops intellectual capital, strengthens the physical infrastructure, integrates research and education, and promotes partnerships. It does so by providing different modes of support attuned to different needs and opportunities, insisting on accountability and efficiency, promoting intellectual integration, and accelerating the transfer of knowledge.[10]

Priority Setting and Budget Approval

The goals of the National Science Foundation are expressed through its budget and programmatic priorities.

The Board conducts the annual NSF long range planning and budget review and approval processes to:

- **Assure the health of the human, disciplinary, and infrastructure base sustaining the generation of knowledge and innovation; and**
- **Support new opportunities for the advancement of knowledge and insure that the process of priority setting responds to such opportunities. For example, information technology and research, education, and assessment on the environment will continue to be areas of special Board attention.** [11]

Oversight

In addition to its responsibility for approving NSF's priorities and budget, the Board exercises its oversight of the Foundation in two important ways. The Board regularly reviews core processes, including planning, priority setting, and merit review of proposals. In 1997, for example, the Board reviewed and revised the NSF criteria for merit review, bringing them into compass with the two overriding objectives of the awards granted by the Foundation: to advance the frontiers of knowledge; and to do so in service to society.[12] Second, the Inspector General Act Amendments of 1988 conferred on the National Science Board the responsibility of supervising the NSF Inspector General.

"As the Federal agency mandated to promote the health of science generally, NSF has a central role in upholding the Nation's position of world leadership."

The National Science Foundation

- **The Board reviews core processes and provides policy guidance to insure adherence to the highest standards of excellence and implementation of programs and awards responsive to opportunities in science and engineering and to the needs of the Nation.**

- **The Board supervises and provides guidance to the Inspector General in a manner that strengthens and enriches the science and engineering enterprise and insures the integrity of the processes for research and education activities that receive Federal funding.**

II. SCIENCE AND ENGINEERING POLICY FOR THE HEALTH OF THE ENTERPRISE

In monitoring the health of the science and engineering enterprise and providing advice to the President and Congress on major issues of national research and education policy, the National Science Board will focus on five major areas. Within these areas, the Board will continue to define and revise specific objectives, as needed, anticipating and responding to issues affecting the health of the U.S. science and engineering research and education enterprise.

The Federal Investment in Science and Engineering

With widespread recognition of the economic and social relevance of science and technology has come a demand for better accountability for research investment choices by Federal funding agencies and for a better understanding of the nature of the return on this investment. Recent legislation has insisted that scientific investments, like all others, be subject to strategic planning and to measurement of performance as the basis for resource allocation.[13] The demands for accountability and for demonstrable effectiveness in supporting national goals and serving society's needs have combined with pressures on the Federal discretionary budget to raise questions about the definition, planning, and management of the Federal research portfolio.

"[P]resently there is no widely accepted way for the Federal government, in connection with the scientific community, to make priority decisions about the allocation of resources in and across scientific disciplines."

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The Board has devoted considerable attention to this issue in the recent past, noting in its working paper on *Government Funding of Scientific Research* that "…presently, there is no widely accepted way for the Federal government, in conjunction with the scientific community, to make priority decisions about the allocation of resources in and across scientific disciplines."[14] Some coordination in research exists across scientific fields and agencies, within the context of congressional committees, in the OMB budget process, and in OSTP through its coordination of interagency, multidisciplinary national initiatives. However, these mechanisms fail, either individually or in sum, to weigh allocation decisions consistently from the perspective of the general health of our national scientific capabilities, our future infrastructure, and the most promising scientific opportunities. As a result, "…important decisions about the allocation of limited resources happen by default without explicit weighing of alternatives."[15]

Similar observations have been made about the congressional process for deciding on appropriations. For example, Senators Bingaman and Lieberman have stated that "…there is no comprehensive presentation, much less examination, of the federal S&T budget at any stage of the congressional budget process."[16] Expressing the sentiments of key decision-makers of different political persuasions from both the Administration and Congress, former OMB Director Franklin Raines has made the point that at the present time there is no particular basis for deciding how much to invest in research or where.[17]

James Sensenbrenner, Chairman of the House Committee on Science, has observed that a reaction is setting in against funding increases in the abstract that threatens "…to return us to the bad old days when science authorizations simply increased spending for each account by 10 percent every year. The authorizations had no credibility with the appropriators and science was sent to the end of the discretionary spending line where it had to fight for funding scraps."[18]

Thoughtful efforts by panels chartered by the National Research Council on questions related to evaluating the Federal research budget and allocating resources have helped lay the foundation for future efforts in what remains a formidable undertaking.[19] The Board concluded in its review of this matter that continued effort to improve coordination in the Federal research budget and priority setting remains a high priority.

"Although the need for establishment of research priorities has been discussed often, no agreed upon method exists for carrying out this task. . . [T]he National Science Board believes this difficult task will become increasingly important and must be faced over the next few years."

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The Board recognizes that this task is difficult and controversial and that many scientists consider it both undesirable and undoable. However, given the pervasive importance of science and engineering to economic and social decision making and to the workforce, it is inescapable that allocations will be made on the basis of whatever understanding and methodology are available to inform the process at the time. It is in the interest of science itself that scientists actively participate in the strategies and methodologies used in this process, and provide political decision-makers with the understanding and tools that will maintain the vigor, flexibility, and creativity of the enterprise.

The Board has concluded that the development of an intellectually well founded and broadly accepted methodology for setting priorities across fields of science and engineering is a prerequisite for a coherent and comprehensive Federal allocation process for research.

The Board will, in cooperation with other stakeholders:

- **Review, in light of changing circumstances, the goals for Federal investment in scientific research as stated in the Administration report, *Science in the National Interest*;[20]**
- **Conduct a state of the art assessment for methodologies for priority setting for research, including an examination of the experiences of other countries; and**
- **Consider what mechanisms will be effective in building broad public and scientific support for, and involvement in, priority setting.**

Educating the National Workforce

A nation's most precious resource is its people. There is no greater challenge and no more fundamental a need than the assurance of a skilled, highly educated, and diverse workforce and of a public that is not just well disposed toward science, but one that is also able to use its knowledge of science and mathematics for individual and collective improvement. Processes of education, training, and public literacy in science and technology require expanding capacity, versatility, and learning from preschool through retirement. The Board's concerns encompass all the major stages of this process.[21]

> *"We shall have rapid or slow advance on any scientific frontier depending on the number of highly qualified and trained scientists exploring it…So in the last analysis the future of science in this country will be determined by our basic education policy."*
>
> *James B. Conant*

As the Board stated in its report on *The Federal Role in Science and Engineering Graduate and Postdoctoral Education*, "The education of graduate and post-doctoral students in a discovery-rich university research environment is at the heart of the post-World War II compact between the Federal government and universities."[22] In the last fifty years, as US society has become larger and more diverse, and the economy more global and complex, stresses on higher education institutions have increased. The Federal responsibility, in partnership with universities, to insure "...constantly improving quality at every level of scientific activity....”[23] has become broader and more varied as science and technology have become more central to the economy and society. The Board believes that “In a time of extraordinary political and economic changes worldwide since the end of the Cold War, understanding the current status and clarifying the principles of Federal support for graduate education in science and engineering are matters of high priority.”[24]

“It is in keeping with the American tradition – one which has made the United States great – that new frontiers shall be made accessible for development by all American citizens.”

Vannevar Bush

The Board will continue to examine problems and issues of higher education in science and engineering with special attention to:

- **The appropriate breadth and focus in education and training responsive to the growing diversity of career and employment opportunities;**
- **The integration of teaching and research, and the development of reward systems that support mentoring and outreach;**
- **The development of partnerships among disciplines and institutions and enhancement of collaboration among research and non-research institutions; and**
- **Improved data to identify current and emerging national needs for the science and engineering workforce.**

The creativity and productivity of the science and engineering workforce will depend ultimately on how schools, colleges, and universities develop and refine human resources. We need a better understanding of how to determine and assess the potential of students, and how to structure transitions in the educational process to encourage greater aspirations and achievement in science, mathematics, and engineering. A major concern is the preparation of an increasingly diverse student body for an economy that must draw on the participation of the entire population to insure optimal performance and the availability of a highly trained workforce in the future.

To encourage the development of this Nation's human resources to their fullest, the Board will:

- **Review and promote policies that encourage the attraction and retention to degree completion of talented students from underrepresented groups; and**

- **Review the utility and predictive value of specific assessment tools, such as the Graduate Record Examination scores (GREs) and the Scholastic Assessment Tests (SATs), for entry to and financial support for graduate education.**

An area of special concern is the quality of education at the K-12 level. The Board has considered the disturbing implications of the Third International Mathematics and Science Study.[25] This study, which reviews the performance of students from different nations in these areas, ranks US secondary students below the international average. No nation can tolerate the low performance that characterizes our K-12 education system.[26] Scattered pockets of excellence will not support the burden of a growing and increasingly sophisticated array of national needs that require a workforce well prepared in science and mathematics.

"Science...can provide every citizen – not only the scientists who are engaged in it – with information necessary to make informed decisions as voters, consumers, and policymakers. For the scientific enterprise to endure, however, stronger ties between this enterprise and the American people must be forged. "

U.S. House of Representatives, Committee on Science

Recognizing its special connection to the science and engineering communities, the National Science Board will:

- **Encourage, through policy guidance, partnerships, and outreach, the involvement of scientists and engineers in the improvement of the quality of K-12 education, both individually and through their employing institutions and professional associations.**

Public Understanding and Enrichment

The ability of all members of society to participate in the 21st century will depend on literacy in science and technology at home and in the workplace. Far from being luxuries, public understanding of science and some degree of science and mathematics literacy are tools for workaday problem solving and essential to individual and collective decision-making. They undergird the long term investments that invariably characterize a successful science and technology policy, both with respect to enhancing the public's familiarity with the growing number of funding and policy issues that have science and technology content and its appreciation for the uncertainty that necessarily accompanies the process of discovery.[27]

Retrieving and applying knowledge to new problems and situations will become an even more important life skill in the 21st century. Information technology has enormous potential for nurturing this skill efficiently and creatively, powerfully engaging the interest and sense of play of individual explorers. Images in an electronic age have a profound impact. They provide opportunities to excite us all, but especially students, to learn more about the natural world and how it works. The burden of creating these opportunities falls not only on the formal K-12 system, but also on "informal science" -- on museums, science centers, the mass media, and the Internet -- that has the ability to deliver wondrous educational experiences outside a classroom setting.

Too few Americans – about one in five – either comprehend or appreciate the value or process of scientific inquiry.[28] While the scientist may expect the lay citizen, by dint of interest and initiative, to educate her or himself to the mysteries of the natural world, the public has a reasonable expectation that scientists will contribute to demystifying for others what is so personally and professionally engaging to them. The challenge to do so is the essence of what former NSF Director Neal Lane has called "civic science."[29]

Through its outreach activities and policy guidance, the Board will:

- **Enlist the science and engineering communities to engage with the public and communicate the joy and fascination of science, as well as its utility;**

- **Communicate the significance, challenges, and opportunities of science and engineering to policy makers and government leaders whose decisions regarding national investments will affect the ability of science and engineering to benefit society; and**

- **Take advantage of the revolution in access made possible by information technology to promote public understanding of science, mathematics, and technology, and build bridges between formal and informal science education.**

Science and Engineering in a Global Context

By its very nature, the science and engineering enterprise is global, often requiring access to geographically specific materials and phenomena and to dispersed expertise. It also requires the open and timely communication, sharing, and validation of findings. Certain issues and disciplines, for example, climate change and biocomplexity, are global in their very definition, and the proliferation of large, complex, and expensive projects and facilities has required participation and support from many nations.

"In reality, uninformed decisions about scientific issues are the equivalent of denying ourselves the future."

Norman Augustine

Recently, the significance of science and technology in the global context has grown dramatically and the substantial expansion of government sponsored scientific cooperation is outpaced by private sector cooperation in science and technology.[30] The global economy that emerged in the second half of the 20th century, resting on a highly articulated communication and information infrastructure, increasingly relies on knowledge and innovation for its growth and for its core processes.

"In a world full of conflicting cultural values and competing needs, scientists everywhere share a powerful common culture that respects honesty, generosity, and ideas independently of their source, while rewarding merit. . ."

Bruce M. Alberts

With the benefits and growth from innovation, there are also problems. The benefits are not equally shared and the gap between the poorest nations and those in a position to benefit from the global knowledge based economy has grown. The use and consumption of resources and the explosion of the world's population, resulting from advances in disease control and agricultural productivity made possible by science and engineering research, have put unprecedented stresses on our planet. The complex, systemic, biological, economic, ecological, and social problems of the years ahead will demand more information, more participation by the scientific communities of all nations, and more cooperation between these communities and political decision-makers.[31]

Science and technology not only can, but must contribute both to the generation of new opportunities and benefits and to the solution of problems. The world-wide exchange of ideas will continue to fuel economic growth in the advanced economies at the same time that it enables less developed nations to catch up and potentially to skip time-draining and ecologically destructive intermediate steps. As John Gibbons has noted, "The United States is ideally positioned to lead a global effort to use science and technology to fulfill the challenge of supplying goods and services at minimal total cost, including to the environment."[32]

The benefits of scientific knowledge and communication also have broader societal significance. In a contentious world, bilateral and multilateral cooperation in science and technology help build stable relations on the basis of mutual benefits. They also create a universal language and culture, based on commonly accepted values of objectivity, sharing, integrity, and free inquiry. The communication revolution and the diffusion of knowledge and ideas contribute to personal initiative and a responsible citizenry by decentralizing decision making and making information broadly available to the general population. This same revolution, based on information technology and the pervasive presence of the World Wide Web, is also transforming educational delivery systems and putting education within the reach of greater numbers of individuals who would otherwise be limited by geographic isolation or financial constraints.

The National Science Board has periodically assessed the role and needs of science in the international arena.[33] Given the extraordinary – and growing – importance of science and technology as we move into the next century, there is a need for a fresh look to encourage, on both Federal and NSF levels, a coherent strategy that supports a productive relationship between scientific and foreign policy objectives.

To promote a better understanding and policies supportive of research and education in the international arena, the National Science Board will:

- **Review the role and contributions of science and engineering in a global context, and examine the Federal institutional framework of policies and agency relations that support fundamental research and education in the international setting;**

- **Assess the experience of other nations with respect to key issues, including planning and priority setting and the delivery of quality education; and**

- **Engage in a dialogue with other stakeholders to enhance global scientific communication and cooperation, international exchanges of students and scientific personnel, development and maintenance of databases to enable research and discovery, and collaboration among Federal agencies whose**

missions affect the conduct of science and education in the international arena.

Science and Engineering Indicators

The National Science Board is responsible, by law, for developing on a biennial basis a report "…on indicators of the state of science and engineering in the United States."[34] This report, which the Board submits to the President for transmission to Congress, serves as the authoritative compilation of data on science and engineering research and education, providing not only a domestic perspective, but international comparisons as well.

As the Federal budget and policy processes have accentuated the demand for greater accountability and benchmarking, the data historically available through SEI have become increasingly valuable for analyzing key trends that illuminate the scope, quality, and vitality of research and education. Thus, SEI serves two critical purposes: first, as the report of record on the health of the enterprise; and second, as the basis for further analysis by all users generally and by the Board in particular. To insure that SEI effectively supports these goals, the National Science Board reviews the report's effectiveness with each biennial cycle. The policy and planning demands of the coming years make this task more compelling than ever.

To position *Science and Engineering Indicators* for the 21st century, the Board will:

- **Conduct a comprehensive review of *Science and Engineering Indicators,* including the utility, timeliness, and accessibility of the data for users; and**

- **Review the effectiveness of SEI as a basis for decision making on major policy issues related to science and engineering, including those described above, to which the Board itself will devote special attention.**

CONCLUSION

The framework described by this Strategic Plan will assist the Board in fulfilling is statutory responsibilities to the Nation as the board of governors of the Nation's premier agency for the support of fundamental research and education, and as a national advisory body to the President and Congress on science and engineering policy. The Board has identified five policy areas for particular attention. These include: the Federal Investment in Science and Engineering, Educating the National Workforce, Public Understanding and Enrichment, Science and Engineering in a Global Context, and the assessment and improvement of *Science and Engineering Indicators*. The balance among specific issues and activities will, predictably, change over time. However, the broad areas of concern described in this plan will continue to inform the development of the Board's policies for the National Science Foundation and contributions to the ongoing national debate on how best to insure the vitality and productivity of the U.S. science and engineering enterprise.

SOURCES FOR SIDEBARS

Location	**Source**
Page 3	As quoted in *A Dictionary of Scientific Quotations* (Philadelphia: IOP Publishing Ltd., 1991), p. 88.
Page 4	President William Jefferson Clinton, Commencement Address at Morgan State University, Baltimore, Maryland, available at http://www.pub.whitehouse.gov (18 May 1997), p. 2.
Page 5	Congressman George Brown, Carey Lecture to the American Association for the Advancement of Science (2 February 1998).
Page 6	National Science Foundation Act of 1950.
Page 7	National Science Foundation, *NSF in a Changing World*, NSF-95-24, (Arlington, VA: 1995), p.2.
Page 8	*Ibid., p.21.*
Page 10	National Science Board, *Government Funding of Scientific Research*, NSB-97-186 (Arlington, VA: 1997), p.1.
Page 11	*Ibid., p.13.*
Page 12	Cited in Vannevar Bush, *Science -- The Endless Frontier*, 40th Anniversary Edition (republished Washington, DC: National Science Foundation, 1990), p.23.
Page 13	*Ibid., p.11.*
Page 14	US House of Representatives, Committee on Science, *Unlocking Our Future. Toward a New National Science Policy* (Washington, DC, 1998), p.10.
Page 16	Norman Augustine, "What We Don't Know Does Hurt Us. How Scientific Illiteracy Hobbles Society," *Science* 279, no. 5357 (1998), pp. 1640-1641.
Page 18	Bruce M. Alberts, "Toward a Global Science," *Issues in Science and Technology* (Summer 1998), p. 25.

ENDNOTES

1 National Science Board, *Government Funding of Scientific Research*, NSB-97-186 (Arlington, Virginia: 1997), pp. 6-7.
2 Vannevar Bush, *Science -- The Endless Frontier*, 40th Anniversary Edition (republished Washington, DC: National Science Foundation, 1990), p. 11.
3 *Ibid*, p. 12.
4 National Science Board Statement, *In Support of Basic Research*, NSB-93-127 (14 May 1993). See also, *Government Funding of Scientific research*, p. 10.
5 National Science Board, *Science and Engineering Indicators – 1998*, NSB-98-1 (Arlington, VA: 1998), pp. 7-3.
6 *National Science Foundation statutory Authority*, Section I, 3.
7 *Ibid*, SEC. 2.
8 *Ibid*, SEC. 4 (j) (2), 6.

[9] National Science Foundation, *NSF in a Changing World,* NSF-95-24, (Arlington, VA; 1995).
[10] *Ibid*, pp. 13, 17.
[11] For example, its 1989 report calls attention to the need for international solutions in dealing with the loss of biological diversity. Building on this foundation, in a resolution approved at its February 1998 meeting, the Board noted the need for a greater focus on the environment and the appropriateness of having NSF expand its activities to promote research and education on the environment. See National Science Board, *Loss of Biological Diversity: A Global Crisis Requiring International Solutions*, NSB-89-171, (Washington, DC: 1989);and Resolution of the National Science Board approved by the NSB Executive Committee at its March 19, 1998 Meeting, *The Proposed National Institute for the Environment*, NSB-98-65.
[12] Resolution approved by the NSB at its March 27-28, 1997 meeting, *New General Criteria for Merit Review of Proposals*, NSB-97-72.
[13] See for examples the *Government Performance And Results Act of 1993*, or the *Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1999*.
[14] National Science Board, *Government Funding of Scientific Research*, NSB-97-186 (Arlington, VA: 1997), p. 1.
[15] *Ibid*., p. 10.
[16] Senator Jeff Bingaman and Senator Joseph Lieberman, editorial, *Science* 280, no. 5366 (1998).
[17] Remarks, AAAS R&D Meeting, February 2, 1998, summarized in *Chemical and Engineering News* (18 May 1998), pp. 31-32.
[18] James Sensenbrenner, Chairman, House Science Committee, Remarks delivered to the URA Council of Presidents Annual Meeting, January 29, 1998, available at http://www.house.gov/science.
[19] Committee on Criteria for Federal Support of Research and Development, National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council (NAS/NAE/IOM/NRC), *Allocating Federal Funds for Science and Technology* (Washington, DC: National Academy Press, 1995). See also, Committee on Science, Engineering, and Public Policy, NAS/NAE/IOM, *Science, Technology and the Federal Government/National Goals for a New Era* (Washington, DC: National Academy Press, 1993).
[20] William J. Clinton and Albert Gore, Jr., *Science in the National Interest* (Washington, DC: 1994).
[21] The Board periodically reviews and assesses major issues concerning higher education in science and engineering. As part of the educational continuum, these areas will continue to merit NSB attention and review. *Undergraduate Science, Mathematics, and Engineering Education*, NSB-86-100 (Washington, DC: National Science Foundation, 1986); Proceedings, National Science Board Symposium on *Science and Engineering Research in the 21st Century*, 335th Meeting of the National Science Board at the University of California, Davis (1996); National Science Board, *The Federal Role in Science and Engineering Graduate and Postdoctoral Education*, NSB-97-235 (Arlington, VA: 1997).
[22] *The Federal Role....*, p. 3.
[23] Bush, *pp. 23.*
[24] *The Federal Role....*, p. 3.
[25] International Association for the Evaluation of Educational Achievement, Mathematics and Science Achievement in the Final Year of Secondary School: IEA's Third International Mathematics and Science Study (TIMSS) (Chestnut Hill, MA: Boston College, 1998).

[26] National Science Board, "Failing our Children: Implications of *The Third International Mathematics and Science Study* (TIMSS), NSB-98-154 (Arlington, VA: 1998).

[27] James Sensenbrenner, Chairman, House Committee on Science, 105th Congress, 2d session, introduction to *The Role of Science in Making Good Decisions*, *National Science Policy Study Hearing* (10 June 1998).

[28] *Science and Engineering Indicators – 1998*, pp. 7-8 through 7-10.

[29] Neal Lane, "Thin Ice Over Deep Waters: Science and the American Dream: Healthy or History," Remarks at the AAAS Annual Meeting (Baltimore: 9 February 1996).

[30] Thomas J. Ratchford, "Science, Technology, and US Foreign Relations," *The Bridge*, 28, no. 2 (Summer 1998).

[31] Jane Lubchenco, "Entering the Century of the Environment: A New Social Contract for Science," *Science* 279, no. 5350, pp. 491-97.

[32] John H. Gibbons, "Viva La Revolution!," *Proceedings of the Institute of Electrical and Electronics Engineers (IEEE)* 86, no. 3 (1998), p. 598.

[33] National Science Board, *The Role of the National Science Foundation in Economic Competitiveness* (Washington, DC: 1988); *Report of the NSB Committee on Foreign Involvement in US Universities,* NSB-89-80 (Washington, DC: 1989)*; Science and Technology Integration in Europe and Influences on U.S. – European Cooperation,* NSB-90-172 (Washington, DC: 1990); *The Competitive Strength of U.S. Industrial Science and Technology: Strategic Issues,* NSB-92-138 (Washington, DC: 1992).

[34] *NSF Statutory Authority,* Section I, Sec. 4 [j][1], 6.

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